A Reductionistic Epistemology utilizing Brain Laterality which Investigates Pharmacists' Ideal Interactive Environment

Bernard Dennis Symon

Submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in the Faculty of Natural Sciences, Department of Pharmacy Practice at the University of the Western Cape.

Supervisor: Prof Nadine Butler

School of Pharmacy

University of the Western Cape

Bellville

South Africa

KEYWORDS

Brain laterality, Pharmacists, Ideal work environment, Reductionistic variables, New brain laterality continuum, South Africa and United Kingdom, Propinquity Principle, Right Hemisphere Theory, Valence Theory, Dominant ear inhibition of emotion.

ABSTRACT

A Reductionistic Epistemology utilizing Brain Laterality which Investigates

Pharmacists' Ideal Interactive Environment

B.D. Symon

PhD thesis, School of Pharmacy, University of the Western Cape

The brain laterality of pharmacists may influence where the pharmacists are best suited to work. Brain laterality refers to the asymmetry of the hemispheres of the brain with regard to specific cognitive functions, such as objectivity and emotion. The left hemisphere functions objectively and rationally, whereas the right hemisphere is subjective and non-rational. Animal behaviour in the literature demonstrated an influence of brain laterality, thus selecting an ideal work environment may also be driven by brain laterality bias. Further support for the research included: amblyopia; hemiplegia; the WADA test.

The research question investigated the matching of the brain laterality groups of pharmacists to their ideal work environments. The aims investigated: ear, eye, hand and foot dominance in determining brain laterality; influence of brain laterality and reductionistic variables on job choice; location of emotion generation and job choice. Five objectives investigated these aims: influence of brain laterality alone; influence of brain laterality and reductionistic variables; influence of a new brain laterality determining continuum; Propinquity Principle in achieving data; correctness of the Right Hemisphere Theory (RHT) or the Valence Theory (VT). The RHT suggests that the right hemisphere is dominant in processing all emotion. The VT argues that the left hemisphere is specialised in processing the positive emotions while the right hemisphere is specialised in processing the negative emotions. The resulting Null Hypothesis posits that there is no statistical difference between the different brain laterality groups enabling pharmacists to work competently in any placement. The Alternative Hypothesis was that there is a statistical difference between the brain laterality groups, thus brain laterality can be used to best place pharmacists into ideal placements.

Global warming questions in the questionnaire determined positive and negative emotion as well as enthusiasm for global warming problems. In South Africa, probability cluster sampling was applied utilising postal and email methods. In the UK, non-probability purposive sampling was applied utilising four methods: snowballing, email, postal, and convenience sampling. Both countries produced similar results for the same sample size.

The Null Hypothesis was not rejected for the research (p-values > 0.005) except for the variable age ($p = 0.0029$). This determined that pharmacists with any brain laterality group could work competently in any work environment assuming the RHT to be correct. The age variable demonstrated that the brain laterality of a pharmacist may change as they get older possibly due to a decreased functioning corpus callosum. The new brain laterality continuum did not demonstrate regions of work environments, but did correlate ($r = 0.72$ where $p < 0.0001$) a simpler brain laterality determination to the literature, which created 16 brain laterality groups for the research. The Propinquity Principle was proved correct as the further the pharmacist was from the research university the more difficult it was to obtain their participation.

The VT was demonstrated to be more correct than the RHT, allowing for the placing of pharmacists into their ideal work environments by matching emotion generation of the pharmacists with the emotional requirements of the work environments. Based on the VT and pharmacists who had worked 10 years or more, it was found that six out of 16 brain laterality groups (groups 1, 5, 6, 9, 13 and 16) were ideally suited to work in specific mutually-exclusive work environments.

Further findings determined that the dominant ear inhibited the dominant emotional site of the related contralateral brain hemisphere, allowing the recessive emotional site of the brain to dominate. The research found that the ear and hand dominance gave substantial influence to emotional determination, with a lesser influence from the eye and foot dominance.

This research fills the gap of analysing the working behaviour of pharmacists, due to their brain laterality, in various mutually-exclusive working areas.

November 2017

DECLARATION

I declare that the study entitled "A Reductionistic Epistemology utilizing Brain Laterality which Investigates Pharmacists' Ideal Interactive Environment" is my own work, that it has not been submitted before for any degree or examination in any other university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references.

Bernard Dennis Symon

November 2017

Signed: .....

DEDICATION

This research is dedicated to my parents, wife, daughter and all the kind people that gave enthusiasm for the completion of this work.

"That deep emotional conviction of the presence of a superior reasoning power, which is revealed in the incomprehensible universe, forms my idea of God."

Albert Einstein

www.brainyquotes.com

ACKNOWLEDGEMENTS

My kind thanks and appreciation goes out to the people and institutions for an active involvement towards the completion of this research.

Parents

Dr Israel and also Pauline Symon for help with funding and various mundane though vital activities related to my study

University of the Western Cape

Prof. Nadine Butler for being my mentor and giving inspiration and guidance, for collecting the reply questionnaires and delivering them personally to me in Johannesburg, for introducing me to Prof. Eagle of the SAPC, which resulted in obtaining the lists of South African pharmacists. Prof Nadine Butler is a remarkable person and this research would not have taken place without her devotion.

Prof. Renette Blignaut and Prof. Richard Madsen of the Statistics department, who assisted with information regarding the sample size, and who explained the statistics and assisted with the calculations, respectively.

Nelson Mandela Metropolitan University

Prof. Ilsa Truter for introducing me to Prof. Nadine Butler, which started this research.

University of Johannesburg Psychology Department

Prof. Christopher Stones, who gave encouragement and discussed psychological terminology for this research.

Rhodes University Pharmacy Department

Prof. John Haigh, who gave encouragement and obtained fellow staff members to complete the questionnaire, and Prof. Ros Dowse for referring me to Nelson Mandela Metropolitan University.

University of South Africa Psychology Department

The staff of the Psychology Department, for giving me a large psychological education, in the achievement of my Honours BSc degree in psychology, which formed the backbone of the research in this degree.

Leicester University

Prof. Clive Hollin of the Psychology Department for his mentoring, guidance and education towards my MSc degree in legal and forensic psychology, were my dissertation was on the importance of brain laterality in rape victim recovery, providing impetus for the current study.

London School of Pharmacy

Miss Cathrine Baumber, the school secretary, for passing the questionnaire around the departments and by so doing obtained a few completed questionnaires by pharmacists working in various departments. In the department of Pharmaceutical Chemistry, Dr. Emma Sharp passed the questionnaire on to a PhD student she was mentoring, Miss Ruena Hankock who obtained 31 completed questionnaires which Dr. Emma Sharp posted to me. My sincere thanks for a fantastic effort.

Kings College London Pharmacy Departments

Prof. Peter Hylands who obtained 4 completed questionnaires from his staff.

Nottingham University Pharmacy Departments

Prof. Claire Anderson who obtained 7 completed questionnaires from their staff.

Sigma Pharmaceuticals UK

Thanks to Mr. Anthony Collins, who obtained 5 completed questionnaires and personally brought them to my home.

Masters Pharmaceuticals

Miss Shilpa Gohil who obtained 48 completed questionnaires from pharmacists in community, hospital and industry at meetings with the local branch of the Royal Pharmaceutical Society of Great Britain.

Hasmonean High School

Mr. Eugene van Zyl, a senior science technician, who helped with the layout of the thesis.

Mr. Conrad Kaminer, head of science and physics teacher, for bringing stamps from South Africa.

Mr. David Brown, a senior science technician, for assistance with computerisation.

Mr Simon Bull MA (History) for proof reading.

Mr Ryan Nippard, a science technician, for enthusiasm and helping with the improvement of the thesis standard.

Cousins and friends

Mr. Eddie Steinberg for transporting stamps from South Africa to the UK and taking questionnaires in envelopes back to South Africa for posting.

Mr. John Arenson, for bringing South African stamps to the UK.

Dr. Alan Goldman for transporting questionnaires to South Africa and posting them.

Mr. Brian Lichter for encouragement.

Rabbis

Rabbi Yehuda Lieberman for encouragement and for the insight on religious aspects of brain laterality.

Rabbi David Lister for encouragement and giving me a book on how to write a PhD thesis.

UK pharmacists involved with snowballing

Finally my sincere thanks to 4 incredible UK pharmacists, whose immense efforts enabled the sample size in the UK to be obtained.

Shilpa Gohil of the Masters Pharmaceutical Company, who obtained 48 respondents.

Ruena Hankock at the London School of Pharmacy obtained 31 respondents.

Ansul Dattani obtained 21 respondents from Barnet and Chase Farm Hospitals.

Seema Varma obtained 17 respondents from the Maudsley Hospital (6) in London and the Aberdeen Hospital (11) in Scotland.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCING AND RATIONALIZING THE RESEARCH

1.1 History and terminology involvement

A brief history of brain laterality as well as salient terms to this research is discussed below.

1.1.1 Background history of brain laterality

Over the past 150 years, scientists have discovered that the left and right sides of the human brain are different. Even if structures exist in both hemispheres of the brain, they differed both in size and function. These differences in hemispheric specialization are referred to as brain lateralization. This brain lateralization was assumed to be unique to humans due to language ability and tool manufacture; however, research today accepts the presence of brain laterality in animals similar to that of humans involving brain functions such as movement, emotion and attention (Corballis, 2009). Thus, in humans, the left brain specializes in language, logic and objectivity whereas the right brain specializes in creativity, intuition and subjectivity (Levinthal, 1983). The brain laterality in animals supports the evolution of asymmetrical functions. In animals and humans asymmetry of the brain has been found to be inborn and partially under genetic control. However, the gene involvement has not been completely established (Corballis, 2009).

In the 19th century, Paul Broca determined the region specialized for speech on the left hemisphere of the human brain. Carl Wernicke, 50 years later, found a specialized region for language on the left hemisphere. In the 1960s Roger Sperry worked with "split brain" patients. These patients had their left and right hemispheres separated by cutting the corpus callosum to treat serious epilepsy conditions. This experiment demonstrated many lateralized functions including the left hemisphere being specialized for language and the right hemisphere for emotional and non–verbal functions. Mooshagian, Iacoboni

and Zaidel (2009) demonstrated spatial attention and interhemispheric visuomotor integration after cutting the corpus callosum. Brain laterality thus influences human and animal functioning in different environments due to lateral dominance of functions through evolution and consequently influences survival (Corballis, 2009).

Rogers (2003) states that scanning a human brain demonstrated panic–prone people to have higher brain activity in the right hemisphere even during rest, suggesting the influence of the right hemisphere only producing this particular behaviour which also suggests the right hemisphere's involvement in emotion.

1.1.2 Delineation of Terms

The following salient terms related to the research are discussed below.

Reductionistic – focusing on a few variables, not the whole. This is the approach to understand the nature of complex aspects by reducing them to the interaction of their parts or to more fundamental things (Reber, Allen, & Reber, 2009). This research adopts a reductionistic approach.

Epistemology – a mental approach to the world by a study of the grounds that claim to know something about the world (Oliver, 2004). Epistemology is a discipline that studies how the knowledge of science is generated and validated. Its function is to analyse the rules that are used to justify the scientific data, considering the social, psychological and historical aspects. This research investigates the epistemology of brain laterality in pharmacists to identify an ideal work environment.

Brain Laterality – A determination of brain hemisphere dominance using the dominance of the ear, eye, hand and foot, Coren, Porac, and Duncan (1979), Dittmar (2002) and Grouios, Ypsilanti, and Koidou (2013), allowing the investigation of emotion and objectivity influencing behaviour, due to this brain hemispheric dominance.

Ideal work environment – the ideal work environment, refers to the mutually exclusive work environment. People in an ideal work environment could have a progressive and dynamic approach to their work (Clark & Mount, 2006; Cox & Fitzpatrick, 1999).

Amblyopia – Reduced vision in one eye with no evidence of organic pathology (Reber et al., 2009).

Hemiplegia - defined by Reber et al. (2009) as a paralysis on one side of the body, due to a stroke caused by damage of the primary motor cortex.

The WADA test - described by Carlson (1991), Grouios et al. (2013), and Levinthal (1983) and named after the inventor who first developed the technique in 1949, where one side of the brain is put to sleep and the other side of the brain is left awake for investigation.

Tympanic membrane – the ear-drum which is the flexible membrane stretched across the end of the external auditory meatus which vibrates with incoming stimuli and transmits the vibration to the auditory ossicles (Reber et al., 2009).

Corpus callosum – described by Reber et al. (2009) as the band of myelinated nerve fibres, located at the floor of the longitudinal fissure that interconnects functions between the two cerebral hemispheres, and thus transfers information from one hemisphere of the brain to the other hemisphere.

Propinquity Principle - hypothesises that pharmacists living and working closer to the research university, are more likely to formally enter the research (Shorter Oxford English Dictionary 2007).

1.2 Investigating associated research

These sections elaborate on the studies of brain laterality being important and viable even though some researchers are not positive in this regard.

1.2.1 Decade of the brain

The Decade of the Brain (DOB) was the 1990s designated by the United States Congress and given approval by President George Bush in July 1990. This DOB stimulated many brain initiatives benefiting neuroscience. There were more than a thousand new neuroscientists entering the profession per year during the DOB. A strong awareness for brain research developed and the benefits associated gave hope for future brain research (Jones & Mendell, 1999).

The DOB stimulated global efforts researching the healthy and diseased brain. More research was carried out during the DOB than the past 50 years. These foundations provided valuable insight to stimulate further research into brain functioning (Tandon, 2000).

Positiveness from research pre, during and post the DOB (Sperry, 1974; Spivak, Segal, Mester, & Weizman, 1998; Witterman, van Lizendoom, van de Velde, van Heuven, & Schiller, 2011) can only give stimulus for the influence of investigating brain laterality placing pharmacists into their ideal work environment (Taylor, Maharaj, Williams, & Sheldrake, 2009).

1.2.2 Understanding brain laterality in humans through animal behaviour

Understanding animal brain laterality is important as it closely relates to the lateral functioning in human beings (Corballis, 2009). If brain laterality influences the behaviour of animals, it would influence the behaviour of humans, as humans are a higher animal species (Zucca, Baciadonna, Masci, & Mariscoli, 2011). Zucca et al.'s study on lions found that the right hemisphere controls the stress from the environment and the left hemisphere mediates the increase in functioning of the right hemisphere to deal with the stress. As an extension of Zucca's findings, it is possible to suggest that this may result in a variation of the brain laterality due to the right hemisphere being more active to deal with the stress from the

environment. This increase in activity of the right hemisphere may induce greater left side dominance in humans as the person becomes ill from the environmental stress. By finding the correct brain laterality for the environmental stress no variation or illness would be produced.

Further animal studies, mentioned below, also demonstrate the importance of brain laterality, animal behaviour, and survival in the animals' natural ideal environments. However, if animals require brain laterality for survival then possibly pharmacists may require a correct brain laterality to survive in their ideal work environment which will be investigated in this research.

Bottlenose dolphins were cited as capable of sleeping with one eye open demonstrating lateralization during sleep (Lyamin, Pryaslova, Kosenko, & Seigel, 2007). Dolphin mothers and their calves did not rest for the first 2 months postpartum, giving them a greater advantage of survival in their environment (Lyamin et al., 2007). Bottlenose dolphins rubbed their left flippers against another dolphin's body, indicating left eye domination and both the eye and the flippers are controlled by the right hemisphere of the brain, indicating the presence of emotion control in the right hemisphere of the brain. (Sakai, Hishii, Takeda, & Kohshima, 2006).

Fur seals in turn have the ability to switch from a terrestrial bihemispheric sleep pattern to an aquatic unihemispheric sleep pattern by varying the contralateral connection strength between the hemispheres of the brain. This gives the fur seal an advantage to survival in both environments (Kedziora, Abeysuriya, Phillips, & Robinson, 2012). Thus by varying the functioning of the brain hemispheres through the corpus callosum the fur seal can vary its sleep behaviour which is critical for its survival. This study portrays that a brain laterality may change thus having an influence on behaviour.

Lastly, the common wall lizard simultaneously uses the left eye for exploration as well as its anti-predatory behaviour and the right eye for predatory food finding behaviour

(Csermely, Bonati, Lopez, & Martin, 2011), thus ensuring the best chance of survival. This is supported by Bonati, Csermely, Lopez, and Martin (2010) in their study about wall lizards where the lizards turned left in a T maze. The different functions of the brain hemispheres in the wall lizard demonstrate the evolutionary advantage of brain laterality.

1.2.3 Refuting brain laterality research

According to Nielsen, Zielinski, Ferguson, Lainhart, and Anderson (2013), using magnetic resonance imaging, determined a local rather than global property of the brain networks, thus disagreeing with a left or right brain dominance and including no gender differences. They did determine small lateralization increases with aging.

Hagemann, Hewig, Seifert, Naumann and Bartussek (2005) used EEG assessment on resting people determined that resting asymmetry of the brain has trait and state properties. Thus there is a left or right brain dominance with each hemisphere having a separate function.

The research observed in sections 1.1.1, 1.2.1 and 1.2.2 such as that of Corballis (2009) support the epistemology of Hagemann et al. (2005) over Nielsen et al. (2013).

The research in favour of brain laterality exceeds that against its existence. One myth in scientific circles is that asymmetry of the brain is only found in humans which is disputed nowadays as asymmetry is widespread among vertebrates and invertebrates, in fact right hemisphere dominance for emotion is found in all primates studied suggesting evolution over the past 40 million years (Corballis, 2014).

1.3 Support for undertaking the research

What follows gave the researcher incentive to carry out the research.

1.3.1 Rationale and Context of the Current Study

The researcher's interest in brain laterality started with sports in high school where he realised he was right eye dominant, right ear dominant, right handed and right footed. He

observed the effects his brain laterality had on the sports he played (rugby, squash and golf) as well as how other people were influenced by their brain laterality. His father, for example, when playing golf used to hit the ball right handed and putt left handed, which reflected his father's brain laterality dominance being left eye, right ear, right handed and right footed. Another individual had the same brain laterality as the researcher's father and he bowled right handed in cricket and batted left handed, while yet another, who is left handed, played squash with his right hand. This curious combination of brain dominance led the researcher to realise that brain laterality influences a person's behaviour as demonstrated by these sporting actions.

The researcher also observed the importance of brain laterality whilst working as a senior pharmacist in the pharmaceutical industry in South Africa. Based on the Right Hemisphere Theory, he discovered a right hemisphere dominant person should only be given "the bottom line" regarding work information to prevent frustration in the interaction; supporting the work of Mintzberg (1976). This could be due to emotional bias of the right hemisphere dominant person. A left hemisphere dominant person, on the other hand, would appear to require great detail regarding work information, due to objectivity control in the left hemisphere of the brain, again supporting the work of Mintzberg (1976). Giving a left hemisphere dominant person an emotional reply when they require detail would frustrate this interaction.

Owing to this complexity in the need for different types of interaction, the researcher went on to study brain laterality in detail as part of his Honours BSc degree in Psychology, and continued investigating brain laterality for his MSc in legal and forensic Psychology. His dissertation investigated the importance of brain laterality in rape victim recovery and found that therapy for rape victims had a more positive outcome if the therapist had a similar brain laterality to that of the rape victim. Only a small sample of 13 rape victims was assessed thus

caution with the interpretation of results is advised. The researcher thus wished to apply the theories of brain laterality to a different environment about which he was knowledgeable: pharmacy.

Regarding the context of the study, in a pharmacy practice setting, one would observe that generally the right handed pharmacists would count the tablets one way and the left handed pharmacists would do so in a mirror image manner. There are however, some right handed pharmacists who count out the tablets as if they were left handed and vice versa. The degree of accuracy in the counting of tablets may be better with a certain brain laterality of the pharmacist. Brain laterality possibly influences the pharmacist's behaviour in this case. Similarly, some pharmacists prefer to kick a ball with their right foot and some with their left foot, or prefer one eye over the other to look down a microscope. A similar observation could be made regarding telephone use, which shows ear use preference. This qualitative observed behaviour and hence epistemology (approach to the world) may be quantitatively different, and would thus be worth investigating, ideally to match the correct pharmacist with their ideal work environment using the pharmacist's brain laterality.

Pharmacists work in diverse work environments ranging from education to community to industry, thus different interactive behaviours are required, depending on the nature of environments (Giorgianni, 2002). For example, pharmacists in community pharmacies primarily deal with patients, whereas pharmacists in educational contexts deal with students, thus catering to different human needs (Giorgianni, 2002). There are other work areas, namely hospital pharmacy, government agencies, marketing and distribution pharmacies, each having different job requirements which require different interactions by people. Placing pharmacists into an ideal work setting, according to their abilities of their brain laterality, may be imperative to optimise the pharmacy profession (Kumar & Sharma, 2016).

Brain laterality has also been considered in religious circles which provides further impetus for the exploration of this research. During discussions between the researcher and a Rabbi, Rabbi Lieberman, the Rabbi referred to a well-known individual, Rabbi Avraham Yeshayahu Karelitz (1878 – 1953), also known as the Chazon Ish, who wrote 40 books and discussed brain laterality in his book, Faith and Trust (Karelitz, 2008). The Chazon Ish stated that one must use the left side of the brain, the side with the intellect, to study the Torah to perfection, researched through years of studying Torah with many people. The right side of the brain is influenced by earthly aspects such as wealth, sexuality and the "here and now", which distracts the brain's left hemisphere objective perfectionism (Karelitz, 2008). People should thus strive for perfectionism directed by the objective side of the brain, stated the Chazon Ish, and repel the emotional subjective desires of the right side of the brain (Karelitz, 2008). Suppressing the right side of the brain would not be easy if a person was right side dominant, as he would have to strive harder than left side dominant people for perfectionism, which is controlled by the left objective side of the brain (Karelitz, 2008). The Chazon Ish continued by saying that decisions must be made by the left side of the brain, but be motivated by the right side of the brain (Karelitz, 2008). He mentioned that the left side of the brain is aware of long term consequences, whereas the right side of the brain, the non-logical thinking side, only sees the present. Although individuals enjoy being in this non-logical thinking side of the brain, people ought to strive to live in the intellect, left hemisphere of the brain to achieve ideal behaviour in their environments (Karelitz, 2008).

Whilst of interest for one's overall daily life, the question remains: Is there a complete domination of one side of the brain over the other, or is there a sharing of information from both sides of the brain via the corpus callosum? The sharing of information would give everyone the ability of emotional perfectionism to a varying degree, which would depend on their brain laterality bias, however, not everyone has the ability of emotional perfectionism.

People do behave differently due to their brain laterality dominance supported by Corballis (2009) and Tavor et al. (2016). Tavor et al. (2016) states further that people all differ in how they perceive, think and act. According to Tavor et al. (2016) different people performing the same task exhibited different patterns of brain laterality activity using functional magnetic resonance imaging (fMRI). This rationalizes the importance to investigate brain laterality and pharmacists' ideal interactive work environment.

1.3.2 Brain laterality selecting an ideal work environment

Mentioned by Lindell and Savill (2010) the left cheek of the human face expresses emotion (controlled by the right hemisphere of the brain) and the right cheek expresses an impassive appearance (controlled by the left hemisphere of the brain). They determined that if an impassive right cheek was put forward the person was a scientist. If the left cheek was put forward the person was emotional and interested in the arts. Psychologists were not biased in either direction demonstrating psychology to be both scientific and artistic. This demonstrates an influence of brain laterality in selecting a work environment suited to their science or art bias. Similarly, pharmacists would select their work environment according to their brain laterality dominance towards science or art.

Spreng et al. (2010) working with a large sample, 588 patients, determined that frontotemporal lobar hemisphere degeneration (FTLD) in conjunction with premorbid occupations demonstrated that right side atrophy patients worked where verbal and mathematics abilities were required. They determined that occupational selection in early adulthood was related to lateralized asymmetry in patients eventually developing FTLD years later. Thus the asymmetry of the brain selects an occupation according to the brain's

lateralized dominance. Pharmacists may accordingly select their ideal work environment according to their brain laterality.

Giorgianni (2002) demonstrates the mutually exclusive pharmacist work areas. Due to the different requirements for work in each work environment, put forward by Giorgianni, different brain laterality would be required for ideal pharmacist placement. Further demonstration of the different work required by pharmacists in different pharmacy work environments is given by O'Shea (2014). Thus a scientific pharmacist may be ideally suited to one work environment and an artistic pharmacist may be ideally suited to a different work environment. This research attempts to determine just which brain laterality group of the pharmacist is ideally suited to which work environment.

1.3.3 Application to pharmacists

The pharmacy profession has changed from a medicine orientation to a patient-centred approach (Droege, 2003). In fact, pharmacy work environments have become extremely specialised where pharmacists' work requirements are mutually-exclusive in each specialised work environment. This is demonstrated by community pharmacists having to deal with medicines and patients, whereas pharmacists in industry have to deal with documentation and manufacturing requirements. These two areas are entirely different and need mutually-exclusive behaviours from the pharmacists working in these areas. In order to strengthen the pharmacy profession, the appropriate placing of pharmacists into each of the mutually-exclusive work environments would be recommended towards ideal professionalism. The correctly placed pharmacist would be able to undertake the required work of the specific work environment competently and with confidence, with a minimum of stress and with lifelong enjoyment. This could be of value to associates and patients because the confident pharmacist instils confidence in others and their satisfaction may affect performance and retention (Ahmed, Tolera & Angamo, 2013).

Using the specifics of the pharmacist's brain function to determine the appropriate placing of a pharmacist for a particular work environment would be desirable. The use of specific brain functions due to biology of the brain could avoid cultural differences and Gestalt problems. Culture and a broad-based theory, such as the Gestalt theory, are generalized (Reber et al., 2009) whereas this research follows a reductionistic approach. An investigation of the functioning of the brain, using specific functions such as objectivity and emotion incorporated into a reductionistic approach, would alleviate these broader problems in determining the correct placement of pharmacists for specific work environments.

Exploring just two functions of the pharmacist's brain, objectivity and emotion, that are critical for selection of the ideal work environment could facilitate the ideal placement for pharmacists which is supported by Potter (2008) where she mentions that logic (or objectivity) is found in the left hemisphere and emotion in the right hemisphere and each hemisphere thus views reality uniquely. The brain's lateralization determines the individual's dominance of these functions (Mintzberg, 1976), and by matching this dominance to the emotional and objective requirements of the specific work environment, pharmacists could be placed into the ideal work environment. Due to the functions of emotion and objectivity being lateralized in the brain, the ear, eye, hand and foot dominance would determine a person's functional behaviour in this regard and thus determine the person's brain laterality. This approach was used in the current study in accordance with the literature of Coren et al. (1979); Dittmar (2002); Grouios et al. (2013) who found this brain laterality assessment appropriate. This current study thus looked at the ability to match pharmacists to their ideal work environments on the basis of 16 different brain laterality groups, created from the options of the ear, eye, hand and foot dominance, in conjunction with 16 other variables that may influence the effect of the brain laterality variable.

The main idea behind the current research is to focus on the brain cortex in understanding pharmacists' behaviours in diverse work environments. The brain cortex is the most advanced region of the brain and is divided into two halves connected by the corpus callosum, which acts as the pathway between the two brain hemispheres during communication (Hoptman & Davidson, 1994).

From birth, one hemisphere of the brain begins to dominate to differing extents in different people. Kasprian et al. (2011); Schaafsma, Riedstra, Pfannkuche, Bouma and Groothuis (2009) believe that the way the baby lies *in utero* may determine which hemisphere of the brain becomes dominant. This domination usually reaches maturation by approximately 20 years or older (Johnson, Blum, & Giedd, 2009). Thus in a brain laterality exploration it would be best to start from this age range.

Different functions are located in specific regions of a hemisphere. This research focused on the functions of emotion and objectivity as these influence a pharmacists' interactive behaviour at work. Emotion may, for example, be required when a pharmacist in a community pharmacy is dealing with a patient, while objectivity would be required in managing the medicine supply (Giorgianni, 2002).

Objectivity is controlled by a person's left hemisphere, Potter (2008), but the location of emotion is less clear cut. Currently, two theories have been proposed as to where emotion is controlled in the brain (Parr & Hopkins, 2000). These theories are the Right Hemisphere Theory and the Valence Theory. The Right Hemisphere Theory suggests that the right half of the brain is specialised in processing all the emotions. The Valence Theory in turn posits that each half of the brain is specialised, where the left hemisphere processes the positive emotions and the right hemisphere is specialised to process the negative emotions. Fernandez-Carriba, Loeches, Morcillo and Hopkins (2002), Gainotti (1983), Parr and Hopkins (2000) and Silberman and Weingartner (1986) discuss the location of emotion

control in the brain with potential for the Right Hemisphere Theory as well as the Valence Theory to be correct. Tompkins and Flowers' (1985) study on hemiplegia illustrated the value of the Right Hemisphere Theory, whereas Propper, Brunye, Christman and Bologna (2010) study of tympanic membrane temperature showed the value of the Valence Theory.

1.3.4 Critique for doing the research

Two aspects require attention at this point, namely the existence of Brain Laterality and the importance of including animal research.

Regarding the existence of brain laterality, studies to be discussed in the next chapter including hemiplegia, amblyopia, WADA test and the "split brain" experiments, support researching brain laterality and its functional differences (Agrawal, Mohanty, Kumar, & Chinara, 2014). Small sample sizes in these studies exist which could negate this support. However, anatomy of the brain and the contralateral movement of nerves gives a secure grounding for brain laterality existence (Carlson, 1991).

The use of animal studies on brain laterality is imperative to demonstrate how animals function in their environments for success which supports the research on how pharmacists succeed in their work environments. Due to an evolutionary sense humans should also possess a brain laterality behaviour affecting our success at work (Corballis, 2009; Zucca et al., 2011). Lindell (2013) stated that hemispheric lateralisation is recognised throughout the animal kingdom and that emotion, being a lateralized function, is important in adaptive behaviour and thus survival. As humans and non-human primates evolved from a similar ancestor this would support a continuation of emotion processing and brain laterality. Lindell continues that emotional lateralization in non-human primates can be used to view emotional lateralization in humans, thus the inclusion of animal studies in this research is justified.

1.4 Conclusions

This research would be lacking without mention of the presence of brain laterality in animals (Corballis, 2009) demonstrating an evolutionary trend of brain laterality functions which supports this research.

Brain laterality is a recognised entity supported by Dittmar (2002); Grouios et al. (2013) and Lindell and Savill (2010).

The ear, eye, hand and foot dominance is an easy non-invasive method Grouios et al. (2013) to determine brain laterality with a questionnaire used by Coren et al. (1979), Dittmar (2002) and Grouios et al. (2013).

Placing pharmacists into their mutually-exclusive work environments (Giorgianni, 2002; Taylor et al., 2009) could be achieved using the pharmacist's brain laterality (Spreng et al., 2010).

The brain functions most suited to this research is that of emotion and objectivity (Potter, 2008). Lindell (2013) stated that emotional lateralization in non-human primates can be used to investigate emotion in humans justifying animal study use in this research.

In conclusion an investigation of brain laterality in animals (Corballis, 2009), the researcher's sporting activities, work experiences, background education and religious readings (Karelitz, 2008), all gave support for the use of brain laterality to place pharmacists into their ideal work environments.

1.5 Summary of Chapter 1

The background gives a history of brain lateralization. Important terms in the research are elaborated. Mention is made of the Decade of the Brain and its positive influence to the importance of brain laterality and the placing of pharmacists into ideal work environments. The importance of introducing animal studies to strengthen this research is discussed.

Refuting the use of brain laterality is discussed concluding that brain laterality is viable for use in this research. Rationalizing enthusiasm for the research by the researcher is discussed. A section on using brain laterality to place pharmacists into ideal work environments is articulated. What is needed for the placing of pharmacists into their mutually-exclusive work environments is discussed. Critique of the use of brain laterality and the use of animal studies is discussed.

1.6 Overview of the Remaining Chapters

In chapter 2, analysis of the literature is presented in the context of reductionism, emotion and objectivity, stress and brain laterality. There is further analysis of amblyopia and brain laterality; hemiplegia and brain laterality; the WADA test and brain laterality; ear, eye, hand and foot use to determine brain laterality; and nerve conduction velocity and brain laterality. In addition, the literature review focuses on variables related to the behaviour of pharmacists, namely age, a doctorate degree, Type A and Type B personalities, corpus callosum influence, and the wearing of glasses affecting behaviour of pharmacists.

In chapter 3, the theoretical framework of how brain laterality of pharmacists can place them into ideal work environments is presented and questions arising from the literature are described and condensed into the research question generating the aims, objectives, and the Null and Alternative Hypotheses. The reductionistic variables will be mentioned and discussed.

In chapter 4, the research methodology will be described. A survey questionnaire will be used on a specific population, pharmacists. Sample size will be determined from tables taking the population size into account. The procedure for data collection will be explained. The data collection instrument will also be explained. This instrument will be discussed involving independent and dependent variables and reliability and validity of the

questionnaire. Ethical considerations will be discussed involving informed consent, protection from harm and ensuring privacy.

In chapter 5, the results are presented relating to the research objectives:

1. The investigation of 16 brain laterality groups of pharmacists, determining if they are statistically different in selecting pharmacists for their most preferred work environments.
2. Each of the 16 reductionistic variables, and in conjunction with each other and brain laterality for the placement of pharmacists into their ideal work environments.
3. A new continuum of brain laterality determination and the continuum's correlation to a simpler brain laterality determination.
4. The Propinquity Principle.
5. The correctness of the use of the Right Hemisphere Theory or the Valence Theory for brain laterality research.

In chapter 6 the significance of this research will be discussed, as well as recommendations for future research. Limitations and strengths pertaining to the measuring instrument will be explained.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction and overview

The literature review details the boundaries chosen for the literature search, to support the analysis of brain laterality of pharmacists and various other reductionistic variables that may influence the placing of pharmacists' into their ideal work environments.

2.2 Boundaries for the literature review and their rationale for the research

These boundaries give a rationale for their inclusion in this research with further support from the literature discussed later in this chapter. A reductionistic approach is used in this research thus clarification of these reductionistic variables follows which support the research.

Reductionism. Reductionism focusses on a few variables with greater intent than a Gestalt approach where generalization is involved. Reductionism is the approach to understand the nature of complex aspects by reducing them to the interaction of their parts (Collins, 2003). This research investigates brain laterality and 16 other reductionistic variables for the placing of pharmacists into their ideal environment. This reductionistic or convergent approach gives greater impetus to the validity of the reductionistic variables. A divergent Gestalt investigation would not emphasise the specific variables investigated (Reber et al., 2009).

Animal research and brain laterality. According to Corballis (2009) animal brain laterality understanding relates to lateral functioning in humans. Without studies on animal brain laterality human studies on brain laterality would be lacking possibly due to what is ethically allowed to be carried out on humans and animals. For example, humans cannot be subjected to stress from the environment to observe an influence on their right hemisphere. Zucca et al. (2011) demonstrated this right hemisphere stimulation from stress in the environment on lions. The lions became ill from this stress and their right hemisphere varied in functionality.

This may exist in pharmacists working in the wrong environment with the consequence of stress developing (Gaither et al., 2008), which may affect their brain laterality. Thus studying animal survival due to their brain laterality would only assist pharmacists to be stress reduced in their ideal work place. Thus this approach adopts the thinking that animal behaviour could be associated to human behaviour as humans are seen as an advanced animal species (Corballis, 2009).

Emotion and Objectivity. Due to the nature and importance of the pharmacy profession, where emotion is required to interact with sick people and objectivity is required to maintain non-expired drugs in the pharmacy or manufacturing, these two brain functions will be used in this research. The environments the pharmacists will work in are also regarded as being emotional or objective environments in this research (Giorgianni, 2002). Thus the research investigated if an emotional pharmacist would be suited to an emotional work environment and an objective pharmacist suited to an objective work environment. The pharmacist's brain laterality dominance will determine if they are emotional or objective (Coren et al., 1979; Mintzberg, 1976) and the emotional or objective work environments will be determined by the type of work the pharmacist is required to do. Working with patients is an emotional work environment and working in industrial manufacturing is identified as an objective work environment (Giorgianni, 2002; Oldfield, 2015; Schommer, Brown, & Sogol, 2007).

Investigating the two emotional theories is imperative to understanding how emotion may influence the pharmacists. Central to the current research is the Right Hemisphere Theory (RHT) which postulates that emotion is situated in the right hemisphere of the brain and objectivity situated in the left hemisphere of the brain, thus interpretation of emotion is located in the right hemisphere (Borod, 1992). In contrast, the Valence Theory (VT) argues that negative emotion is situated in the right hemisphere of the brain and positive emotion is situated in the left hemisphere of the brain, cited by Ali and Cimino (1997) and Achuff

(2001). For this reason, the literature supporting these theories was investigated to determine which theory is best suited to the exploration of ideal placement of pharmacists into their ideal work environments.

Stress and brain laterality – Literature regarding stress affecting pharmacists and their profession is explained to determine how brain laterality may alleviate stress conditions in pharmacists' work environments. Ocklenburg, Korte, Peterburs, Wolf and Gunturkun (2016) state that stress can affect lateralization in humans with greater involvement of the right hemisphere whereas lateralization can also protect against stress where the left hemisphere modulates the stress in the right hemisphere. The prevention of stress accumulation may come about if the correct brain laterality of the pharmacist is placed in an ideal work environment for that brain laterality.

Amblyopia and brain laterality - It was important to study the relationship between amblyopia and brain laterality to determine the influence of amblyopia on brain laterality and job choice. People with amblyopia have hand eye co-ordination and psychosocial difficulties (Packwood, Cruz, Rychwalski, & Keech, 1999) thus this would affect job choice and effect the results of this research. Amblyopia pharmacists could be regarded as extremely emotional if their left eye was dominant and extremely objective if their right eye was dominant supported by the Nobel-prize winning research on kittens of Hubel and Wiesel (1965).

Hemiplegia and brain laterality – Similarly, studies of the relationship between hemiplegia and brain laterality was important to demonstrate where emotion is controlled in the brain. Most of the hemiplegia research demonstrated the RHT to be correct (Silberman & Weingartner, 1986) however, hemiplegia also demonstrates the existence of a lateralized brain with different functions in each hemisphere imperative to give relevance to this research (Kucharska-Pietura, 2006; Serino et al., 2010).

The WADA test and brain laterality – The WADA test demonstrates asymmetry and dominance of one hemisphere of the brain over the other and in the context of the current study, literature was found for the functions of objectivity and emotion demonstrated to be found in different brain hemispheres, giving credibility to brain laterality research (Levinthal, 1983). Even though a small sample size was used in the WADA test the significance for this research was that laterality does exist and that the hemispheres have different functions (Carlson, 1991). These different functions, objectivity on the left hemisphere and emotion on the right hemisphere (Karelitz, 2008) could thus be applied in this research to place pharmacists into their ideal work environments.

Ear, eye, hand and foot – For these preferred indices to determine brain laterality of pharmacists and to demonstrate how the dominance of the ear, eye, hand and foot can influence behaviour (Coren et al., 1979) literature regarding accident prone behaviour, schizophrenia, posttraumatic stress disorder (PTSD), migraine, grip strength and the corpus callosum was reviewed regarding these indices and brain laterality. Thus using the ear, eye, hand and foot dominance to determine brain laterality of the pharmacists would be applicable, as demonstrated in these sections, easy to apply in a questionnaire and non-invasive preventing rejection of the research. In this research the brain laterality determination of Coren et al. (1979) will be structured to create an accurate new continuum for brain laterality determination. This new continuum supported by the literature (Coren et al., 1979) will be correlated to a shorter simpler brain laterality determination for easier use with large sample sizes.

Nerve conduction velocity and brain laterality - Varying nerve speeds demonstrated brain laterality, as the faster nerves were controlled by the dominant brain hemisphere, to the contralateral dominant limbs (Sathiamoorthy & Sathiamoorthy, 1990). Nerve conduction velocity gives credibility to the existence of brain laterality and to the different functions of

the two brain hemispheres. Nerve conduction velocity gives support to emotion being situated on the right hemisphere of the brain as the left hand in a right hander has a faster nerve conduction for sensitivity demonstrating an emotional presence (Tan, 1993).

Age and brain laterality - An investigation in this research was carried out to confirm if brain laterality changed with age supported by Dargent-Pare, De Agostini, Mesbah and Dellatolas (1992). As pharmacists get older their choice of ideal work environments may change if their brain laterality changed due to aging. Thus age was investigated for an influence on brain laterality and consequently job choice. The pharmacist may enjoy their work environment until their brain laterality changes. Steroid hormones and stress have been found to induce a variation in functional hemispheric asymmetry on aging cited by Ocklenburg et al. (2016).

Pharmacists and their work area - Literature was sought to discover the manner in which pharmacists interacted with others and their work environments. This included studies regarding stress, job satisfaction, future goals, gender interactions and work environments. The relevance here was to determine if pharmacists could be placed into their ideal work environments with brain laterality of the pharmacists as well as reductionistic variables with scant research in this direction. Certain jobs suite different people (Parker, 2014) thus finding the correct job for pharmacists using brain laterality and reductionistic variables can only strengthen the profession and create enjoyment of the work (Ahmed et al., 2013).

Pharmacists and Type A and Type B personalities - Characteristics of Type A (doing work fast, impatience, perfectionism, determinism and hostility) and Type B (doing work slowly, patient, relaxed and calm) personalities, involved with the pharmacy profession, were investigated, even though Type A personality could not be related to heart disease in the 1990s, as being a Type A or B personality would affect where a pharmacist desired to work, especially regarding the desire to work fast or slowly (Smith & Bryant, 2012). The

characteristics of a Type A personality that were investigated were control of people around them, how they became Type A personalities, and their attitudes to work. It was also investigated if Type A behaviour could be found in certain of the 16 brain laterality groups investigated in this research.

The Corpus Callosum Influence - Age and gender influences of the corpus callosum will be investigated in this research. This was carried out as the corpus callosum may decrease in functionality over time influencing brain laterality and hence job choice. The corpus callosum is larger in females (Stout, 2000) thus giving a different functionality and possible job choice. Transfer tests, maturation, anatomy, excitation and inhibition, stress levels, competence of a task, schizophrenia and transmission, hemispheric compensation, unitary consciousness and a feeling of total integration, associated to an involvement with brain laterality research were also explored to demonstrate the importance of the functioning corpus callosum in males and females in job choice.

Wearing of glasses affecting behaviour of pharmacists - An understanding that lenses in glasses removes blue light (Henderson & Grimes, 2010) with the effect that the lack of blue light will induced depression in pharmacists suffering from Seasonal Affective Disorder (Strong et al., 2009). This could affect pharmacists' work attitude and choice of placement due to depression. Thus all pharmacists wearing or not wearing glasses were assessed for possible depression by a self-assessed enjoyment scale in this research.

Pharmacists and work location - The influence of the distribution of pharmacists, in the UK and South Africa, encompasses where pharmacists choose to work and depends on various factors, for example having a doctorate and location of studying pharmacy (Dambisya, Modipa, & Legodi, 2007). These two countries were chosen due to the researcher living in the UK and having studied pharmacy in South Africa. In addition, gender influences, job satisfaction and stress may all influence pharmacists' distribution. The future of the pharmacy

profession, under the past education systems in the United Kingdom and South Africa, may also influence pharmacists work choice, and this was explored in the literature. The enthusiasm of the pharmacists in South Africa and the UK to be involved in this research will be determined by the pharmacists proximity to the research university (propinquity principle) as a greater difficulty for involvement may create inaccuracy of the data due to lack of enthusiasm. The closer the pharmacist is to the research university the more enthusiasm for the research (Reber et al., 2009).

2.3 Brain laterality

According to Reber et al. (2009) brain laterality is involved with the asymmetry of the hemispheres of the brain with regard to specific cognitive functions. A variety of cognitive, perceptual and affective components of behaviour are lateralized (Rogers, 2003). The left hemisphere of the brain is analytical, functioning in a sequential rational fashion. The right hemisphere of the brain is synthetic, functioning in a holistic non-rational manner (Karelitz, 2008). Analytical skills such as problem solving, hypothesis-formation and testing, and even consciousness, are regarded as left hemisphere dominant, whereas art, music and even the unconscious, are right hemisphere dominant (Grouios et al., 2013). However, Reber et al. (2009) believed that these sharp delineations in hemispheric functions, for specific capacities, may be oversimplifications. They thus define brain lateralization as the process by which different functions and processes become associated with one or the other side of the brain.

The left hemisphere specializes in analytical thought, structure, discipline and rules, time sequences, mathematics, categorization, logic and rationality and deductive reasoning, knowledge, details, definitions, planning and goals, written, spoken and heard words, productivity and efficiency, science and technology, stability, extraversion, physical activity

and control of the right side of the body. The left hemisphere of the brain is emphasized in education and in society in general (Reber et al., 2009).

The right hemisphere in turn specializes in intuition, feelings and sensitivity, emotions, daydreams and visualizing, creativity in art and music, colour, special awareness, rhythm, spontaneity and impulsiveness, the physical senses, risk taking, flexibility, learning by experience, relationships, mysticism, play and sport, humour, motor skills and control of the left side of the body. The right hemisphere has a holistic way of perception (Reber et al., 2009).

In every brain laterality function, one hemisphere is dominant (Corballis, 2009); however, the other hemisphere participates to some extent. There is thus a dominant and recessive brain hemisphere influencing each other via the corpus callosum (Cherbuin & Brinkman, 2006) and the resulting brain laterality of the person may thus be assessed along a continuum of behaviour depending on the degree of dominance of the brain hemispheres.

An additional elaboration on brain laterality is that the two halves of the brain's cerebral cortex, the left and right side, execute different functions (Stout, 2000). This brain laterality theory was developed by the Nobel Prize winners Roger Sperry and Robert Ornstein and helps with the understanding of behaviour, personality, and creativity, and gives the correct thinking to do various tasks (Levinthal, 1983). Furthermore, the left and right hemispheres of the brain are joined by the corpus callosum, which is a bundle of more than 200 million nerve fibers, transmitting information from one hemisphere to the other, enabling the hemispheres to communicate. The corpus callosum may be cut in people with severe epilepsy, reducing the severity of the epilepsy, but demonstrating that the left and right hemispheres of the brain function differently (Levinthal, 1983). The corpus callosum is about 40% larger in women than in men, which demonstrates the necessity to include gender into any brain laterality research (Stout, 2000).

2.3.1 Brain laterality in animals

If animals are affected by brain laterality in their environments, then humans being advanced animals, may also be influenced by brain laterality in their environments (Corballis, 2009). Corballis (2009) mentioned that dogs tended to wag their tails to the left, using the right hemisphere, when confronted by a larger dog but waged the tail to the right, using the left hemisphere, when confronted by their owners (Quaranta, Siniscalchi, & Vallortigara, 2007). Davidson (2004) agreed with these finding and using human subjects found that the left hemisphere was used for approaching whereas the right hemisphere was used for avoidance. This demonstrates how animal research can be applied to human research but caution should be advised if the animal is not as advanced as the human (Corballis, 2009). The evolution of brain laterality is strongly influenced by social selection pressure in animals (Corballis, 2009), and this may also be the case with humans, possibly through their work environments (Rogers, 2003). Corballis (2009) mentioned other factors, such as embryology and movement in the uterus where the right side of the baby faces the front of the mother in the last trimester to develop into a right handed individual.

It can be seen, with a variety of animals, that having the appropriate brain laterality for their environments is important for that animal's survival. For example, how bottlenose dolphins survive in their environment, expanding from chapter 1, is cited by Lyamin et al. (2007). They are inquisitive aquatic mammals, which form strong bonds within their pods and sometimes have helped humans with rescue and fishing. They have to come to the surface of the water to breathe and can stay underwater for 20 – 30 minutes. Their skin is sensitive to human touch and other elements in the water. They can move through the water quickly, without exerting large amounts of energy, relying on their pectoral fins and their tail. The dolphins use echolocation to communicate in the water. What is of importance to brain laterality research is the sleep pattern of these dolphins in that they are capable of sleeping

with one eye open and exhibiting slow wave activity in the electroencephalogram (EEG) of one hemisphere at a time, which represents their sleep period. Three dolphins with their calves were monitored from birth to 13 months postpartum. The bottlenose dolphin mothers and calves showed a complete absence of rest for at least 2 months postpartum. Thus bottlenose dolphins can stay awake for 2 months to look after their calves by keeping one eye open. The mothers and calves were highly active and vigilant during this initial 2 month period and continuously monitored their positions, relative to each other, by sight, when awake and when asleep. (Lyamin et al., 2007). This demonstrates different functioning of the two brain hemispheres creating a rationale for brain laterality research and behaviour. The dolphin's brain laterality appears ideal for its survival in its environment and humans learn from this animal that matching the human's brain laterality to their environment would also enable well-being for the human (Dittmar, 2002). Similarly demonstrated below with the Fur seal where their brain laterality importance is demonstrated for their survival emphasizing the importance of brain laterality to human survival in their environments. Mention is also made of the wall lizard and its brain laterality and survival demonstrating that even primitive animals need brain laterality for survival, however, caution is advised with transferring information from primitive animals to humans as this data may not correlate ideally with human survival as it does with the data from more advanced animals (Corballis, 2009).

Fur seals for their part, cited by Kedziora et al. (2012), have muscular fore-flippers and the ability to walk on all fours. They have a dense underfur and are closely related to the sea lions. The males are five times heavier than the females, thus one of the most sexually dimorphic of all mammal groups. Dominant males reproduce with more than one female. The pups are born on land and during this period the dominant male parent fasts to protect the families and territories, as he cannot go to sea for food, for fear of losing the females and territories in his absence. Fur seals are preyed upon by sharks and orcas. Of potential interest

to brain laterality research is that fur seals can switch from a terrestrial bihemispheric to an aquatic unihemispheric sleep pattern, by varying connection strength between the hemispheres. Kedziora et al. (2012) postulated that inhibitory connections between ventrolateral preoptic (VLPO) nuclei in opposite hemispheres are responsible for unihemispheric sleep, and thus contralateral inhibitory connections promote unihemispheric sleep, while ipsilateral inhibitory connections promote bihemispheric sleep (Kedziora et al., 2012). This advanced sleep pattern demonstrates the importance of interconnections between the brain hemispheres to influence the function of sleep in different environments. The brain of humans, being an advanced mammal, could therefore also be influenced regarding behaviour by interconnections between the brain hemispheres.

The wall lizard is small and thin, brownish or greyish with tinged green spots and small scales. This wall lizard lives in rocky environments, including urban settings, where it can scurry between rocks, rubble and buildings. Lateral eye positioning in ectotherms facilitates the spread of visual lateralization, that is, the different use of the eyes. This enables the wall lizard to carry out more than one task simultaneously. Csermely et al. (2011) did experiments on wall lizards in captivity, to determine if they showed eye lateralization when exploring a new environment. Exploring a T-maze, they mostly entered the left rather than the right arm, without turning the head, demonstrating a right hemisphere visual control of the left eye investigating the environment, supported by the research of Bonati et al. (2010). Thus, regarding brain laterality research, the wall lizard simultaneously uses the left eye for exploration and anti-predatory behaviour and the right eye for predatory behaviour (Csermely et al., 2011). The wall lizard demonstrates that most animals are influenced by brain laterality affecting behaviour irrespective of their advanced hierarchy (Corballis, 2009).

2.3.2 Brain laterality and brain emotion control demonstrated by either the Right Hemisphere Theory or the Valence Theory

There are two main schools of thought regarding brain laterality and emotion. These have been investigated by pre DOB important authors such as Gainotti (1983), Silberman and Weingartner (1986), and post DOB authors of Parr and Hopkins (2000) and Fernandez-Carriba et al. (2002). These schools of thought are best characterised by Parr and Hopkins (2000) with the other authors mentioned above in agreement. The theories are as follows:

The Right Hemisphere Theory, (RHT), postulates that the right hemisphere is primarily responsible for emotional processes.

The Valence Theory, (VT), posits that the right hemisphere regulates negative emotion and the left hemisphere regulates positive emotion.

The authors mentioned above agree about the potential existence of these two theories. Gainotti (1983), and Silberman and Weingartner (1986) did their research on people with brain damage, further supported by work of Batut et al. (2006) on epilepsy which demonstrated positive and negative emotion on the left and right side of the brain respectively, whereas Parr and Hopkins (2000) and Fernandez-Corriba et al. (2002) investigated the potential for existence of either theory using chimpanzees. The studies are discussed and compared below.

2.3.2.1 Tympanic membrane temperature influenced by emotion

Parr and Hopkins (2000) used the tympanic membrane temperature to assess asymmetries in the perception of emotional stimuli in six chimpanzees. When they were shown negative emotional situations, the left tympanic membrane temperature was significantly higher than normal. This gives partial support to the RHT and the VT. RHT support is due to the chimpanzees observing the negative emotion through the left eye, which stimulated the emotional or negative emotional region in the right hemisphere of the brain,

thus increasing the tympanic membrane temperature in the left ear. The VT was supported as neutral or positive emotion was distributed to the positive emotional region in the left hemisphere of the brain, demonstrated by an increase in the temperature of the right tympanic membrane.

2.3.2.2 Facial expression and emotion

Fernandez-Carriba et al. (2002) in turn worked with chimpanzees and determined that they demonstrated a right hemisphere specialization for facial expression of emotion. These facial expressions were asymmetrical, with the left side of the face mostly involved (the right hemisphere of the brain) in the production of emotional responses, where $P < 0.05$ for these responses. Thus, these researchers found that chimpanzees, like humans, demonstrate a right hemisphere specialization for facial expression of emotions. This may demonstrate the validity of the RHT.

2.3.2.3 Word recognition and emotion

Ali and Cimino (1997) used normal individuals, 79 undergraduate students to whom they presented lateralized positive, negative and neutral English words and non-words. Participants were asked to recall and recognise the words and non-words. This study demonstrated the left hemisphere of the brain recognising positive words and the right hemisphere of the brain recognising negative words, thus providing strong support for the Valence Theory in memory recognition.

Holtgraves and Felton (2011) in turn examined the hemispheric asymmetry in normal humans in the processing of verbal stimuli, varying in emotional valence. Recognition for positive emotional words, presented to the right visual field, (the left hemisphere of the brain), was faster than when shown to the left visual field, (the right hemisphere of the brain). However, negative emotional words had faster recognition, when shown to the left visual field. This demonstrates that the Valence Theory in brain laterality investigations, regarding

the function of emotion, could be more valid than the Right Hemisphere Theory. Thus Ali and Cimino (1997) and Holtgraves and Felton (2011) support the existence of brain laterality encouraging the existing research.

2.3.2.4 Anger and emotion utilizing the tympanic membrane temperature

Propper et al. (2010) used the method of tympanic membrane temperature, in humans, to measure brain hemispheric activity when people are angry. Their research supported the Valence Theory, with a large difference between the left and right tympanic membrane temperatures, suggesting increased anger or hostility in the individual. The left tympanic membrane temperature was higher than the right tympanic membrane temperature in people that were angry. This demonstrates the negative emotion, stimulated by anger, in the right hemisphere of the brain, increasing the temperature of the left tympanic membrane in the ear. Propper et al. (2011) provide further evidence that anger is associated with the asymmetry of hemispheric activation. This could demonstrate that a negative emotion, anger, is totally in the right hemisphere of the brain, as when there is extreme laterality of the emotional regions, anger may be the potential behaviour. Extreme laterality may thus induce greater anger (Propper et al., 2011).

2.3.2.5 Right Hemisphere Theory or Valence Theory regarding emotion

The right prefrontal cortex is dominant in the activation of stress and emotion, and the left hemisphere counters this activation through processes of inhibition using the corpus callosum, (Sullivan, 2004), thus supporting the Right Hemisphere Theory; however, a small sample was used in the research thus the Valence Theory still has credibility. Even so, the positive emotional site in the left hemisphere may be the site inhibiting the stress and the negative emotion in the right hemisphere, which thus emphasizes the Valence Theory. This research will determine the emotion of the pharmacists by asking a negative emotional question dealing with global warming effecting future drug supply and a positive emotional

question on global warming involving how pharmacists can be proactive in educating people on global warming (Patz, Campbell-Lendrum, Holloway, & Foley, 2005).

2.3.2.6 Human and animal emotional control

According to Rogers (2003) the right hemisphere in humans expresses intense emotion which includes aggression and this function is also found in chicks, toads, lizards and monkeys. Monkeys and humans express emotion such as fear on the left side of their face (controlled by the right hemisphere). The left hemisphere of vertebrates including humans is used for decisions (Rogers, 2003).

Kensinger and Choi (2009) used humans to view positive, negative and neutral objects shown to the left and right hemisphere. The memory of negative objects shown to the right hemisphere was remembered well. This demonstrated that the right hemisphere was specialized for negative emotional information supporting the Valence Theory (Kensinger & Choi, 2009).

2.3.3 Emotion and objectivity

The importance of investigating emotion and objectivity in brain laterality research is elaborated below using the best of the pre, during and post DOB books and articles. These sections demonstrate the function of objectivity to be in the left hemisphere of the brain and the function of emotion to be in the right hemisphere if adopting the RHT and negative emotion in the right hemisphere, positive emotion in the left hemisphere if adopting the VT.

2.3.3.1 Split brain experiments

Levinthal (1983) cited studies by two neurosurgeons, Philip Vogel and Joseph Bogen, who in the early 1960s, severed the corpus callosum and the anterior commissural to control epileptic seizures in patients where anti-seizure medication was not effective (Bogen & Vogel, 1974). The cognitive functions of these patients were investigated by Sperry (1974)

and his associate Gazzaniga (1970) and Gazzaniga (1998). They had the rare opportunity to understand the consequences of one hemisphere being isolated from the other in humans. Sperry (1974) maintained that each hemisphere seemed to have its own separate and private sensation. Mintzberg (1976) in turn put forward that emotions appeared to be controlled in the right hemisphere of the brain, and that objectivity appeared to be controlled in the left hemisphere of the brain (Corballis, 2014; Levinthal, 1983; Mintzberg, 1976).

Despite this cognitive duality, the split brain produced no change in personality, temperament or overall intelligence (Levinthal, 1983). However, there was a functional asymmetry in the two hemispheres. There was a difference in the kind of response made to information given to a particular hemisphere. Only objects viewed in the right visual field could be named, since only the left hemisphere is capable of verbal expression (Gainotti, 2013). This demonstrates the contralateral transfer of the right visual field to the left hemisphere of the brain, similarly the left visual field is transferred contralaterally to the right hemisphere of the brain (Gazzaniga, 1998). In the split brain patients the optic chiasm does the transfer and was not dissected with the corpus callosum. This demonstrates the importance of using the eye to determine brain hemisphere dominance and why a right eye dominance would point to a left hemisphere dominance and visa versa. However, recent research has found that both eyes have a left and right visual field and that this information is sent to both left and right hemispheres (Levinthal, 1983; Reber et al., 2009). This makes the use of the eye rather sceptical as its function is not clear cut. However, at least 75 percent of the sight is contralaterally transferred at the optic chiasm allowing the use of the eye in this research (Guyton & Hall, (13th Ed) 2016). Continuing, Sperry (1974) found that the right hemisphere could communicate the recognition of pictures, in nonverbal terms only, by using innervation of muscles in the left arm and hand. In nonverbal tasks, it was found that the right hemisphere performed better than the left. These split brain experiments demonstrated the

importance of the corpus callosum in transferring information between the two hemispheres. The transferring of information creates a homeostatic effect of the two hemispheres as determined by Hebbal and Mysorekar (2003). Thus cognisance must be taken of the corpus callosum functioning in brain laterality research, as a varying of the functioning of the corpus callosum may affect the homeostatic effect of the individual.

2.3.3.2 Matching to previous occurrences

In a different study, research by Miller, Valsangkar-Smyth, Newman, Dumont and Wolford (2005) found that in normal subjects the left hemisphere of the brain tends to look for patterns, objectivity, that match previous occurrences, supported by Gainotti (2015) with familiar people recognition, but this was not the case with the right hemisphere of the brain. This demonstrates that the left hemisphere functions objectively whilst the right hemisphere functions subjectively, which is supported by Karelitz (2008).

2.3.3.3 Dementia involvement

Using dementia patients, Perry et al. (2001) in turn demonstrated that the anterior temporal lobe of the right hemisphere controlled emotions, empathy and social behaviour. The subjects with right temporal lobe atrophy showed severely impaired recognition of emotion from faces and voices. Empathy was lost and interpersonal skills were severely affected from right hemisphere damaged patients. There was also a fixed emotional expression, unresponsive to situations stimuli. Mendez and Lim (2004) mentioned that there was a sense of altered "humanness" in right hemisphere frontotemporal dementia patients. Semantics is controlled in the left hemisphere and emotion in the right hemisphere, according to Perry et al. (2001), supporting the Right Hemisphere Theory, but in one of their left handed cohorts a reverse of this situation existed, which is possible in about 5% of the normal population according to McManus (2002). This 5% error in a brain laterality investigation could be alleviated with a large sample size.

2.3.3.4 Word recognition

Further studies were reviewed, namely one by Mneimne et al. (2010) who determined that words presented to the right visual field, (left hemisphere of the brain), were recalled and recognised more accurately than the left visual field, (right hemisphere of the brain). This word presentation could support the findings of Miller et al. (2005) by having patterns of the words in the left hemisphere of the brain, on which the words could be matched, enabling accurate recall and recognition.

2.3.3.5 Influence on the tympanic membrane

Helton, Kern and Walker (2009) in turn determined that negative emotional stimuli, of the right hemisphere of the brain, increased the temperature of the tympanic membrane of the left ear. Thus the ear tympanic membrane could be influenced by the contralateral emotional site of the brain hemisphere, as the increase in temperature of the tympanic membrane demonstrates a connection between the emotional site in the brain hemisphere and the tympanic membrane (Helton, 2010). The temperature increase of the ear tympanic membrane comes about due to vibrations of the tympanic membrane. The influence from the emotional site in the hemisphere of the brain could be stimulatory or inhibitory. Thus, Helton et al. (2009) demonstrated that as the site of emotion in the brain was stimulated, a temperature increase of the contralateral ear tympanic membrane developed. Helton et al. (2009) provides support to the Valence Theory with positive and negative emotion being controlled in different brain hemispheres demonstrated by investigator gender increasing the tympanic membrane temperature (Helton, Carter, & Carter, 2011).

2.3.4 Relationship between brain laterality and pharmacist work environment

According to Woodward and Chen (1994), pharmacists that were in a good mood on a day would be more satisfied with their work than pharmacists that were not in a good mood.

To achieve this conclusion, pharmacists were randomly selected from the Iowa Board of Pharmacy Examiners mailing list and a similar procedure was adopted in obtaining the South African cohort from the South Africa Pharmacy Council.

Lapane and Hughes (2006) investigated job satisfaction and stress among pharmacists working in long-term care facilities. They found more than 90% of pharmacists to be very satisfied with their jobs. Short staffing was the most frequently reported source of stress, which the pharmacists said affected their ability to perform their duties. A study by McCann, Hughes, Adair and Cardwell (2009) determined the level of job satisfaction and stress in pharmacists in Northern Ireland, finding that community pharmacists were more stressed than hospital pharmacists. Stress in both these groups was caused by interruptions, excessive workload and inadequate staffing. These studies thus demonstrated that environmental stressors induced stress in the pharmacists, thus it is critical to investigate if the placing of the correct brain laterality of the pharmacist into their best suited work environment alleviated stress which could result in better productivity. Pharmacists in their ideal environments may thus not feel they had an excessive workload due to a better ability to achieve the workload. Using brain laterality of the pharmacists is a reductionistic approach to investigate the influence of brain laterality in ideal job placement. It is appreciated that other factors such as personality and aptitude may be a broader approach, they may even have an influence on ideal job placement, but this research strives to determine the influence of brain laterality on ideal job placement.

Olson and Lawson (1996) examined job satisfaction of pharmacists using a mailed questionnaire. Questions on clinical pharmacy training and participation in clinical pharmacy services were included in the questionnaire, which was taken from a previously validated survey. There was a 58.4% response rate. The pharmacists' level of job satisfaction showed a

positive association with clinical pharmacy involvement, as the more time hospital pharmacists worked in clinical activities, the more satisfied they were with the job.

Olson and Lawson (1996), Lapane and Hughes (2006), and McCann et al. (2009) demonstrated the importance of finding the correct persons for work environments. In this research the correct pharmacist for the job would have a brain laterality that suited the requirements of the work environment. For example a left hemisphere dominant objective pharmacist may be best suited to work in an objective environment such as research or industry. A right hemisphere dominant emotional pharmacist may be best suited to work in community or hospital pharmacies due to emotional patient interactions.

Mott, Doucette, Gaither, Pedersen and Schommer (2003) stated that the stress pharmacists continually face should be reduced to increase the quality of their work. It was determined that gender, race, years of experience, marital status and children also affected work attitude. Their survey was carried out using postal mail in the United States from lists of licensed pharmacists, with a cohort of 1737 practicing pharmacists demonstrating the success and hence usability of a postal method. They found 68% of the pharmacists experiencing job stress and 48% experiencing work-home conflict. The job stress was significantly higher in corporate community pharmacies and hospital settings than in independent community pharmacies. It was found that the unhappy pharmacists felt increased stress whilst working, and often slow down their pace of work due to their inability to cope with work under stress. Their decision-making skills are distracted and it takes them more time to complete every work task, irrespective of the placement they hold. Borritz et al. (2005) supported the above findings of Mott et al. (2003) by investigating psychosocial factors and burnout. Owing to this, solutions ought to be found to lessen stress of work to prevent endangering the pharmacy profession, the physical and mental state of the pharmacists and possibly compromising patient safety. Thus this research investigates if stressors of the work environment could be

removed or reduces by placing the pharmacist with the ideally suited brain laterality for the job into that work area.

2.3.5 Brain laterality, emotion and stress

Sullivan (2004) stated that the prefrontal cortex (PFC) plays an important role in regulation of emotion and stress. Working with rats, the author showed hemisphere specialization in that the right PFC is dominant in stress. On the other hand, the left hemisphere plays a role in countering the activation through inter-hemispheric inhibitions done through the corpus callosum. This research strengthened the Right Hemisphere Theory, but demonstrated that emotion was controlled by the left hemisphere of the brain. However, the positive emotional site in the left hemisphere of the brain could have been controlling the negative emotional site in the right hemisphere of the brain, thus supporting the Valence Theory. In terms of the corpus callosum joining sites of similar function, Hoptman and Davidson (1994) determined that the positive emotional site may be attached to the negative emotional site and control could be carried out by the dominant hemisphere emotional site.

A study by Lawrence (1994) determined the pattern of handedness of a group of depressed and non-depressed female and male college students. For the female students, the rate of non-right handedness was more in the depressed group than in the non-depressed group. The study observed no difference in the pattern of handedness between the groups of non-depressed and the depressed male subjects. It was observed that the relationship between depression and handedness, among women, may be attributed to the association between the two variables to a common third variable: sex-role behaviour in their work environment.

Denny (2009) investigated a cohort from 12 European countries to analyse if there is a relation between depression and handedness. The results depicted that the left handers were significantly more likely to have depressive symptoms than the right handers. Depression is

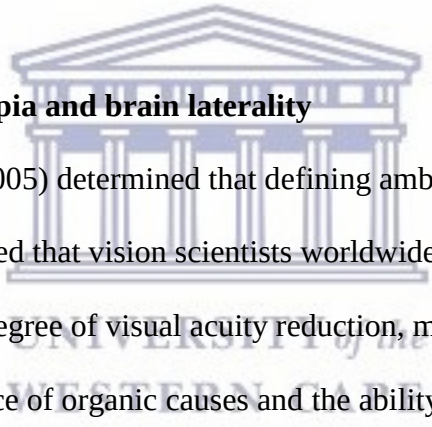
an emotional symptom and the region for emotion is found on the right hemisphere of the brain according to the Right Hemisphere Theory (Perry et al., 2001; Reber et al., 2009). The right hemisphere of the brain also controls the left hand. Thus if someone is right hemisphere dominant, determined by being left handed, they have a dominant emotional region in the right hemisphere of their brain, making them prone to emotional swings, leading to depression in the environmental setting. This coincides with the findings of Zucca et al. (2011) where a study on lions found that the right hemisphere controls the stress from the environment and the left hemisphere mediates the increase in functioning of the right hemisphere to deal with the stress. If the stress from the environment is too great the lions' brain laterality may change and the lions become left paw dominant and ill. This change of brain laterality is supported by Alfano and Cimino (2008). The work of Denny (2009) could support the Valence Theory, due to the possibility that negative emotion would cause depression by influencing the negative emotional site in the right hemisphere of the brain. The region of the brain used to control the hand is large, according to McManus (2002), giving strong influence to the use of the hand, thus a left handed person would have a very dominant right hemisphere, with more potential for emotional or negative emotional problems.

2.3.6 The ear, eye, hand and foot preferences and brain laterality

Various researchers such as Coren et al. (1979), Lee et al. (2016) and McManus (2002) have used ear, eye, hand and foot preferences to determine brain laterality bias. McManus (2002) stressed the importance of the hand in determining brain laterality, since the region of control of the hand in the brain is large compared to that for the ear and eye. He stated that most right handers are also right footed and most left handers are left footed. However, to give an all-inclusive accurate brain laterality determination, it is preferable to

use the ear, eye, hand and foot dominance, as concluded by Coren et al. (1979) and McManus (2002).

According to McManus (2002) ear dominance can be determined by which ear the person prefers to use with the telephone. Regarding the dominance of eye, McManus (2002) suggested that, if one stretches out ones arm and points at some small object in the distance and then closes one eye, if the finger is still aligned with the object, then the open eye is the individual's dominant eye. If the individual then looks with the other eye, the non-dominant eye, then the finger should no longer point at the object when the dominant eye is closed. Asking a pharmacist which eye they preferred to use when looking down a microscope would also indicate the dominant eye (McManus, 2002).



2.3.7 Relationship of amblyopia and brain laterality

A study by Ohlsson (2005) determined that defining amblyopia is difficult and not specific enough, and he believed that vision scientists worldwide should decide on a definition. He stated that the degree of visual acuity reduction, magnitude of inter-ocular difference in acuity, the absence of organic causes and the ability to treat the deficit, need consideration. According to Reber et al. (2009) on the other hand, amblyopia may be regarded as reduced or indistinct vision in one eye. It is a condition where there is no evidence of organic pathology or refractive error. Amblyopia is the partial or complete loss of vision in one eye caused during development. This author stated that amblyopia may be associated with colour blindness, diabetes and toxic substances such as alcohol and nicotine. Pharmacists with amblyopia could thus be more specific in choosing their ideal work environments, due to these complications (Reber et al., 2009).

The Nobel Prize winners, Hubel and Wiesel (1965) carried out a classical experiment on the relationship of amblyopia on brain laterality. They raised kittens with an eye sutured

shut and found that the ocular dominance columns were unable to develop properly. The primary visual cortex organised itself to respond entirely to the undeprived eye. It was found that there is a period, up until the kittens are about four months old, during the establishment, that monocular deprivation during this period damages the ocular dominance columns (Hubel & Wiesel, 2005). Thus a pharmacist with amblyopia would have a dominant undeprived eye and a deprived eye which would affect work ability and hence work choice becomes more important to the pharmacist.

Jackson, Newport and Shaw (2002) confirmed the influence of amblyopia, showing different functions on the left and right side of the brain. They demonstrated that binocular vision is crucial for the accurate planning and control of movement. A job involving a lot of hand actions, such as counting tablets and opening and closing of containers may not be suited to someone with amblyopia, due to these hand-eye coordination problems. Neuropsychological and psychophysical studies confirm that binocular vision is crucial for accurate planning and control of prehension (hand-eye) movements. These authors also stated that monocular viewing relies on pictoral visual clues, to calculate grasping, resulting in errors with the grip strength and assessment of the object size. Thus grip increases with monocular vision, but maximum grip force is reduced, as well as a constant misperception of object size in amblyopia. Amblyopic pharmacists may thus be better suited to work in academia or documentation depending on which eye is affected (Grant, Melmoth, Morgan, & Finlay, 2007).

2.3.8 Hemiplegia and brain laterality

Hemiplegia is defined by Reber et al. (2009) as a paralysis on one side of the body, due to a stroke which is the sudden death of some brain cells due to a lack of oxygen when the blood flow is blocked or an artery is ruptured, and the excess blood on the brain cells kills

the brain cells by clotting the brain cells together. The paralysis takes place on the opposite side of the body to where the stroke occurred in the brain. These stroke victims demonstrate a lack of functions where the stroke occurred and thus may be used to evaluate where certain functions normally occur. (Borod, 1992; Kucharska-Pietura, 2006; Serino et al., 2010; Tompkins & Flowers, 1985). These researchers from pre during and post the DOB (giving an expanded appreciation) will be cited in other sections of this chapter where hemiplegia studies have been used to support where brain function is located.

Hemiplegia, as far as the definition is concerned, tends to support the RHT. The stroke victims, from the above studies, demonstrated either being emotional or not emotional, which favours emotion being controlled in the right hemisphere of the brain. However, each of these researchers used a small sample size, thus their results may not be completely accurate. The stroke may have been more widespread in the brain than observed, which would have favoured the VT, pointing to the function of emotion being in both hemispheres, as both these emotional sites may have been affected by the stroke, positive emotion in the left hemisphere and negative emotion in the right hemisphere, which would produce a non-emotional person.

Serino et al. (2010) stated that patients with right hemispheric infarction have poorer locomotion outcome than patients with left side infarction. Serino et al. (2010) were supported by Goto et al. (2009). The right hemispheric infarction patients did not have the emotional motivation to try to walk again. This gives evidence that the site for emotion, or negative emotion, is in the right hemisphere of the brain, since the loss of the ability to walk is a negative emotion. Hemiplegia thus demonstrates that the two hemispheres of the brain function differently, in particular regarding the function of emotion, giving support to investigating the influence of brain laterality affecting behaviour of pharmacists and where best for them to work.

2.3.9 The WADA test and brain laterality

The WADA test, described by Levinthal (1983) and Carlson (1991), named after the inventor who first developed the technique in 1949, puts one side of the brain to sleep by injecting amobarbital into the carotid artery in the neck causing the ipsilateral side of the brain to sleep and the other side of the brain is left awake. The side that is awake can be investigated for various functions. The presence of the function under investigation, for example language control, would be detected if present in the hemisphere that was awake. Carlson (1991) stated that most language disturbances occur after damage to the left side of the brain, and the best way to demonstrate which side of the brain is dominant for speech is to perform a WADA test. In 95% of right-handed people, the left hemisphere is dominant for speech. This is due to the objectivity of the sounds in the speech. The left hemisphere combines all the parts of the speech together to obtain a speech sound.

This WADA test thus demonstrated the two brain hemispheres to have different functions and that there is a dominant hemisphere for a particular function. However, as the WADA test was invented in the 1940s it may not be as accurate a procedure since additional research has shown that the amobarbital may cross into both hemispheres after being injected into the carotid artery of the neck, therefore not only the WADA test should be used to rationalise the study of brain laterality, but also amblyopia and hemiplegia. From a neuropsychological viewpoint there could still be support for a brain laterality investigation regarding the WADA test due to vast differences in hemispheric functioning observed (Carlson, 1991).

2.3.10 Accident behaviour and brain laterality

Mandal, Saur and Bhattacharya (2001) using ear, eye, hand and foot preferences determined the brain laterality of people, with a sample size of 150 people, in relation to

accident behaviours. They used a questionnaire of 22 questions to determine the person's handedness, and 5 questions each to determine the person's footedness, eye and ear dominance. The questionnaire also required the people to report the number of accidents committed, during their lifetime, whilst actively playing sport, driving or doing house work that needed medical attention. Regression analysis of the results indicated that accident-prone behaviour was significantly predicted from left handedness, but not by foot, ear or eye preference. Minor accidents, those not requiring medical assistance, were not included. Bhushan and Khan (2006) found similar findings to Mandal et al. (2001) with locomotive drivers.

Ida, Dutta and Mandal (2001) investigated the incidence of accidents, which required medical assistance, amongst people that were left or right handed, and no bias, in India and Japan with a sample size of 418 and 697, respectively. They wanted to determine if left handers were more accident prone than right handers. A questionnaire was used to determine the brain laterality, using the ear, eye, hand and foot preferences. Handedness appeared to have the most influence when compared to the ear, eye and foot in assessing brain laterality and functioning in an environment regarding accidents. Left handers were found to commit more accidents in India than in Japan. Reanalysis of the data indicated that mixed handers committed more accidents than extreme left or right handers in Japan, but not in India.

Denny (2009) analysed a large cohort from 12 European countries with respect to a relationship between depression and handedness. The results depicted that the left handers are significantly more likely to have depressive symptoms than the right handers. The accidents committed by the left handers could have an association to being depressed. These depressed left handers are 5% more likely to be depressed than the normal population, and hence more likely to commit an accident.

2.3.11 Schizophrenia, posttraumatic stress disorder and brain laterality

Schizophrenia and posttraumatic stress disorder, (PTSD), are looked at for brain laterality association, as brain lateralities may influence schizophrenia and PTSD behaviour. Thus, if brain laterality influences abnormal behaviour, as demonstrated below, there is likely to be an influence of brain laterality on the normal behaviour of pharmacists in their ideal work environments.

Dane et al. (2009) described schizophrenia as a cerebral lateralization abnormality and they determined that people that are left eye dominant and right handed with poor hand eye coordination have more chance of becoming schizophrenic than other brain laterality groups. This demonstrates a potential for different functioning with different brain lateralities. Thus different brain laterality of people may induce different approach to the world including job choice. Their study (Dane et al., 2009) consisted of 88 schizophrenia patients, 60 men and 28 women, ranging in age from 17 to 63 years and 118 non-schizophrenia control patients. Handedness was determined by using the Edinburgh Handedness Inventory. Eye dominance was measured using the near-far alignment test. This finding of the left eye right hand dominance being most susceptible to developing schizophrenia was found only in males; possibly due to hormonal factors, it was not found in female schizophrenia patients. Inconsistent handers demonstrated higher chance of psychopathy than consistent handers determined by Shobe and Desimone (2015) emphasising the importance of the hand in a brain laterality investigation.

Spivak, Segal, Mester and Weizman (1998) examined brain laterality in 100 healthy males, used as the controls, and 80 combat men with PTSD, using the inventory of Coren et al. (1979) for lateral preference determination. They found that mixed laterality preferences were found in PTSD patients, significantly more so than in the controls (65% vs 43% respectively; $P< 0.005$). They hypothesised this to mean that there was less lateralization in

PTSD patients than the controls. PTSD patients were thus not extremely right or left hemisphere dominant, but more central along a continuum of brain laterality. These PTSD patients also had a more active right hemisphere regarding perception and cognitive processes.

2.3.12 Migraine and brain laterality

The importance of including handedness to assess brain laterality to determine behaviour of pharmacists, in their work environments, is discussed in the following studies, which support the premise that if brain laterality influences migraines, it may also influence normal functioning and hence job choice.

Aygul, Dane and Ulvi (2005) and Fasmer, Akiskal, Hugdal and Oedegaard (2008) proposed that migraines were a frequent co-morbid disorder in their bipolar disorder patients and that migraines were associated with left handedness. Two hundred and one patients were interviewed using semi-structured interviews. The criteria of the Headache Classification Committee of the International Headache Society were used to determine the presence of migraines. The Edinburgh Inventory was used to assess handedness as being either left-, right- or mixed-handedness. Fifty eight percent of the sample had migraines and 29% of these patients were left handed. There was a significant increased prevalence of left handers in the migraine group (37% vs 19% with P = 0.021). They also found a significantly higher prevalence of left handers in eating disorders (48% vs 26% with P = 0.008) and with asthma (45% vs 26% with P = 0.026). Thus they concluded that, in a sample of patients with major mood disorders, left handedness is associated with migraines and thus left handedness could also have an influence on normal individuals' behaviour. This demonstrates that left handers may not select to be pharmacists due to potential mood disorders, eating disorders, asthma or obtaining migraines as they may feel that these disorders would interfere with their work.

The findings of McManus (2002) demonstrating the importance of including the hand preference in a brain laterality investigation (see 2.4.6), is supported by the research of Fasmer et al. (2008) as demonstrated above.

2.3.13 Nerve conduction velocity and brain laterality

Sathiamoorthy and Sathiamoorthy (1990) investigated the influence of one side limb dominance on the muscles and motor conductivity velocity of the median and ulnar nerves in left and right handers, in both genders, with a sample size of 25 people each that were right or left handed. The age range was 18 to 30 years. The nerves had a greater velocity in the dominant hand, demonstrating contralateral control of a limb by the brain.

Tan (1993) agreed with the findings of Sathiamoorthy and Sathiamoorthy (1990) but elaborated further, that right handers had faster conducting sensory nerves in the left hand and faster conducting motor nerves in the right hand in normal right handed males. These authors pointed out that the sensory nerve's speed is faster when the right hemisphere of the brain is involved, and the motor nerve's speed is faster when the left hemisphere of the brain is involved in right handed, normal people. This could demonstrate that emotion or sensitivity is controlled by the right hemisphere of the brain, giving possible support to the Right Hemisphere Theory. These studies on nerve conduction velocity demonstrate that the brain hemispheres function differently regarding the functions of motion of a limb and sensory ability giving rationale to the existence of brain laterality regarding functionality.

2.3.14 Age and brain laterality

Dargent-Pare et al. (1992) investigated age, gender and handedness effects and foot and eye preferences, using normal adults, from five different countries. They used a questionnaire and a total sample size of 5064. The frequency of the crossed preferences was 5% between the

hand and foot and 19.5% between the hand and eye. The proportion of crossed hand foot preference was higher in men than women (7.4% vs 2.5%) and higher in left handers than right handers (16.3% vs 4.1%). These figures demonstrated a cross-sectional study but are in agreement with the findings of McManus (2002) (see 2.4.6). Foot and eye preferences were significantly associated with handedness. In right handers, a gradual shift to the "right" with increasing age was systematically observed, both for footedness and eye dominance. Gender differences in the proportion of crossed hand-eye preference, were variable from one country to another. Dargent-Pare et al. (1992) put forward that as people get older, their brain laterality may change, with amplification of both dominant and recessive characters of the hemispheres. This may change the enjoyment of a pharmacist's job as their younger brain laterality may have been ideal for their work environment but the changed brain laterality may not be ideal for that work.

Ofte and Hugdahl (2002) in turn investigated a right-left discrimination test with males and females, from childhood to old age. The sample consisted of 322 male and female subjects, including children and adults older than 50 years. The test consisted of line drawings of a person, with no arms, one arm or both arms crossing the vertical body axis. The subjects were required to mark with a pencil, as fast as possible, which was the right or left hand in the drawings. The drawings are viewed from the back or front. The results demonstrated increasing performance from children to young adults with a decline in performance in older adults, above the age of 50 years. Ofte and Hugdahl (2002) supported the work of Dargent-Pare et al. (1992) demonstrating the change in brain laterality with aging. Thus brain laterality is regarded as fluid, with potential for change as people age, possibly due to a decreased functioning of the corpus callosum. It is relevant to say that these studies depict the importance of using age as a variable in investigating brain laterality of pharmacists.

2.3.15 Brain laterality and personality in the context of Type A and Type B personalities

Type A personality is induced into the person by poor parental upbringing such as over encouragement to achieve (Muhammad, 2016). There may be a specific brain laterality group that is more conducive to becoming a Type A personality which will be investigated in this research. The speed of doing work of a Type A personality, always rapidly, (Smith & Bryant, 2012) makes inclusion of this personality in this research imperative due to the effect this would have on job choice. Ugwu, Onvishi, Ugwu and Onvishi (2015) demonstrated that Type A personality people were non-compliant with safety behaviour at work potentially causing injury to themselves or others at work. This accident optimism and fatalism of Type A personality people necessitates inclusion of Type A personality pharmacists in this research as it would affect job choice and thus Type A personality may overpower the influence of brain laterality (Smith & Bryant, 2012).

Hartman (1997) showed that students judged as left- or right-brain dominant had significantly different personalities supported by Hartman, Hylton and Sanders (1997). The fact that the two brain hemispheres are anatomically different, as mentioned by Carlson (1991) and each hemisphere controls different functions according to Karelitz (2008) and Mintzberg (1976) demonstrates that the hemisphere which dominates would set that person's personality. The Type A and Type B personalities were investigated, due to their relevance to the pharmacist's profession. Smith and Bryant (2012) stated that a Type A personality person would interact with another person completely differently to a Type B personality person. It was believed prior to the DOB that a Type A behaviour pattern was more than twice as likely to suffer a serious heart attack. However, this could not be substantiated during the DOB. The key characteristics of the Type A personality, according to Smith and Bryant (2012) and Shi et al. (2013) are excessive competitiveness, a desire to win all the time, exaggerated time urgency, always being in a hurry, never relaxing and having a high level of hostility and

aggression. People that have a Type A personality become involved in aggressive encounters more frequently than persons who do not have these traits (Smith & Bryant, 2012). Type B personality is quite the opposite. These are people who are rarely seen in a hurry, impatient or strained by having to perform some task (Smith & Bryant, 2012). Due to these extreme traits of a Type A personality, an affecting influence may occur when researching brain laterality behaviour of pharmacists, and thus Type A personality should be taken into account.

According to Muhammad (2016) the parents of the future pharmacist would create the Type A personality by being forceful on the child to achieve, and that this Type A personality could result in a more aggressive controlling behaviour at work when the child eventually becomes a pharmacist. Thus the Type A traits of the pharmacist may appear to choose the job and not the brain laterality of the pharmacist (Ugwu et al., 2015).

2.3.16 The influence of the corpus callosum on brain laterality

Leavengood and Weekes (2000) looked at the effects of stress on hemispheric specialization and the corpus callosum transfer, finding a significant correlation between them. They achieved this in their study of 28 normal subjects, who completed the Spielberger State-Trait Anxiety Inventory and did a bilateral Stroop task. This bilateral Stroop task has separate conditions, which measure the hemisphere's specialization, as well as the corpus callosum transfer. People with greater stress experience showed more efficient corpus callosum transfer than those with lower levels of stress. Thus, stress enhanced the corpus callosum functioning of transfer without affecting hemispheric specialization. Thus a small amount of stress for pharmacist may be beneficial for appreciation and competence of the work environment due to greater functioning of the brain's two hemispheres.

Hoptman and Davidson (1994) found that pathological variations in IHTT

(inter-hemispheric transfer time) may have cognitive consequences and they also determined that the data suggested that when both hemispheres are competent at a difficult task, there is a benefit to inter-hemispheric interaction. The action of the corpus callosum in the distribution of attention is relevant to this advantage. Thus, when both sides of the brain are involved with a particular behaviour, via the corpus callosum, that person will be more competent at that behaviour than if the behaviour is controlled by only one side of the brain completely. In this regard, any study of brain laterality must incorporate the influence of the corpus callosum, due to its "fluidity" of function with increasing age and the ability to share information between the brain hemispheres, giving the homeostatic effect of thought and behaviour. This was supported by Bryden and Bulman-Fleming (1994) using normal subjects. Mazerolle, D'Arcy and Beyea (2008) demonstrated interhemispheric transfer across the corpus callosum white matter with magnetic resonance imaging showing the movement of information between the hemispheres.

David (1994) in turn showed that abnormal inter-hemispheric transmission, across the corpus callosum, could explain typical schizophrenic phenomena. Agenesis of the corpus callosum could be associated with schizophrenia. Magnetic resonance imaging showed abnormal corpus callosum size in schizophrenic patients. The corpus callosum was smaller in volume in schizophrenic patients, preventing adequate inter-hemisphere interaction, resulting in an unstable brain producing mental illness. Complete lateralization of a function is the rare occasion when all the neurons for that function reside in one hemisphere; however, most functions are not completely lateralized and hence the corpus callosum links the two hemisphere regions associated with a particular function. Wong (2000) stated that the greater the laterality of the function, where the function is totally found in one hemisphere, the less linking is required by the corpus callosum of that function and hence the smaller the corpus callosum. The size of the corpus callosum in autism is smaller than normal cited by Keary et

al. (2009) which demonstrates that the size of the corpus callosum can influence behaviour. The corpus callosum of females is 40% larger than that of males, (Stout, 2000) which means that females must have greater laterality of functioning, with a greater interaction of the brain's two hemispheres compared to the brain hemispheres of males. For this reason, a gender investigation ought to be included in a brain laterality investigation of pharmacists.

Hebbal and Mysorekar (2003) looked for an interrelationship between brain laterality and functional behaviour such as strength of the hand and foot, foot-eye-ear preferences, and asymmetries in visual acuity and audiometry. They found no interrelationship between handedness, footedness, eye dominance, ear dominance, taste and smell. The corpus callosum may have been the influencing factor here, producing a homeostatic effect of the two hemispheres. Jeeves and Moes (1996) stated that people with variations in corpus callosum size and function demonstrate differences in inter-hemispheric transfer time, particularly the elderly over 60 years old. According to Brizzolara, Ferretti, Brovedani, Casalini and Sbrana (1994) the myelination of the corpus callosum is completed by the age of 10 years, when the corpus callosum reaches maturity, and the corpus callosum communicates both in an inhibitory and an excitatory influence on the contralateral hemisphere (Bloom & Hynd, 2005), while an increase in the size of the corpus callosum indicated greater functional isolation of the two brain hemispheres (Hellige, Taylor, Lesmes, & Peterson, 1998).

Gazzaniga (2000) in turn showed that the absence of the corpus callosum does not affect cognitive functioning of each brain hemisphere, while Sauerwein and Lassonde (1994) stated that the corpus callosum also has a facilitatory function allowing for interhemispheric compensation as part of cerebral reorganization when unilateral brain damage may have occurred.

The studies above demonstrate the necessity to include the influence of the corpus callosum in a brain laterality investigation. The necessity is emphasised by stress and

functioning of the corpus callosum, benefit to inter-hemispheric interaction, “fluidity” of function with increasing age, females having a 40% larger corpus callosum than that of males, producing a homeostatic effect of the two hemispheres, variations in corpus callosum size, and inhibitory and an excitatory influence.

2.4 Pharmacy as a profession

There are large similarities between pharmacy in South Africa and the United Kingdom such as where pharmacist choose to work after university, literature used eg Martindale and the environment layout in community pharmacies. These similarities encourage both countries pharmacists to be investigated giving a more substantial international review to the pharmacist’s brain laterality influence for potentially choosing their jobs. Gender will be investigated as there may be an influence regarding brain laterality due to females having a 40% larger corpus callosum than that of males. The number of pharmacists will also be investigated regarding gender problems which may affect the future of the profession. What induces job satisfaction will be investigated as a satisfied pharmacist will work longer. The influence of the pharmacists wearing spectacles which may induce depression if the pharmacist suffers from Seasonal Affective Disorder will be articulated. These investigations will give greater insight as to how brain laterality influences the pharmacy profession. Hence all these sections have an objectivity and or emotional aspect relating to brain laterality which includes a gender situation in both South Africa and the United Kingdom.

2.4.1 An overview in South Africa and the United Kingdom

Gilbert (1998) stated that community pharmacists in South Africa were linked to social characteristics and the political transformation taking place in terms of distribution at

that time. Thus changes in community pharmacy and its provision of Primary Health Care to all the people of South Africa is tied into the greater transition in society and its future health care services. Gilbert (1998) investigated these findings using data collected from a documentary search, as well as interviews with key informants and a survey of community pharmacists. This author also determined that the health services in South Africa were undergoing transition and that the sector-wise distribution of pharmacies appeared slow to change. Table 1 represents the sector-wise distribution of the pharmacies in the various provinces of South Africa for the year 2011 giving an overview of the number of vacancies that pharmacists could fill which may explain why there is a slow change.

Table 1 Distribution of pharmacies in South Africa (2011)

Registered Organizations (Sector)										
Sector	**EC**	**FS**	**GP**	**KZN**	**LP**	**MP**	**NW**	**NC**	**WC**	**Total**
Academic Institution	2	0	2	1	1	0	1	0	1	8
Community Pharmacy	226	149	1099	518	142	227	204	59	478	3102
Consultant Pharmacy	0	0	10	2	0	0	0	0	2	14
Institutional Private	21	15	93	37	8	17	24	4	40	259
Institutional Public	92	55	79	100	39	43	55	43	133	639
Manufacturing Pharmacy	9	1	211	10	0	2	6	0	28	267
Wholesale Pharmacy	23	9	161	32	5	3	3	2	50	288

(Source: http://www.pharmcouncil.co.za/B_Statistics.asp)

KEY: PROVINCES

EC = Eastern Cape LP = Limpopo WC = Western Cape

FS = Free State MP = Mpumalanga

GP = Gauteng NW = North West

KZN = Kwa Zulu Natal NC = Northern Cape

These statistics in Table 1 show that a larger number of pharmacies is distributed across the community pharmacy sector, which makes the greater need for community pharmacists in this sector evident. A brain laterality investigation may guide pharmacists into their ideal work environments alleviating the shortage of community pharmacists as the best community pharmacists may be discouraged from working in less appropriate work environments for their brain laterality.

Modipa and Dambisya (2008) supported by Dambisya, Modipa and Legodi (2007), stated that there was a poor distribution of pharmacists in the South African health system. Fifteen point six percent of pharmacists work in the public sector and they serve more than 80% of the population according to the South African Pharmacy Council data cited by Modipa and Dambisya (2008). They looked into the profile and career preferences of the University of Limpopo pharmacy students, investigating factors that would influence their choice as to where they worked. Eighty percent of the responding students were of rural origin. Thirty nine percent of the respondents put pharmacy as their first choice. Forty six percent preferred to work in a government hospital, 36% in industry, 7% private hospital, 6% community pharmacy and 3% in academia. Forty percent preferred to work in rural areas. Thus Modipa and Dambisya (2008) determined, using a questionnaire with a response rate of 93% that most University of Limpopo pharmacy students wanted to work in rural areas and the public sector, motivated by the need to serve the community. These desires could have been influenced by the fact that 77% of the pharmacy students attended rural government schools, whereas only 4% attended private schools. Thus these findings demonstrate that, regarding distribution of pharmacists, if the pharmacists came from a rural background they desired to work in a rural setting, and pharmacists from an urban background desired to work in an urban setting. However, brain laterality may recommend pharmacists into their ideal environment instead of the pharmacists working according to their background environment.

By comparison, when looking at the distribution of pharmacists in the UK, due to similarities with the South African pharmacists and requiring an international perspective, Hawthorne and Anderson (2009) stated that cognisance must be taken of the landscape of medicinal distribution in the UK. The pharmaceutical full lines wholesalers (see Table 2) occupy a main position in the supply chain, influencing the distribution of pharmacists. About three quarters of all the medicinal products that are sold in Europe are distributed through pharmacies by the pharmaceutical full line wholesalers. Most of the medical products, that is 93%, distributed by the pharmaceutical full line wholesalers, are sold to the retail pharmacies, followed by the hospital pharmacies with 4%, as seen in Table 2. Thus availability of medicines, population size in an area, and backgrounds of the pharmacists may all contribute to the distribution of pharmacists in the UK. Hawthorne and Anderson (2009) with a similar view to Modipa and Dambisya (2008) in South Africa, determined that the challenges of pharmacists in the UK were mainly that pharmacists were unevenly distributed in the UK with respect to location and working in the private or public sector. According to Table 2, most of the pharmacists in the UK would be working in private community pharmacies, creating a shortage in the public sector. Again brain laterality may assist in placing pharmacists into ideal work environments which could prevent an uneven distribution of the pharmacists. Sceptics may postulate that brain laterality may induce only another uneven distribution, however this research uses a reductionistic approach that places pharmacists only according to the workings of their brain laterality and not for example a broarder aspect of demographics or background upbringing. The brain laterality approach would create a more realistic distribution of pharmacist only according to how best the individual pharmacist's brain laterality functioned.

Table 2 Distribution of pharmacies in the United Kingdom (2012)

Source: http://www.ipf-ac.at/uploads/media/GIRP_IPF_clean_FV_120112.pdf

2.4.2 Gender influences on the pharmacy profession

Hawthorne and Anderson (2009) analysed the literature regarding the pharmacy profession in the UK, from January 1998 to February 2008 and similarly Modipa and Dambisya (2008) analysed the South African pharmacy profession. There was an increase in the number of female pharmacists who were working fewer hours, which decreased their overall full-time work contribution compared to males. Hassel (2006) agreed with Hawthorne and Anderson (2009) that in the UK female pharmacists, within years of graduation, had given up work or were working part time. With a 60% intake of female pharmacists in the UK, this would create a decreasing supply of pharmacists for an increasing demand, despite an increase in pharmacy students and pharmacy schools for the period January 1998 to February 2008. On the other hand, there has been an increase in demand for pharmacists, clinical governance measures, and an understanding of medication therapy, allowing pharmacists to be able to deal with an increased number of prescriptions. To expand the future pharmacist workforce, there will have to be increases in recruitment and retention, more recruitment of male pharmacists and a greater retention of female pharmacists - which in itself is quite complex, requiring coordinated action from the pharmacy schools and all

other pharmacy work environments. These findings appear to be similar to the situation in South Africa as put forward by Modipa and Dambisya (2008).

Quandt and McKercher (1982) in the United States, pre DOB but applicable today, looked at perceptions of duties performed by male and female hospital pharmacists, using a postal survey method containing 153 questions. Self - assessment was used to determine the time spent in various activities, either dispensing or clinical. The time spent in clinical activities by men and women was similar. Women reported more time dispensing than men; however, greater job satisfaction was expressed by men than women. There was a gender difference in how men and women pharmacists perceived their tasks. Due to men and women perceiving their tasks at work differently, possibly due to the different sized corpus callosum, the influence of gender on work choice could be possible.

Sajatovic, Hatters-Friedman and Schuermeyer (2004) supported the findings of Shoaf and Gagnon (1980) who also investigated the gender differences in the pharmacy environments in North Carolina. They used a mailed questionnaire, distributed in August 1978, achieving a 28% response rate. They determined that 29% of women versus 5% of men worked part-time. To avoid biasing the data, the part time pharmacists were not included in the calculations. Women earned less than men, as fewer women were in management placements. However, male and female pharmacists were found to be equally satisfied with their placements, but there appeared to be differences between male and female pharmacists' work situations, thus making the inclusion of gender influences imperative in a brain laterality study of pharmacists being placed into ideal work environments.

2.4.3 Job satisfaction

The following sections discuss requirements for a pharmacist's job satisfaction in South Africa and the United Kingdom. These requirements include a postgraduate

qualification, adequate staffing, interpersonal interactions, job commitment, clinical involvement, long term goals and type of work environments. A self-assessed enjoyment level investigation will be adopted to determine job satisfaction of pharmacists in this research.

2.4.3.1 Perceived utilization of skills, postgraduate qualifications and adequate staffing

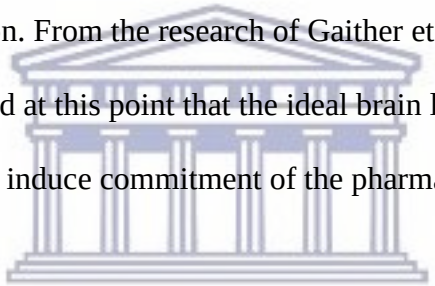
Cox and Fitzpatrick (1999) in Arizona studied the relationship between job satisfaction and perceived utilization of skills amongst pharmacists working in institutional and ambulatory care settings, using a mailed questionnaire with a response rate of 35% and found a significant positive relationship. A significant positive relationship was also found between job satisfaction and adequate competent staffing without a large workload. Postgraduate qualified pharmacists were more satisfied with their job than pharmacists with only a bachelor degree. Pharmacists with management titles, working in institutional settings, and older pharmacists, perceived that they were utilizing their skills to a greater extent than mostly younger pharmacists practicing in ambulatory care settings, with only a general title. Thus a doctorate degree and a job with a meaningful title increased job satisfaction. Thus according to Cox and Fitzpatrick (1999) the influence of a doctorate degree to work choice, due to greater satisfaction of their job, requires its inclusion in a brain laterality investigation for the placing of pharmacists into their ideal work environments.

2.4.3.2 Interpersonal interactions, job commitment and workload

Gaither (1999); Gaither et al. (2003); Gaither et al. (2008) and Johnson, O'Connor, Jacobs, Hassell and Ashcroft (2014) on UK community pharmacists and errors, investigated career commitment and job stress on work related attitudes, career commitment, achieved expectations, job satisfaction and organizational commitment on job turnover intention. Gaither et al. (2008) used a mailed survey which was sent to a random sample of licensed

pharmacists across the United States. A response rate of 46% was obtained. Psychometric analysis indicated reliability and validity of the results. Interpersonal characteristics and interactions strongly predicted job satisfaction. An increase in job satisfaction and organizational commitment decreased job turnover intention. Lea, Corlett and Rogers (2012) agreed with the findings of Gaither et al. (2008).

Independent pharmacy owners tended to have most positive attitudes to work. Gaither et al. (2003) found the most common reason for staying in a placement was a good salary and a good relationship with co-workers and the most common reason for leaving a placement was stress due to workload. Gaither (1999) concluded that increasing the commitments of the pharmacists would reduce the negative effects of job stress and would improve work-related attitudes and satisfaction. From the research of Gaither et al. (2003) and Gaither et al. (2008) it can only be speculated at this point that the ideal brain laterality of the pharmacist for a particular placement may induce commitment of the pharmacist for the particular work environment.



Hall (1982) maintained that a person that has worked for 10 years or longer is extremely stable in that work environment. Stevens (2005) agrees with the findings of Hall (1982) mentioning that the longer a person works over 10 years the greater the attachment and stability that person has for the work. Stevens (2005) also determined that the more educated the person was the longer they worked. Hall (1982) and Stevens (2005) support the use of a ten year work period to be used to demonstrate stability and suitability of pharmacists in an ideal work environment with a particular brain laterality in this research.

2.4.3.3 Clinical pharmacy involvement

Olson and Lawson (1996) in the USA determined job satisfaction among hospital pharmacists using a mailed questionnaire with a response rate of 58.4%. The pharmacist's

level of job satisfaction showed a positive association with clinical pharmacy involvement. Mean job satisfaction increased as time spent performing clinical pharmacy activities increased. Thus a brain laterality investigation of pharmacists would have to investigate the time spent in various work environments, as well as the pharmacists' enjoyment of the placements. Muijrers, Knottnerus, Sijbrandij, Janknegt and Grol (2004) in a Dutch study and Lonie (2006) were in agreement with Olson and Lawson (1996) that more time spent performing clinical pharmacy meant enhanced satisfaction with their work environments.

2.4.3.4 Short staffing inducing stress

A study by Lapane and Hughes (2006) in the USA found that the pharmacists worked more effectively in organized, clean, well-lit and ventilated areas. The most important source of stress for pharmacists, in the long term care sector, was short staffing which reduced job satisfaction. Brain laterality may thus select the best pharmacist for a particular placement enabling the correct pharmacist for a short staffed environment to achieve the required workload (Stevens, 2005).

2.4.3.5 Career goals for satisfaction

Savage et al. (2009) worked with pharmacy students in UK to identify short and long term career goals, where they wanted to practice as pharmacists and to ascertain what factors influenced these goals. A 19 question questionnaire was given to students in each of the 4 years at university, as well as 5 years after graduation. Pharmacy students considered the work environment to be the most important factor regarding career goals. Upon graduation the community setting was the most popular; however, 5 years later, half wanted to be in a clinical setting and the other half in community pharmacy. Thus pharmacy students' short and long term career goals provided insight to pharmacy faculty members to improve the

experiential curriculum, as well as assist employers in increasing job retention and satisfaction. Investigating brain laterality of the pharmacists may help to put pharmacists into their ideal work environments, which may increase retention and satisfaction of the pharmacists in their work if brain laterality in this research is found to be appropriate.

2.4.3.6 Non-corporate and corporate pharmacists influenced by the work environment

Clark and Mount (2006) in the USA examined the experiences of new pharmacists within 3 months of graduation at various practice sites to comprehend how these shaped their professional ethos, job satisfaction and practice habits. They used a random mailed survey, with a response rate of 14%. They found statistical differences between corporate community pharmacy pharmacists and non-corporate community pharmacy pharmacists. The Pharmacy Service Orientation measure, a tool for assessing pharmacists' impressions of pharmacy practice sites, gave mean values of 7.42 for non-corporate community sites and a mean of 5.13 for corporate community sites with $P < .001$. The non-corporate community pharmacy pharmacists had significantly greater pharmaceutical care–oriented practice habits, with more job satisfaction. Multivariate regression demonstrated that the type of practice site and type of pharmacy work experience accounted for more than 25% of the observed variance. Thus in a brain laterality of pharmacists' investigation for placing pharmacists into ideal work environments, the type of work environments available for the pharmacists to work in have to be considered (O'Neill & Gaither, 2007).

Kreling et al. (2006) in the USA determined from a mailed survey that community pharmacies were oriented towards dispensing activities. They also determined that if equipment and information technology were available for dispensing, including patient care, productivity and quality of care would increase and the pharmacists' level of satisfaction

would increase. Thus the different type of work environments should be included in a brain laterality study, due to possibly having an influence on the pharmacists' work satisfaction.

The findings of the above authors support each other regarding the importance of pharmacy work environments in creating a positive approach to the pharmacy profession, and increasing the job satisfaction of the pharmacists.

2.4.3.7 South African situation pertaining to job satisfaction

According to Rothmann and Malan (2011) hospital pharmacists are experiencing excessive stress due to high demand for their services, a lack of resources in the hospital pharmacy as well as a shortage of pharmacists in South Africa. They determined that job related stress and burnout were significant amongst hospital pharmacists.

Modipa and Dambisya (2008) pointed out that job satisfaction of South African community pharmacists was not related to income. Service to the community was the main reason for their job satisfaction. Interactions with patients were found to be most satisfying whereas interaction with doctors and lack of recognition for the pharmacy profession were least satisfying. Improvements were suggested to be with infrastructure and more involvement with health systems to improve job satisfaction.

2.4.4 The future of the pharmacy profession

Hassell (2006) compared the work profile and employment destination of two cohorts of pharmacists in the UK, those that qualified in 1992 and 1997, with respect to the active movement and rate of change that occurred in employment. A questionnaire was sent to 38000 pharmacists in 2003. The pharmacists were contacted using their addresses from the Royal Pharmaceutical Society of Great Britain (RPSGB). The response rates, for the two graduation cohorts, were 62% and 58% respectively. A larger proportion of woman

pharmacists, compared to male pharmacists, after 5 years, were either not working as a pharmacist or were working part time. This pattern increased significantly the longer the female pharmacists had worked as pharmacists. Pharmacists also tend to move out of the main sectors of practice, namely hospital and community, with increasing years of practice. Young pharmacists tended to move overseas to work. Given that 60% of student intake is female, to maintain or increase pharmacist numbers it would be advisable to train more male pharmacists, both in the UK and South Africa, as suggested by Hawthorne and Anderson (2009) and Modipa and Dambisya (2008). A brain laterality of pharmacists' investigation may assume at this point to help to maintain female pharmacists in work by placing them into their ideal work environments.

In their study, De Oliveira and Shoemaker (2003) in the USA stated that patients want to be heard and seen as individuals with unique experiences and responses to medication. Thus pharmacists in community and hospital pharmacies should ensure that patients' needs are met and to do this they have to grasp the concept of "patient-centred". To become more patient-centred, pharmacists have to develop the skills of openness, by listening and acknowledging the patients. A pharmacist's reliance on pharmacology and pharmacotherapy must be combined with a consideration of the patient, as an individual, to give the best care. This approach of pharmacists is created through their basic education acquired at university.

Fjortoft (2003) in the USA utilised interviews to examine the caring behaviour of community pharmacists in their interactive environments. The respondents stated that the best caring pharmacists were about "being for the patient". The caring pharmacists would greet the patient, inquire about the patient's health and family, and be sincerely interested in the patient's well-being. Fjortoft and Zgarrick (2003) in turn assessed the level of caring ability of practicing pharmacists, as well as differences in caring ability due to gender, qualification obtained, practice setting, years in practice and if a clinical setting was provided. A random

survey of pharmacists in Illinois was used, where a questionnaire was mailed to them, acquiring a response rate of 30%. There was no statistical difference in the caring ability regarding gender, qualification obtained or practice setting. There was a significant difference between years worked and caring ability. The longer the pharmacists had worked, the more caring they were. Furthermore, pharmacists that gave a clinical service were more caring than those pharmacists who did not, and demonstrated that the longer pharmacists had been working with patients and had been concerned about their "wellbeing" the better they become at their work. Thus the time worked in a particular work environment could be critical to an investigation of brain laterality of pharmacists, influencing suitability to the work environment.

Regarding the future of pharmacy in South Africa, Malangu (2014) points out that the community pharmacy is a source of health services for the world. South Africa has provided services such as family planning, emergency care for minor conditions and screening in the past. A new postgraduate diploma in South Africa would provide expanded services. Pharmacists with this diploma would be able to examine, diagnose, prescribe and monitor the treatment of patients according to the Primary Health Care Standard Treatment Guidelines of South Africa. Pharmacists would have to carry out a formal consultation including a history of the patient, physical examination and conduct and interpret laboratory results. Placing the correct person into such a community pharmacy becomes more critical than in the past due to added responsibilities. Brain laterality of the pharmacist may give direction to this important placement.

2.4.5 Spectacles affecting behaviour of pharmacists

Henderson and Grimes (2010) researched intraocular lenses that were introduced in the 1990s to block ultraviolet (UV) and blue wavelength light less than 500nm as they may

be harmful to the eyes. However, the blocking of blue light is not detrimental to visual acuity, colour perception and contrast sensitivity (Hovis, Lovasik, Cullen, & Kothe, 1989). The wearing of glasses or contact lenses may thus reduce blue light (<500nm) into the eyes; thus among pharmacists susceptible to Seasonal Affective Disorder (SAD), this could result in depression. Consequently the pharmacists' epistemology to their job would be effected if they were depressed.

Strong et al. (2009) in the USA researched thirty subjects suffering from SAD according to the DSM-IV criteria, who were randomly placed in blue or red light environments for 3 weeks, using a parallel double-blind trial. The red light was used as the control. The results were assessed using the Hamilton Depression Rating Scale-17. Scores improved more for the blue light condition (51%) than the red light condition (31%), where P = 0.05. Thus narrow bandwidth blue light therapy, of about 470nm, was superior to red light therapy in preventing depression in SAD sufferers. Thus the wearing of spectacles all the time by a pharmacist suffering from SAD may remove the blue light going into the pharmacist's eyes which prevents depression in SAD sufferers.

Swedo et al. (1997) in the USA and Westrin and Lam (2007) from Sweden and Canada respectively, in turn demonstrated that there is a beneficial effect of blue light therapy on children and adults that suffer from SAD, thus it should also influence pharmacists that are SAD sufferers. They pointed out that prevalence rates for SAD are between 0.4% and 2.9% of the general population, and that SAD sufferers have impaired psychosocial functioning. Westrin and Lam (2007), suggested that long term light therapy is required for SAD sufferers. Blue light therapy has to be continued every day, and throughout the winter, as there is rapid relapse into depression if the light therapy is stopped too early (Rastad, Ulfberg, & Lindberg, 2008). Westrin and Lam (2007) also suggested the use of antidepressants for the depression, in conjunction with light therapy. The fact that antidepressants are sometimes

needed in conjunction with blue light therapy demonstrated the severity of SAD and hence the continuous wearing of spectacles by pharmacists should be considered.

Schiffer, Anderson and Teicher (1999) found that lateral visual field glasses induced an absolute difference in anxiety, greater than the monocular glasses. The lateral visual field glasses also induced a shift in mood and hemispheric dominance.

Due to a large proportion of spectacles being worn (Henderson & Grimes, 2010), with the potential of an influence on the mood of the pharmacists, which would influence the pharmacists work choice, the constant wearing of spectacles should be included in brain laterality research.

2.5 Education

The level achieved at university could influence enjoyment of a work environment which would influence job choice. These sections investigate this education level which may have an effect on brain laterality and job choice.

2.5.1 The influence of a university education

Zgarrick and MacKinnon (1998) in the USA investigated pharmacists that were interested in a non-traditional Pharm D programme, their motivation for doing such a programme and where they preferred to work thereafter. A mailed questionnaire was used (response rate was 28.8%) requiring information such as current placements, number of jobs, preferred work areas and interest in the Pharm D programme. Those interested in the Pharm D degree expected support from employers after obtaining the degree. The findings showed the following: 31.9% of respondents were interested in the degree, stating that it would improve their clinical skills and also improve the quality of their work. Half the respondents remaining indicated that they wish to remain in their current place of employment after completing the Pharm D degree. Seventy two percent of hospital pharmacists and 21% of

chain pharmacists said they would like to stay in their current job on completion of a Pharm D degree. Given these findings, it is apparent that the preference to do a professional doctorate programme depends on the orientation and the motivation of the individuals derived from the interest towards the field. Zgarrick and MacKinnon (1998) explained that pharmacists attempting a doctorate were motivated by a desire to improve clinical skills, and possibly to improve job prospects or enhance their existing working conditions and status.

O'Hara, Kirk and Sperandio (1978) and Fjortoft and Lee (1995) concluded that the additional clinical education of a Pharm D programme may have a role to play in developing pharmacists with greater professional commitment and job satisfaction. They found that more pharmacists holding a Baccalaureate degree were working in community pharmacy than Pharm D pharmacists, who were working mostly in clinical and educational activities. Pharm Ds were more committed to the profession and had higher levels of job satisfaction. Thus doctorate degrees could have an influence as to where a pharmacist desires to work and thus should be investigated along with brain laterality. To determine these results, Fjortoft and Lee (1995) in the USA used a mailed survey technique, achieving 65% and 54% response rate for the Baccalaureate and Doctorate level pharmacists, respectively. These differences were mostly found in hospital placements, but not in community pharmacies. This could be due to Baccalaureate level pharmacists working in community pharmacies. Pharm D and PhD doctorate degrees are very different degrees. These researchers investigated the Pharm D doctorate degree only. However, pharmacists may have selected either doctorate degree for the advantage of having a Doctorate degree, with subsequent increased job satisfaction, more clinical work and an educational bias.

According to Laloo, Bobat, Pillay and Wassenaar (2014) there exists a potential shortage of academic and research doctorate people in South Africa. South Africa's University of KwaZulu – Natal is addressing this matter by introducing a program that will

increase teachers essential to improving quality and quantity of health care. The program is associated with giving undergraduates research models for enthusiasm towards a doctorate degree. The talented students will be selected for the program giving them a background into research ethics with the best teachers to support the PhD being selected. Rural training sites will be used anticipating that the researcher returns to these needed environments.

2.5.2 Lifelong learning, Bachelor level and Pharm D degrees

Bond et al. (1994) in the USA explored professional lifelong learning, pharmacy organizational memberships and salary, and the influence of these on advanced training. Pharmacists with advanced degree training, for example a doctorate degree, showed the strongest correlation of membership affiliation and earning the highest salaries. The practice site also had an influence on the behaviour of the pharmacists. Hospital pharmacists devoted more time to professional lifelong learning outside work than community pharmacists. These results were obtained from a survey with a 55% response rate. People may do a PhD degree due to enthusiasm for a particular placement such as moving from hospital pharmacy into university education where a PhD degree is required.

Ofte (2002) in Norway in turn found that medical students performed better on the right-left discrimination tests than psychology and law students, and that education may produce more enthusiasm for a task and a better epistemology to life and work. Essentially therefore, according to Ofte (2002) the more educated the person, the more enthusiasm they should have for their work. The education level of pharmacists could thus influence their desire to work in specific work environments and thus should be included in a brain laterality investigation to place pharmacists into their ideal work environments.

Reid and McGhan (1986) supported by Ofte (2002) found in their California survey that Bachelors level pharmacists, in their study, were mostly found in hospital management

or staff placements. Pharm D pharmacists were mostly involved with education. However, when Pharm D and Bachelor degree pharmacists spent the same amount of time doing the same job activities, Bachelor degree and Pharm D pharmacists had the same degree of job satisfaction. A mailed questionnaire method was used, which gave a 51% response rate. This research demonstrated a statistical difference concerning education as the only difference between Pharm D and Bachelor degree pharmacists. Koda-Kimble, Herfindal, Shimomura, Adler and Bernstein (1985) in the USA in agreement with Bond et al. (1994) stated that the basic hypothesis is that the more qualified a pharmacist, the more the pharmacist enjoyed their work.

According to Gray, Riddin and Jugathpal (2016) the process of change in South Africa's health care system is unfolding and consequently pharmacists need to be crucial in their managing and policy development ensuring provision of patient care with access to medicines for all.

2.5.3 Extending the pharmacy degree to include patient care

Watanabe et al. (2005) mentioned that in Japan pharmacists' activities consist mostly of dispensing, but in some hospitals they are involved in patient care. In the United States, activities have evolved over the past 40 years where there is now an inclusion of assessing the patient's quality of life. The pharmacy degree in the United States is now six years long, to include patient care. Japan, within the next few years, is also going to move into a six year pharmacy degree, to include aspects the pharmacists require to know regarding patient care. The World Health Organisation (WHO) and the International Pharmaceutical Federation (IPF) made recommendations on the activities of pharmacists, to move from only medicinal activities to include patient care activities. The use of brain laterality to place the best pharmacist into their ideal work environment may alleviate the necessity of the pharmacy

degree being lengthened due to the pharmacist having the required emotionality to work with patient care. In a similar vein, Austin and Ensom (2008) pointed out that in Canada the academic environment was debating how best to improve the pharmacy curriculum to meet current and future skills needs, and if a Pharm D would be the future standard entry-to-practice qualification in Canada.

Scahill, Harrison and Sheridan (2010) showed that there is a high level of support to maintain the current and technical roles of pharmacists in New Zealand. Pharmacists here believed that their degree was adequate for what they had to do and that there should be accreditation for enhanced or collaborative services. A national postal survey of practicing pharmacists in New Zealand was carried out, with a 51.8% response rate, to achieve these viewpoints of the New Zealand pharmacists.

Droege (2003) in turn pointed out that in the USA there has been a considerable paradigm shift from a product-centred approach towards a patient-centred approach in pharmacy. Pharmaceutical care is the best way of practicing pharmacy, making drug-therapy safer, more effective, and more convenient for the patients. The time spent by the pharmacists with the patients has increased over recent times, however, this alone is not sufficient to bring about a paradigm shift in view of what the pharmacists actually do to give quality patient care. Education and practice should be the core part of teaching of pharmaceutical care, which is important for the pharmacists to deliver the best care interaction with the patients. Thus the pharmacy curricula should teach reflective practice, be problem-based, be positioned in collaborative teams, and have an outside focus with what actually happens. This demonstrates the importance of placing the correct person in the pharmacy placement, which may be achieved utilising the emotion generated by the different brain laterality groups of the pharmacist with the Valence Theory.

Austin and Ensom (2008), Droege (2003) and Watanabe et al. (2005) all agree that the pharmacy degree needs to include more patient care education, as the profession is encompassing more care for the patient than purely drug dispensing. This was in contrast to the situation in New Zealand (Scahill et al., 2010), thereby postulating that a study of the required emotion generated by different brain laterality groups of pharmacists may be best to place pharmacists into their ideal work environments. Thus, it could be speculated that the more emotion generated by the pharmacist's brain laterality, the more patient care delivered.

2.6 Brain laterality influencing ideal work choice

The literature in this chapter demonstrates the existence of brain laterality in both animals and humans. Brain laterality, through evolution and a genetic involvement, influences functioning of the species and hence survival in their environments (Corballis, 2009).

Kumar and Sharma (2016) investigated left and right hemisphere dominant leaders. They found left hemisphere dominant leaders emphasized continuous improvement and planning whereas right hemisphere dominant leaders emphasized innovation and managing. This focused on brain dominance types of leaders demonstrating their functioning according to their brain laterality.

The research of Mintzberg (1976) supports the work of Kumar and Sharma (2016) where they determined that people involved with planning in the work place should be left hemisphere dominant and people involved with management should be right side dominant. This expresses an existence of two work environments. A work environment where the work involves planning for which the left hemisphere dominant person would be ideal. This planning environment could be in industry where a pharmacist would have to plan the manufacture of the medicines. A work environment where the work involves managing for

which the right hemisphere dominant person would be ideal. This managing environment could be in community pharmacies where the pharmacist would have to manage patients and medicine stocks.

Spreng et al. (2010) with frontotemporal lobar degeneration patients found that the dominant hemisphere (hemisphere without atrophy) determined the selection of a work environment. This occupation selection occurred in early adulthood and is related to brain laterality at that time. Left hemisphere dominance gave direction to verbal work environments and right hemisphere dominance gave direction to non-verbal work environments.

This research investigates how pharmacists can be placed into their best work environments according to their brain laterality. There is no research available involved with the placement of pharmacists into their ideal work environments according to their brain laterality. Thus there is a gap in the literature in this regard which this research attempts to rectify. The research of Kumar and Sharma (2016) as well as Spreng et al. (2010) demonstrates the necessity for researching this gap in the literature to hopefully strengthen the pharmacy profession.

2.7 Summary

Chapter 2 gave a broad literature review associated with the pharmacists' brain laterality involved with their job satisfaction and ideal work place interactions. Animal studies involving dogs, fur seals, wall lizards, dolphins and chimpanzees were cited for their brain laterality affecting their behaviour, imperative to their survival in their environments and this could similarly demonstrate importance of brain laterality for human survival, as humans are advanced animals. Further support for researching with brain laterality was found

when investigating stress, amblyopia, hemiplegia, the WADA test, nerve conduction speed and the functioning of the corpus callosum.

Stress was found to be activated by the right hemisphere of the brain while the left hemisphere of the brain countered this activation of stress.

Amblyopia affects prehension and thus people with amblyopia would be more selective in choosing work environments. Hemiplegia strengthened the rationale for correctness of the RHT. The WADA test demonstrates that the two brain hemispheres have different functions and that there is a dominant hemisphere.

To determine the pharmacists' brain laterality the ear, eye, hand and foot dominance was used. Accident prone behaviour was significantly predicted from being left handed.

Support for this research included the influence of age on brain laterality, the influence of the work area, a doctorate degree and Type A or B personalities.

Seasonal Affective Disorder, SAD, was cited from the literature elaborating that the wearing of glasses could produce depression in pharmacists that suffer from SAD, and depression may influence finding the ideal work place for pharmacists.

The literature demonstrated functional differences existing between the right and left hemispheres of the brain where the dominant hemisphere sets the behaviour of the person and left or right hemisphere dominance demonstrates a different personality. In the Right Hemisphere Theory (RHT) emotion is totally controlled by the right hemisphere of the brain. According to the RHT a right hemisphere dominant person would be more emotional and a left hemisphere dominant person would be more objective. The Valence Theory (VT) demonstrates control of negative emotion in the right hemisphere of the brain and control of positive emotion in the left hemisphere of the brain.

Two distinct work environments were mentioned in the literature; planning and managing. Planning ideally for left hemisphere dominant people (pharmacists in industry) and managing ideally for right hemisphere dominant people (pharmacists in community pharmacies).

CHAPTER 3: THEORETICAL FRAMEWORK

Chapter Three discusses reductionism, the questions derived from the literature review, the research question, aims of the research, the research objectives, the Null and Alternative hypotheses and the reductionistic variables.

3.1 Introduction

The current study aims at filling the gap in the literature by determining if brain laterality, determined by ear, eye, hand and foot dominance, can place pharmacists into their ideal work environments, with and without the influence of other reductionistic variables, and investigating which theory, the RHT or the VT is best for this purpose. From these findings the environment most suitable for the working behaviour and capabilities of the pharmacists may be identified.

Thus the research question for the current study is: Could brain laterality be used to assign pharmacists to their ideal work environment? The questions which follow, generated from the literature in Chapter 2, outline the direction and support towards the present study.

3.2 Understanding reductionism

Reductionism is defined as follows: The theory that every complex phenomenon, especially in biology or psychology, can be explained by analysing the simplest, most basic physical mechanisms that are in operation during the phenomenon (American Psychological Association 2014 Dictionary.com).

Reber et al. (2009) in turn defines reductionism as a philosophical point of view, which maintains that complex phenomena are best understood by a componential analysis that breaks down the phenomena into their fundamental, elementary aspects. The core of the reductionistic's position is that greater insight into nature will be derived by recasting the

analyses carried out at one level, into a deeper, more basic level. Thus reductionism is an issue of degree, of pragmatic considerations and elegance. The early reductionistics attempted to reduce perception to elementary sensations. The Gestalt theorists, as mentioned in Reber et al. (2009), argued that to do so loses explanatory power, for the perceived whole is not equivalent to the sum of its parts; it is greater.

According to Wineman and Fisher (2009), reductionism refers to an approach that focuses on treating one key variable or more than one key variable to achieve deeper understanding of a disease or psychological phenomenon, but overlooking the interaction of systems and their dependency on one another to produce homeostasis. Reber et al. (2009) and Wineman and Fisher (2009) support each other in defining reductionism; however, Reber et al. (2009) appears more elaborate in approach with a slight bias towards the correctness of the Gestalt theorists. The present study makes use of a reductionistic approach to the research as only a few variables are investigated for the placing of pharmacists into their ideal work environments. There is an appreciation that systems have an influence on homeostasis but this research investigates the influence of a few variables that have no or little research, evident in the literature, which may present a strong or no influence to the homeostasis. These variables are brain laterality of the pharmacists and 16 other reductionistic variables with scant literature support for this research. It is important to determine if there is any influence of these variables for the placing of pharmacists into ideal work environments as the positive consequences would allow reductionistic variables the ability to place the pharmacists into ideal work rather than looking at many Gestalt variables for a similar placing. The use of a Gestalt approach would make the research extremely large with a lack of the smaller details. Thus, reductionism used in this research, attempts to reduce perception to elementary sensation, whereas the Gestalt theorists claim that reductionism loses explanatory power as the perceived whole is greater than its parts (Reber et al., 2009).

3.3 Deductive approach to identifying variables

` The following sections generate questions which give direction towards the main research question.

Animal studies must be included in this brain laterality research due to a large amount of literature reporting survival of the animals in their environments due to the animals' brain laterality. The more advanced the animal is compared to humans the more chance of an acceptance of the animals brain laterality and environment influence to be compared to pharmacists' brain laterality and work environment demonstrating association of the pharmacists' survival in their work environment (Corballis, 2009).

A positivist approach is used in this research due to the use of reductionistic variables which poses questions to be articulated.

The functions of objectivity and emotion imperative to be investigated with brain laterality research, particularly with this research, as these functions are related to behaviour of pharmacists in their different work environments (Giorgianni, 2002).

The variables of mood, handedness, wearing of glasses, stress and gender may influence the placement of pharmacists and questions arising from these variables will be articulated.

Questions arising from amblyopia, hemiplegia and the WADA test, which supports the existence of brain laterality and lateralized functioning of the brain will be elaborated.

3.3.1 Brain laterality – animal studies

To support the influence of brain laterality on human behaviour necessary for success in their work environment, a variety of animal studies were evaluated to demonstrate how brain laterality contributes to survival in the animals' environments. A cross-section of animals studied were evaluated to assess the correlational behaviour of these animals to human behaviour. These animals include dogs, lions, fur seals, dolphins, wall lizards and

chimpanzees. The questions arising from these animal evaluations supporting a human brain laterality influence on their environment are as follows:-

- From the lions study of Zucca et al. (2011) it was demonstrated that the environment may induce stress in the right hemisphere of the lions affecting the brain laterality of the lions consequently they became ill. Could this situation happen with a pharmacist in his/her work environment where the stress of the environment overstimulates the right hemisphere of the pharmacist inducing a changed brain laterality with the consequence of illness or termination of employment? The changed brain laterality of the pharmacist may induce the pharmacist to find a more suited work environment according to the new brain laterality?
- Does the ability of the fur seal, advanced in relation to humans, to switch from a terrestrial bihemispheric sleep pattern to an aquatic unihemispheric sleep pattern by varying connection strength between the hemispheres, which is important for their environmental survival (Kedziora et al., 2012) demonstrate the importance of brain laterality and the functioning of the corpus callosum in humans for survival and environmental homeostasis?
- Does the ability of dolphins to keep one eye open for two months to protect their calves (Lyamin et al., 2007) achieved by brain laterality techniques, demonstrate the importance of brain laterality for survival in humans?
- Does the wall lizards' brain laterality development, where the left eye is used for anti-predatory behaviour and the right eye for predatory behaviour (Csermely et al., 2011) demonstrate that even primitive animals rely on brain laterality for survival, thus more complex animals, such as the human, may rely on brain laterality to a greater extent?

- Does the increase in temperature of the tympanic membrane, influenced by the contralateral stimulated brain hemisphere of the chimpanzee (Helton et al., 2009) demonstrate that similar brain laterality functioning could take place in humans?
- The wagging of a dog's tail demonstrates the brains hemispheres functioning differently according to the environmental situation; wagging to the right with the owner and wagging to the left when the environment stresses the dog (Corballis, 2009; Quaranta et al., 2007). This difference in functionality between the brain hemispheres influenced by the environmental stressors may be more complex with humans that may be right or left hemisphere dominant with the consequence of different resultant behaviour dominance according to which hemisphere is dominant; right hemisphere obtain an emotional behaviour dominance, left hemisphere obtain an objective behaviour dominance. Could this be related to pharmacists in their work environments (both planning and managing environments) demonstrating the pharmacist to be a planner (left hemisphere dominant) or a manager (right hemisphere dominant)?

3.3.2 Reductionistic variables – positivist approach

When looking at a few variables only, amongst many, for their influence alone, a positivist reductionistic approach must be used, as mentioned by Oliver (2004). This generates the following two questions:

- Is the research going to adopt a convergent or divergent approach, where the divergent approach is all encompassing regarding investigative questions, with the whole being larger than the individual questions, or a convergent approach which looks at elemental questions of the whole, to analyse each elemental question as to its influence on the whole, thus being reductionistic, as put forward by Reber et al. (2009)?

- In investigating only a few variables which may influence pharmacists being placed in their ideal work environment, using a positivist approach, would a convergent, and thus reductionistic approach, viz. epistemology, be adequate?

In the context of the above, the questions are:

- What is reductionism and will this positivist approach (epistemology) lead to viable and meaningful answers in the present study?
- Can brain laterality influence a pharmacists' behaviour in general and in striving to identify their ideal work environment?

Literature favours the Right Hemisphere Theory (RHT) when researching brain laterality (Perry et al., 2001), however, there is some support for the Valence Theory (VT) (Helton et al., 2009), which thus cannot be ruled out of brain laterality research and needs to be asked since without a definitive answer neither the RHT nor the VT would be viable. Viability would require a functional difference in the brain hemispheres.

- Is there proof of brain laterality existence, where the brain's two hemispheres differ in functionality and dominance?

3.3.3 Reductionistic variables – objectivity and emotion

A difference in functionality is demonstrated by the split brain experiments cited by Levinthal (1983) and Mintzberg (1976), and therefore leads to one question as follows:

- Are the main functions of the two brain hemispheres, objectivity and emotion, enough to determine two different work environments for pharmacists?

A reductionistic approach to the functions required in a pharmacist's work environment, which covers most of the behaviours required in all pharmacy work environments, are objectivity and emotion (Sperry, 1974; Spreng et al., 2010). This is supported by Carlson (1991) and Mintzberg (1976) who supported the RHT for the most part, and thus the following questions were generated:

- Are objectivity and emotion the best choice of brain function to achieve an understanding of a pharmacist's work behaviour?
- Do the two brain hemispheres of the cortex of the brain have the same functions of objectivity and emotion? In other words, is there a lateralization of objectivity and emotional functions, and are these brain hemispheres similar for all humans?

The function of emotion has mostly been regarded as being facilitated in the right hemisphere of the brain according to Gainotti (1983) and Parr and Hopkins (2000). However, these researchers used small samples in their research, creating potential error with the results. A further potential error was that negative emotion could have been demonstrated to the subjects of Gainotti (1983) and Parr and Hopkins (2000) which would have given rationale to the existence of the VT. Confirmation of the VT could have been obtained had positive emotion been shown to the left hemisphere, thus an investigative question to determine the validity of the use of the RHT or the VT for brain laterality research was posed as follows:

- Which is the correct theory, relating to the facilitating of emotion of the brain hemispheres? The Right Hemisphere Theory, where emotion is totally facilitated in the right hemisphere of the brain? The Valence Theory, where negative emotion is facilitated in the right hemisphere and positive emotion controlled in the left hemisphere of the brain?
- In summary therefore, in the use of brain laterality to place pharmacists into their ideal work environment, would the use of the Right Hemisphere Theory and the use of the two functions of objectivity and emotion be more valid than the use of the Valence Theory, where only the function of emotion is utilized by both brain hemispheres?

3.3.4 Reductionistic variables – placement of pharmacists

The following questions derived from the literature search endeavour to determine if the reductionistic variables influence the placing of pharmacists into their ideal work environments:

- Does mood of pharmacists affect their work behaviour?
- Are left handers (demonstrating right hemisphere dominance facilitating negative emotions and hence possible depression) and glasses-wearers (where blue light preventing depression is blocked) who suffer from Seasonal Affective Disorder more likely than right handers (demonstrating left hemisphere dominance facilitating positive emotion) and those that do not wear glasses continually, to become depressed, which would affect pharmacists in their work environments?

In this regard, the work of Sullivan (2004) was reviewed to support the use of these particular stress factors.

- Would knowledge of brain laterality help in the reduction of stress factors of a pharmacist by putting the pharmacist, according to their brain laterality, into their more suitable work environment?

Gaither et al. (1999), in their study about career commitment, demonstrated that reducing stress would increase performance and lengthen time worked. In contrast, the current research investigates the influence of brain laterality in reducing stress to increase work performance by being the correct brain laterality pharmacist for that particular job, and posed the following question:

- Does reducing job stress (which would maintain a normal functioning right hemisphere researched by Zucca et al., 2011) increase work performance and lengthen time worked in a particular job due to having the correct brain laterality of the worker for that work environment?

3.3.4.1 Gender issues for work placement

The works of Lindblom et al. (2006) and Soares et al. (2007) were used to support the use of gender in this research. The brain laterality of male and female people is different demonstrated by females having a 40% larger corpus callosum (Stout, 2000) resulting in greater inter-hemispheric communication thus this brain laterality difference may present a different desire of male or female pharmacists for work environments.

- Is there a gender influence in placing pharmacists into their ideal work environment?

Hassell (2006) found that female pharmacists had mostly left work after 5 years but it is possible that the brain laterality of the female pharmacist, if used correctly, could put her into a more suited work environment, which would keep her working for longer. Also, that more male pharmacists are required to prevent a shortage of pharmacists because female pharmacists tended to leave work after 5 years. Two questions were generated based on above findings:

- Could brain laterality help to maintain female pharmacists in their placement for longer than 5 years?
- Could the use of brain laterality of the male pharmacist give ideal direction of work for pharmacists which may persuade more males to become pharmacists, which is needed by both South Africa and the UK, given the disproportionate number of female pharmacists who, in addition, tend to leave work after five years?

3.3.4.2 Length of time worked

Whilst there is literature on the length of time a pharmacist has worked (McCann et al., 2009; Gaither et al., 1999), there appears to be no studies associating the length of time

worked with specific brain laterality groups. The lack of this information gives rise to the following questions:

- Will the longer a pharmacist has worked support the notion that the brain laterality of that pharmacist has been shown to be suited to that area of work?
- Do reductionistic variables (such as Gender issues or Length of time worked) place the pharmacists into their ideal work environment alone, or in conjunction with brain laterality?

3.3.5 Amblyopia and hemiplegia

Grant et al. (2007), Jackson et al. (2002) and Loftus et al. (2004) demonstrated the importance of including amblyopia in the use of brain laterality investigations.

- Would hand-eye coordination difficulties, grip strength differences and social interactional difficulties affect the choice of the work environments by the pharmacists with amblyopia? These amblyopia traits would influence a brain laterality investigation for placing pharmacists into their ideal environment as the amblyopia may influence the choice and not the brain laterality of the pharmacist. This is supported by the research of Hubel and Wiesel (2005).

Serino et al. (2009) demonstrated functional asymmetry of the brain's hemispheres and where emotion is controlled in the brain, which would be important to the placing of pharmacists into their ideal work environment. This gave rise to the following questions:

- Do hemiplegia studies demonstrate functional asymmetry of the brain which would influence a pharmacist's behaviour?
- Do hemiplegia studies support the Right Hemisphere Theory or the Valence Theory?

3.3.6 WADA test

The WADA test, although created in 1949, still holds some validity to demonstrate different functions of the two brain hemispheres as well as demonstrating that one of the hemispheres eventually dominates (Carlson, 1991). This information is important when embarking on a brain laterality investigation, and supporting evidence for this is given by Uijl et al. (2009), giving rise to the following question:

- Does the WADA test demonstrate different functions and dominance of the brain hemispheres?

3.3.7 Brain laterality

The next ten sections ask questions (inspired by the literature) of the variables which give positive or negative direction towards placing pharmacists in their ideal environment according to their brain laterality. There is a psychological and biological involvement which includes an emotional theory investigation as well as the tympanic membrane involvement generating questions towards the research question. The age, aspirations and the personality of the pharmacists are investigated similarly deriving questions. Spectacle wearing and pharmacist distribution are also investigated which generated questions. These questions give direction towards the rationale for the research question.

3.3.7.1 Ear, eye, hand and foot dominance

The use of the ear, eye, hand and foot dominance to determine brain laterality is reported in the works of Coren et al. (1979) and McManus (2002) and was shown to be useful to determine brain laterality. The following questions were therefore generated:

- Is the choosing of the ear, eye, hand and foot to determine brain laterality dominance ideal?

- Is there reliability and validity for choosing the ear, eye, hand and foot to determine brain laterality dominance in this research?

In support of the use of the ear, eye, hand and foot dominance to determine brain laterality and an influence on behaviour, the research studies by Dane et al. (2009), Ida et al. (2001), Mandal et al. (2001), Spivak et al. (1998) and Tiwari and Mandal (1998) are significant, and prompted the following question for the current study:

- Can the dominance of the ear, eye, hand and foot determine behavioural differences in brain laterality groups of pharmacists as demonstrated by accident prone behaviour, schizophrenia, PTSD and migraines?

3.3.7.2 Grip strength

Grip strength in the literature was reported as being superior to self-assessment for a person's dominant hand, to determine brain laterality according to Siengthai et al. (2008); however, due to convenience when using a large cohort, this research would be using self-assessment to determine hand dominance. This study generated the following question?

- Will self-assessment for dominant hand determination be reliable for this research study?

3.3.7.3 Corpus callosum

Jeeves and Moes (1996) found that the corpus callosum varied in function in over 60 year olds, with gender having an influence, thus requiring exploration in pharmacists over the age of 50 years for both genders. Furthermore, Brizzolara et al. (1994) stated that the corpus callosum matured by the age of 10 years old, while Clarke and Zaidel (1994) demonstrated that the size of the corpus callosum influences it's functioning, and Leavengood and Weekes (2000) found that the corpus callosum increases in functioning with stress. In addition, Bloom and Hynd (2005) found the corpus callosum to be both inhibitory and excitatory. Hoptman and Davidson (1994) found that the corpus callosum connects similar sites in the two brain hemispheres and when this connection occurs the consequences are beneficial in

that a task would appear easier. This would support the Valence Theory. All these studies generated various questions to be explored for the current study as follows:

- Does the corpus callosum vary in its functioning in pharmacists over the age of 50 years with a gender influence?
- When does the corpus callosum mature which would influence at what age a brain laterality research study on pharmacists could begin?
- Does the anatomy of the corpus callosum, in particular it's size, influence functioning and hence affect the pharmacist's behaviour?
- Is the corpus callosum inhibitory or excitatory, or both, in pharmacists?
- Does stress increase the functioning of the corpus callosum in pharmacists?
- Is the corpus callosum attached to similar functional sites on the two hemispheres of the brain which would support acceptance of the Valence Theory?
- In summary, therefore, will the functioning of the corpus callosum, with age, influence the fluidity of brain laterality, which may influence the placement of pharmacists in accordance with their brain laterality into ideal work environments?

3.3.7.4 Right Hemisphere Theory (RHT) or Valence Theory (VT)

The research of Sathiamoorthy and Sathiamoorthy (1990), Tan (1993) and Gupta et al. (2008) tended to support the RHT and demonstrated the importance of using the hand to determine the brain laterality dominance. The following question was posed for purposes of the current research:

- Does nerve conduction velocity support the Right Hemisphere Theory or the Valence Theory as well as demonstrate the importance of using the hand in brain laterality research?

3.3.7.5 Age

According to Dargent-Pare et al. (1992) and Ofte and Hugdahi (2002) brain laterality of individuals may change as they get older, thus age must be investigated in any brain laterality research, prompting the following question:

- Does brain laterality change with increasing age making brain laterality "fluid" and non-static?

3.3.7.6 Career aspirations

Quandt and McKercher (1982) found that men and women perceived their tasks at work differently. Fjortoft and Lee (1995) found that pharmacists with a doctorate degree were more committed to their work and had greater satisfaction with their work than pharmacists without a doctorate degree. Bond et al. (1994) in turn found that hospital pharmacists were more interested in lifelong learning than pharmacists in other work areas, and that it would be advantageous for the pharmacy profession to determine which brain laterality may influence the pursuit of a doctorate degree. Furthermore, Watanabe et al. (2005) stated that the USA and Japan were lengthening the pharmacy degree to include patient care, but investigating brain laterality may influence pharmacist placement without having a longer degree. In addition it appears from Hawthorne and Anderson (2009) that male and female pharmacists do differ in work behaviour, time spent working and job satisfaction depending on where they work; thus gender influence needed to be included in this research, as did the issue of extending pharmacy degrees. Thus the questions to be asked are as follows:

- What is the direction of the pharmacy profession regarding patient care, relationship with the doctor, desire to dispense, stress at work, job satisfaction, future work plans, shaping a professional ethos, the work environment, academic career choice, gender perceptions and pharmacist goals?

- Are pharmacists with a doctorate degree more committed and satisfied with a positive attitude to their job?
- Do pharmacists working in hospitals have the greatest desire compared to other work areas to be involved in lifelong learning?
- Does a doctorate degree in pharmacy improve the pharmacist's professionalism?
- Do male and female pharmacists offer the same work behaviour, time spent working, similar desires of where to work and job satisfaction?

3.3.7.7 Brain laterality and personality

Smith and Bryant (2012) demonstrated that Type A personality people want to perform their work rapidly and Type B personality people want to perform their work slowly, while Hartman (1997) demonstrated that different brain laterality groups had different personalities. Looking at the Type A and B traits suggested by Smith and Bryant (2012) and the findings of Hartman (1997), it would appear that different brain laterality groups could be biased towards a Type A or Type B personality however, no literature in this respect has been found. The rationale for including Type A and Type B personalities in this research is the large influence a Type A personality may have on job selection, due to having traits of aggression and rushing work, elaborated by Smith and Bryant (2012) and Reber et al. (2009) which would bias the influence of the pharmacist's brain laterality on job choice. Including the Type A personality in this research would enable a comparative influence of the Type A personality with and without brain laterality for ideal job placement. Furthermore, according to Smith and Bryant (2012) the parents of a would-be pharmacist would create the Type A personality and that this Type A personality would manifest with a more aggressive controlling behaviour at work. These studies prompted questions as follows:

- Do brain laterality groups have different personalities?

- Can a Type A and Type B personality be determined by the desire to do their work quickly or slowly?
- Would different brain laterality groups have a different ability to be a Type A or Type B personality?
- What causes a Type A personality person and how would this trait affect a pharmacist's work behaviour?

3.3.7.8 Distribution of pharmacists

Modipa and Dambisya (2008) described the poor distribution of pharmacists in South Africa to serve the population. Hawthorne and Anderson (2009) found a similar poor distribution in the UK. If brain laterality could help place pharmacists into ideal work environments, this could even out the distribution of pharmacy placements. The question to be answered is:

- Would brain laterality placement of a pharmacist in ideal work areas for their brain laterality improve the poor distribution of pharmacists in the UK and South Africa?

3.3.7.9 Wearing spectacles

Strong et al. (2009) showed that blue light prevented depression in Seasonal Affective Disorder (SAD). Henderson and Grimes (2010) stated that some inter ocular lenses prevented penetration of blue light (<500nm). Thus combining the approaches of Strong et al. (2009) and Henderson and Grimes (2010), the continual wearing of spectacles by SAD sufferers may induce depression due to the potential blocking of blue light by the spectacles. Thus the continual wearing of spectacles was included in this research, as depression could affect a pharmacist's enjoyment of work.

- Will the wearing of glasses continually affect the behaviour of pharmacists by producing depression in the pharmacists who may be suffering from SAD?

If the pharmacist was suffering from depression due to SAD, his judgment of the best approach to life would be affected regardless of which brain laterality the pharmacist had, which is supported by the findings of Fournier, DeRubeis, Amsterdam, Shelton and Hollon (2015); Strong et al. (2009) and Terroni and Fraguas (2010). Fournier et al. (2015) mention that depression discouraged the unemployed from seeking work. Thus pharmacists that are depressed would not have the desire to find their ideal job using their brain laterality. Similarly, Terroni and Fraguas (2010) state that depressed people have negative judgment which would affect job choice irrespective of brain laterality influence. The question to be asked is:

- Will the wearing of glasses continually affect the choice of where to work by the pharmacist?

Westrin and Lam (2007) and Strong et al. (2009) in turn demonstrated that there is a beneficial effect of light therapy on children and adults, thus it should also influence pharmacists that are SAD sufferers because both children and adult pharmacists require the beneficial effects of blue light therapy to prevent depression.

- Does light therapy demonstrate that there is a beneficial effect on behaviour and mood of pharmacists suffering from SAD and wearing glasses continuously?
- In summary, will the wearing of glasses continuously by a pharmacist influence the manner in which he selects which environment is most suited to him?

3.3.7.10 Tympanic membrane related to the emotional site

Helton et al. (2009) found that the negative emotional stimuli given to the right hemisphere of a chimpanzee increased the temperature of the tympanic membrane of the left ear, demonstrating an association of an emotional site in the brain to the associated ear. In addition, the reverse direction of stimulation may take place where a vibrating tympanic membrane, due to the hearing of sound, influenced the emotional site in the contralateral

hemisphere (Helton et al., 2009). This generated the following questions for the current research:

- Does the experience of negative emotional stimuli to humans increase the tympanic membrane temperature of the left ear as it does in chimpanzees?
- If the tympanic membrane temperature increases due to vibration from the hearing of sound in humans, would this influence the related emotional site in the hemisphere of the brain, either in an excitatory or inhibitory fashion, and hence influence the behaviour of a pharmacist?
- In summary, does sound through the dominant ear inhibit the related emotional site in the hemisphere of the human brain which would demonstrate the Valence Theory being more valid than the Right Hemisphere Theory for brain laterality studies?

The questions mentioned above associated with animal brain laterality studies; the WADA test; the corpus callosum; nerve conduction velocity; and the tympanic membrane related to the emotional site could be seen as supportive of the study.

The questions mentioned above which were associated with a positivist convergent reductionistic approach viz: RHT and VT; objectivity and emotion; stress and depression; gender; brain laterality and reductionistic variables influencing job placement; amblyopia and hemiplegia; ear, eye, hand and foot dominance; self-assessed hand dominance; age; career aspiration; personality; distribution of pharmacists; and wearing of spectacles; were all included in the study.

The above section concludes the presentation regarding research questions that developed from the literature.

3.4 Research question

What is the role of brain laterality using brain functions of emotion and objectivity supported by animal and human research with and without the influence of the reductionistic variables in investigating the matching of pharmacists and their ideal interactive environments?

3.5 Aims of the research

The research aims to investigate the role of brain laterality in examining the ideal interactive environment of the pharmacists, by endeavouring to determine if brain laterality of pharmacists, in conjunction with and without other variables, can reductionistically place pharmacists into their ideal work environment. Furthermore, the research also aimed to determine if emotions have an impact on the preference of pharmacists for choosing work environments. The specific aims were as follows:

Aim 1: To understand brain laterality of pharmacists through the ear, eye, hand and foot dominance.

Aim 2: To examine the brain laterality groups, by themselves and in conjunction with reductionistic variables, to observe if there is a statistical difference in matching pharmacists with their ideal work environment.

Aim 3: Evaluate the Right Hemisphere Theory and Valence Theory of emotion in regard to their application and inclusion in this brain laterality research.

3.6 Research objectives

Objective 1: To determine if brain laterality alone can match the pharmacists into their ideal work environments.

Objective 2: To determine if reductionistic variables by themselves and in conjunction with each other and brain laterality, can place pharmacists in their ideal work

environment.

Objective 3: To create a new continuum of brain laterality to determine a pharmacist's brain laterality accurately and determine correlation to a simpler brain laterality determination to be used in the current research.

Objective 4: To analyse the validity of the Propinquity Principle regarding enthusiasm to formally enter the research by returning the completed questionnaire.

Objective 5: To explore the degree of correctness between the Right Hemisphere Theory and the Valence Theory regarding a brain laterality investigation using the data on global warming, as this control of emotion may place pharmacists into their best environments using the brain function of emotion only.

.

3.7 The null and alternative hypotheses

Null Hypothesis: There will be no statistical difference in the placements of pharmacists in their ideal work environment according to brain laterality after applying Propinquity Principle, Right Hemisphere Theory, Valence Theory and 16 reductionistic variables with the use of both a literature based new continuum and a simpler determinate to determine the 16 brain laterality groups of the pharmacists.

Alternate Hypothesis: There will be a statistical difference in the placements of pharmacists in their ideal work environment according to brain laterality after applying Propinquity Principle, Right Hemisphere Theory, Valence Theory and 16 reductionistic variables with the use of both a literature based new continuum and a simpler determinate to determine the 16 brain laterality groups of the pharmacists.

3.8 Reductionistic variables

Various reductionistic variables to be investigated in the current research have been listed below, followed by a discussion on each as it pertains to the current study and the decision to include them.

a. Brain Laterality
b. The wearing of glasses or contact lenses
c. Type A and Type B personalities
d. Living in the UK or South Africa
e. Knowledge on global warming influencing the pharmacy profession
f. Pharmacists preventing global warming
g. Employed or self employed
h. Number of placements as a pharmacist
i. Length of time worked as a pharmacist
j. Time worked in their last placement
k. Type of educational institution attended
l. Preferred placement setting
m. Actual placement setting
n. Postgraduate qualification
o. Age of the pharmacist
p. Gender of the pharmacist
q. Enjoyment of their work

The variable of **brain laterality**, both singularly and in conjunction with the 16 other variables, may influence where a pharmacist would be most suited to work. Brain laterality influence on job suitability incorporated the Right Hemisphere Theory as the theoretical

frame-work to the research together with the other 16 variables influence, and this approach was compared to the Valence Theory as stated in objective 5.

The **wearing of glasses or contact lenses** by the pharmacist may be a factor causing depression if the pharmacist suffers from Seasonal Affective Disorder (SAD). This means that the pharmacist could have episodes of depression, which would affect his work and the enjoyment thereof.

A **Type A personality** would be inclined to strive for higher placements in the work place whereas a **Type B personality** would be content to stay working where he is. The literature (Smith & Bryant, 2012) stated that Type A personalities have excessive competitiveness, exaggerated time urgency, with a high level of hostility and aggression. Due to the aggressive behaviour of Type A personality pharmacists, they may not be suited to community pharmacy, compared to Type B pharmacists who are more relaxed and get on well in interpersonal interactions. In industry there are fewer interpersonal interactions than in community pharmacy, thus Type A personality pharmacists may be more suited in these environments with less chance of aggressive interactions. The intention therefore of this variable was to determine if specific brain laterality groups fell into either Type A or Type B personalities, which may demonstrate where Type A or Type B pharmacists desired to work.

Living in the UK or South Africa is a variable that could give a general overview of the type of person working as a pharmacist in the two countries (Hawthorne & Anderson, 2009; Modipa & Dambisya, 2008). The pharmacists working in different areas of pharmacy may have similar brain laterality in both countries. The intention of this variable is to demonstrate a more international applicability of brain laterality by using similar pharmacy functioning countries.

The issue of **global warming** is also relevant to the current study as follows: A large number of raw materials for the pharmaceutical manufacture of medicines come from the

botanical world. Starch is derived from wheat and is used as an excipient in most tablets. Similarly with morphine from the poppy plant, digoxin from the fox glove plant, and aspirin from the selix alba tree as active ingredients in pharmaceutical preparations elaborated by pre DOB literature Tooley (1971); Trease and Evans (1980) and literature during DOB Reynolds (1996) and post DOB literature Patz et al. (2005). The availability of the raw materials for the pharmaceutical manufacture of medicines will be depleted as global warming has more of an influence on the medicinal raw material-bearing plants supported by Root et al. (2003). This will make medicines more expensive and rarer for a larger global population. Knowledge of the effect on medicinal manufacture ought to be present in the pharmacist's psyche in order for pharmacists to assist with the prevention of global warming by explaining to others what global warming is and how it is affecting mankind. A specific brain laterality may cause a pharmacist to be more interested in and enthusiastic about global warming and its impact on the pharmacy profession. The knowledge about global warming in the UK and South Africa thus required explanation as it pertains to the current study. Knowledge alone however may be insufficient. Pharmacists could be motivated to take an active role in the prevention of global warming, depending on their specific brain laterality, by discussing global warming with patients, helping more people understand the problems. In support of this, Patz et al. (2005) suggested that disease surveillance should be carried out by medical professionals so that anticipatory measures could be ready when needed, as climatic factors influence the emergence of infectious diseases. Altizer, Ostfeld, Johnson, Kutz and Harvell (2013) were in agreement with Patz et al. (2005) and stated that disease emergence, extinction and transmission are strongly dependent on climate.

Thus, knowledge of the serious influence of global warming on the future drug supply would demonstrate the emergence of a negative emotion in a pharmacist (Lombardi & Sinatra, 2013). In a similar vein, the pharmacist's desire to help and try to prevent global

warming demonstrates a positive proactive approach which would positively influence the pharmacist's emotions (Mak & Singleton, 2017).

The research further intends to determine, with an appreciation that many other factors may have an influence, if there was a specific brain laterality that indicates an individual's preference for **having one's own business or being an employee**. If a pharmacist has owned his own pharmacy for a long period of time, it may be fair to conclude that their brain laterality is ideally suited to this (Morris, 2015). Similarly, it could be concluded that the **more placements** a pharmacist has had, the less secure they may be mentally in their placements due to the regular changing of their work (Spurk, Kauffeld, Meinecke, & Ebner, 2015). This cognition adds weight to the simple reductionistic idea, which this research attempts to determine, that a specific brain laterality would be best suited to a particular work environment and that a pharmacist having been in many placements, might not know what the best work environment would be for him. Conversely, the appropriate brain lateralization may produce a confident pharmacist, making fewer errors and having a longer working lifetime in only a few different work environments.

The **length of time** worked as a pharmacist as a variable will be included in order to investigate if this is related to brain laterality. Information from pharmacists that have worked as pharmacists for many years in only a few placements would be useful in demonstrating which brain laterality was suited to these placements. Also, due to learned experiences the pharmacists' desire for their **current placement** should be greater than for previous placements (Hardin, Donaldson, & James, 2014). The intention of the research was to investigate if pharmacists spent most of their working time in this last placement. Thus this research hypothesised that the longer a pharmacist has spent in his current placement, the more his brain laterality group could be suited to that placement.

Regarding **education**, technikons in South Africa, for example the Witwatersrand Technikon pharmacy department, prior to amalgamation with Rand Afrikaans University in 2005, resulting in the University of Johannesburg, only offered diplomas in pharmacy, which meant that pharmacists graduating from a technikon could not automatically obtain postgraduate qualifications, a limiting influence. The intention of this education variable is to research this limitation influence. If a pharmacist who graduated from a technikon wished to work in academia or research, this would not be possible as he could not pursue postgraduate studies (at Masters or Doctorate level). Therefore, pharmacists who obtained a diploma in pharmacy could have been prevented from working in a placement they would be suited to, according to their brain laterality, because they had a diploma instead of a degree in pharmacy. The current research will investigate what diploma pharmacists have accomplished and which brain laterality they tend to have. The research will also investigate if the brain laterality of the diploma pharmacist is similar to the brain laterality of a pharmacist with a doctorate. If this is the case, it could indicate that the pharmacist with a diploma could have achieved a doctorate in pharmacy due to having the same brain laterality.

Pharmacists strive to find their **preferred placement setting** in order that they will feel competent and satisfied with the work (Hawthorne & Anderson, 2009). Pharmacists who had worked for a long time, but were still not working in their preferred placement, could be an indication that the two hemispheres of the brain are not interacting positively to place the pharmacists in their preferred placement. The intention of this variable (preferred placement setting) was to determine if the pharmacist is working in his preferred work environment - if not, determined by assessing the enjoyment level of the pharmacist, this could demonstrate a decreased functioning corpus callosum (Jeeves & Moes, 1996), where this decrease in the communication between the hemispheres of the brain possibly gives the pharmacist a feeling of being in the wrong work environment even after many years practicing in that placement.

The dominant hemisphere of the brain of the pharmacist may become more dominant if the corpus callosum decreases in functioning with age and at the same time the recessive hemisphere of the brain would become more recessive. An investigation will be carried out to compare the functioning of the corpus callosum, by comparing pharmacists whose preferred work area and **actual work area** differ, with those pharmacists where the preferred work area and actual work area are the same, and hence the corpus callosum may be functioning adequately (Jeeves & Moes, 1996). A pharmacist's understanding regarding preferred work area not being the same as the actual work area, may reduce the pharmacist's stress levels and may vary between the different brain laterality groups.

Regarding the influence of a **postgraduate education**, this refers to the impact of the work that is developed during their tenure of the postgraduate education. These influences account for the selection of the working area in the profession of pharmacy and may help establishing an interest towards one area over another.

Age of the pharmacist as a variable will be investigated in order to observe if the pharmacist's brain laterality changed with increasing age. As this is not a longitudinal study where the same pharmacists are investigated over time, different pharmacists at different ages will be investigated in a once off investigation. If there is a difference between preferred and actual work environments in different age ranges, if the pharmacist had worked in a placement for a long time, this may demonstrate a decreased functioning corpus callosum due to an inability for the brain to reach a homeostatic decision where to work. A changing brain laterality may cause the pharmacist to strive differently regarding his preferred work, which may have come about due to a decreased functioning of the corpus callosum, as mentioned previously. A statistically significant difference between the brain laterality groups of pharmacists and age would mean that a pharmacist's brain laterality could change as they aged. In addition if a statistically significant difference exists for age between the different

brain laterality groups, a cross sectional investigation, which implies an association between the actual and preferred work environments, this would demonstrate a fully functioning corpus callosum, due to inter-hemisphere interaction. Furthermore, a pharmacist that was right hemisphere dominant would become more so with age and would thus become more emotional and subjective in behaviour due to these sites being found in the right hemisphere of the brain, according to the Right Hemisphere Theory. The Valence Theory, on the other hand, would claim these pharmacists are more negatively emotional. A pharmacist that is left hemisphere dominant would become more left hemisphere dominant with age and would thus become more objective in behaviour as well as more positively emotional according to the Valence Theory, since the site for objectivity is found in the left hemisphere of the brain, according to the Right Hemisphere Theory. In this case the Valence Theory would state that these pharmacists would become more positively emotional. This demonstrates the potential for fluidity of brain laterality and variation in behaviour of pharmacists as they aged.

An additional important variable and determinant in brain laterality is **gender**. Male and female pharmacists may have selected different working environments based on their gender preferences. Gender may influence where the pharmacist would like to work and thus needs to be included in the current study.

Lastly, in terms of **enjoyment level of the work**, this variable will be included in order to demonstrate that if the enjoyment level is high, and the pharmacist has worked in a particular job for a long time, his brain laterality would be suited to that placement to a greater extent than if the pharmacist has worked in a placement for a long time but did not enjoy the work experience. Thus assessing the pharmacist's enjoyment of a placement through self-assessment was important in assessing whether one of the 16 groups of brain laterality was ideally suited to that placement. A low level of enjoyment for pharmacists susceptible to SAD could indicate the pharmacist's dislike of the placement, as a result of

depression, possibly induced by the continuous wearing of glasses, which blocked blue light. Greater levels of enjoyment could indicate more appreciation for the pharmacy profession, while lower levels of enjoyment could indicate higher stress levels.

3.9 Summary

This chapter introduced an understanding of reductionism, gave the rationale, aims and objectives of the current research, and detailed the questions which were derived from the literature review. These questions were condensed into a main question, viz. What is the role of brain laterality using brain functions of emotion and objectivity supported by animal and human research with and without the influence of the reductionistic variables in investigating the matching of pharmacists and their ideal interactive environments? This in turn generated the 3 aims of the research. From these three aims the 5 research objectives were developed. In addition, the Null and Alternative hypotheses were stated and the 17 reductionistic variables, were mentioned and discussed.

Chapter four discusses the research methodology.

CHAPTER 4: METHODOLOGY

4.1 Introduction and overview

The purpose of this study was to examine if brain laterality alone, or in conjunction with 16 reductionistic variables, could place pharmacists into their ideal work environments. This chapter demonstrates the methodology utilised to achieve this purpose.

Discussion in this chapter includes: research methodology overview; sample size; procedure for data collection; questionnaire design, independent and dependent variables, reliability and validity of the questionnaire and their quotients; new continuum involvement; methods of analysis; limitations and strengths; ethical considerations; summary.

4.2 Research methodology overview

A survey was administered to a selected sample of pharmacists from a specific population identified by registration to the South African Pharmacy Council, SAPC, and the Royal Pharmaceutical Society of Great Britain, RPSGB. A survey, in a research methodology design, used to collect data from a specific population, or a sample from that population, utilises a questionnaire as the survey instrument, which was the approach of this study (Robson, 1993). This is a widely accepted tool for conducting social science research methodology as indicated in this study (Rossi, Wright, & Anderson, 1983).

This study only used a questionnaire and not interviews. According to Leary (1995), there are distinct advantages in using a questionnaire as questionnaires are less expensive and easier to administer than personal interviews. Questionnaires also lend themselves to group administration and ensure confidentiality. Robson (1993) indicated that mailed surveys were extremely effective at providing information in a relatively brief time period at low cost to the researcher compared to electronic mail (Mavis & Brocato, 1998) and compared to

interviews. For these reasons, a positivist methodology was used in this study utilising the designed questionnaire for the survey instrument to assess the hypotheses and aims of the research. This approach was supported by Oliver (2004).

Of the many different research philosophies available, each involving different assumptions about the world (ontology), the best suited to this study was that of positivism. This philosophy aimed to utilise scientific method, use deductive reasoning, empirical evidence and hypothesis testing. This involved the use of quantitative data and a survey based on scientific methods with numeric sample sets. The ontology of this positivist method is that the world is objective and independent of our subjective experience. The epistemology of positivism is that the world is knowable and this knowledge is communicable between people (Reber et al., 2009; Tekin & Kotaman, 2013).

According to Oliver (2004), if research tests a hypothesis it would use a positivistic epistemology method. The current research tested the hypothesis that brain laterality and a further 16 variables may influence the placement of pharmacists into their ideal work environments. To carry out positivistic epistemological research, data should appear to support the research, and either support or reject the research hypothesis. Given the nature of positivist epistemology, however, even if the data did support the research hypothesis, additional data collected could reject the research hypothesis.

4.3 Sample size

The appropriate number of participants give a meaningful conclusion from the data. The smaller a difference for detection between the means, the more data must be collected for its determination. A Type 2 error must be avoided by having a sufficient sample size (Hashim, 2010). Type 2 error exists when the null hypothesis is not rejected, even though it is false.

Corballis (2009) and Karelitz (2008) support the rationale that the null hypothesis in this study should be rejected by demonstrating different behaviour for each dominant brain hemisphere. The power of a study is equal to one minus the probability of a Type 2 error. A standard acceptable power level is .80 with an acceptable alpha level of .05. In order to achieve these values the correct sample size has to be obtained.

According to the SAPC, there were 11000 pharmacists in South Africa, and according to the RPSGB there were 46000 pharmacists in the United Kingdom in August 2008. Professor Renette Blignaut of the Statistics Department of the University of the Western Cape determined that a sample size of 255 in South Africa and a sample size in the UK of 255 would be sufficient to reject the Null Hypothesis, this therefore would give a 2% sample of the South African pharmacists and a 0.1% sample of the UK pharmacists. Thus 1% of the pharmacists in the UK and South Africa combined were sampled. In South Africa the 255 required pharmacists were obtained in Johannesburg, Grahamstown and Cape Town only as these are the major cities in South Africa and Grahamstown is where the researcher studied pharmacy. There were only 27 pharmacists in Grahamstown, thus a questionnaire was sent to each of these pharmacists. There were 852 pharmacists in total in Cape Town thus 100 pharmacists were required to reply from Cape Town. There were 1490 pharmacists in total in Johannesburg thus 130 pharmacists were required to reply from Johannesburg.

The 255 pharmacist sample in the UK were obtained from Plymouth, Oxford, London, Folkestone, Manchester and Aberdeen as these areas exist randomly along an inverted T.

The table of Krejcie and Morgan (1970) supported by Cohen, Manion and Morrison (2004) demonstrated that the smaller the population size the larger the proportion of the sample. The population size of pharmacists, both in South Africa and the UK was between 50000 and 75000 obtained from the numbers given by the SAPC and the RPSGB mentioned

above. Using the tables of Krejcie and Morgan (1970), which are cited by a large number of articles today, give a sample size of 381 for this pharmacist population size. The final sample size collected for this study was 510 demonstrating adequacy for the study.

4.4 Procedure for data collection

The following sections mention who was included in this research, the adopted sampling approach used in South Africa and the United Kingdom, method and area used to obtain samples in South Africa and the United Kingdom, how the propinquity principle was carried out in South Africa and the United Kingdom, aspects for developing an effective questionnaire, classifying pharmacists with the use of the different sections of the questionnaire.

4.4.1 Inclusion criteria

The data in the current study was collected on participating pharmacists to observe their influence on where the pharmacists actually worked. Only qualified registered pharmacists with the SAPC and the RPSGB were included in the study. These pharmacists were between the ages of 20 to 80 years old.

4.4.2 Directions adopted

The research with the South African sample adopted a positivist approach which required a probability sample. A probability sample requires each pharmacist of the research population to have a known probability of inclusion in the sample. The South African probability sampling involved cluster sampling where the population of pharmacists was divided into geographical areas of Johannesburg, Cape Town and Grahamstown from which random samples were drawn (Cohen et al., 2004). In each area the first sample element was randomly chosen from numbers and subsequent elements were chosen at every kth interval (Cohen et al., 2004).

The UK sample was obtained using non-probability sampling where purposive sampling and snowballing were applied. Purposive sampling is where a deliberate effort to obtain a representative sample is by including typical areas in the sample (Cohen et al., 2004). Snowballing occurs when respondents obtain further respondents.

4.4.3 UK and South African procedure

Non-probability purposive sampling was applied to the UK sample where towns were chosen along an inverted T pattern of the UK. The sample was chosen over a large area as follows: Plymouth, Oxford, London, Folkestone, Manchester, Nottingham and Aberdeen. Four pharmacists, chosen in London obtained half the required sample in the UK using the snowballing method due to lists of pharmacists not obtainable from the RPSGB as a result of the Data Protection Act. Snowball sampling is a non – probability sampling technique where existing study subjects recruit future subjects from among their acquaintances. The UK sample was also obtained in various work areas including community, hospital, industry, research and education by means of post, email and physically handing questionnaires to pharmacists. The post and email addresses were obtained via the internet.

Lists of South African Pharmacists were obtained from the SAPC in August 2008. In South Africa, convenience sampling was adopted to select the towns. The largest towns of Johannesburg and Cape Town were selected to ensure the required sample size. All the pharmacists from Grahamstown were selected which is where the researcher studied pharmacy. The pharmacists in Johannesburg and Cape Town were randomly selected from the SAPC lists to obtain the South African sample.

A probability sample, achieved in South Africa, drawing randomly from the wider population, enables the researcher to make generalization as there is representativeness of the wider population. A non-probability sample, achieved in the United Kingdom, avoids representation of the wider population; only a particular group is represented of the wider

population. Skewness or bias may be apparent in the non-probability sample due to lack of generalizability to the wider population (Cohen et al., 2004). It was however postulated that the data obtained in South Africa would be similar to that of the United Kingdom, due to a similar pharmacy work culture, generating potential for generalizability to the entire pharmacy population in both countries with a minimal bias.

4.4.4 Data collection methods for testing the propinquity principle

The propinquity principle hypothesised that pharmacists living and working closer to the research university would be more likely to formally enter the research context than pharmacists living and working further away from the research university (Reber et al., 2009). This was measured using different stamps on the reply envelopes for the Cape Town and Johannesburg reply envelopes.

In South Africa two methods, postal and email, were used to obtain the required sample of 255 respondents. In the UK four methods, postal, email, snowballing and the researcher walking into pharmacies, were used to obtain the required sample of 255 respondents. A comparison of the number of methods required in the two countries, to achieve the same sample size, was used to further investigate the correctness of the propinquity principle.

4.4.5 Effectiveness of the questionnaire

For a survey questionnaire to be effective in giving the information required, the questionnaire should be designed to be easy to understand and easy to complete as cited by Leary (1995). The development of the questionnaire for this study took the following points into consideration:

(i) Determine what information was required from the survey. What were the main objectives in designing the questionnaire and which questions would address these

objectives? The questions in the questionnaire should not be redundant and should be specific and useful to the topic.

(ii) An introductory covering letter should explain briefly about the questionnaire. This covering letter must be brief and engage the target audience. Thought of the pharmacist's attention span was considered when developing the length of the covering letter and the questionnaire.

(iii) Closed questions were used only. This made it easier for the pharmacists to answer the questions without having to write a sentence.

(iv) The questions were ordered in a meaningful and easy to follow way. Easier questions were started with encouraging the pharmacists to finish the questionnaire. The formulation of like topics were grouped together.

(v) Variety was introduced to the questions preventing the respondents from becoming bored. Variety included questions on global warming, speed of doing work, brain laterality determination and the wearing of glasses.

4.4.6 Classifying pharmacists into mutually-exclusive brain laterality groups

The questionnaire comprised of sections A, B, C and D.

Section A, the biographical section, covered the pharmacist's age, gender, ear and eye problems, the wearing of glasses, preferred and actual work areas, time worked as a pharmacist and time worked in their current placement, number of placements, institution graduated, where they live, owning a pharmacy, qualification level, enjoyment level.

Section B determined brain laterality using four questions each asking the pharmacists which ear, eye, hand and foot was dominant. This resulted in 16 groups of brain laterality taking all the combinations into account. From this method of brain laterality determination each pharmacist was determined to be in one of these 16 mutually-exclusive brain laterality groups. This section was correlated to the brain laterality determination of Section C which

was derived from the literature (Coren et al., 1979) giving reliability and validity to both brain laterality determinations.

Section C determined brain laterality more accurately using 13 questions obtained from Coren et al. (1979) supported by Coren (1993). There were four questions determining hand dominance and three questions each for determination of the eye, ear and foot dominance. This brain laterality assessment was found to be reliable and valid both by Coren et al. (1979) and Lee et al. (2016).

Section D consisted of three questions. Two questions determined the pharmacist's desire for preventing global warming and knowledge that global warming could affect future drug supply. These two questions were also used to determine the pharmacist's positive and negative emotion generation respectively, that is, the preventing question to demonstrate positive emotion generation, and the future drug situation question to demonstrate negative emotion generation. The work of Lombardi and Sinatra (2013) and Mak and Singleton (2017) demonstrate the reliability and validity of these emotional questions both negative and positive emotion respectively by using these questions in their research. The third question enquired about the speed of doing work. Pharmacists that rushed their work were regarded as Type A personalities, whereas doing work slowly would class the pharmacist as a Type B personality. The reliability and validity of this Type A or Type B determining question is supported by the research of Smith and Bryant (2012).

Where people are classified into mutually-exclusive categories, nominal data is used. All the people in a particular category would be alike, regarding the attribute being measured and those people in different categories are different regarding that attribute (Huysamen 1987; Cohen et al., 2004).

4.5 Questionnaire design

The questionnaire used in this study addressed three aims. First, to understand the ear, eye, hand and foot dominance in the examination of brain laterality of pharmacists. A new continuum of brain laterality was designed in this respect as well as a four-question determination of brain laterality. Second, to examine brain laterality by itself or in conjunction with reductionistic variables, to observe if there is a statistical difference in placing pharmacists into their ideal work environments. Third, to determine the correctness of the RHT or the VT regarding the site for emotion control, as this emotional site may be a motivation for the placing of pharmacists into their best environments.

A brief overview of the rationale for each question in Sections A, B, C and D of the questionnaire is given in Table 3 below.

Table 3 Reason for each question in the questionnaire

Section A	
Questions	Rationale
1. Age range	All pharmacists from the age of 20 to 80 years old were included in the study. Under 20 and over 80 year olds were excluded from the research due to their brain laterality not having matured and retirement respectively. Some pharmacists may not have been prepared to give their exact age, thus to prevent exclusion of these pharmacists a 5 year range was introduced. This was a continuous numerical variable with 12 age ranges.
2. Gender	How gender and brain laterality may affect where best for the pharmacist to work. This is a nominal categorical variable.
3, & 4. Deafness and eye problems	Deafness in an ear may invalidate the results. If deaf in both ears the questionnaire would be used as this could still assess brain laterality, due to the emphasis being on preferred ear for use if the ears could be used. If a person was blind in one eye the questionnaire would be used thus introducing amblyopia to the research. The questionnaire would only be discarded if the answers to question 3 and question 4 were both YES alleviating any chance of error in assessing brain laterality. If only one YES for these two questions the questionnaire would be used as preference is being examined. These were nominal categorical variables.
5, 6 & 7. Wearing of glasses	To determine if the wearing of glasses or contact lenses will influence the mood of those with Seasonal Affective Disorder (SAD) and hence

	influence the level of enjoyment of the pharmacist's work. These were nominal categorical variables.
8. Work preferred area	To determine if pharmacists are in their preferred area of work. If not, their corpus callosum may not be functioning adequately, demonstrated by Ofte and Hugdahl (2002) and Jeeves and Moes (1996) where the corpus callosum decreased in functionality for over 50 year olds, consequently the brain's two hemispheres may not agree as where best to work. This was a nominal categorical variable.
9. Actual work area	Areas were chosen which are mutually-exclusive in terms of job requirements and required behaviours. This was a nominal categorical variable.
10. Time spent in current placement	To determine if the pharmacist is in the correct work placement for his brain laterality. This was a discrete numerical variable.
11. Time worked as a pharmacist	To filter out pharmacists not working in fields related to pharmacy. This was a discrete numerical variable.
12. Number of pharmacy placements worked in	A large number of placements would mean that the pharmacists were not suited to the placements (Savage et al., 2009) and thus it was hypothesised their brain laterality would not be suited to these placements. The length of time spent in their last placements would thus be valuable (Clark & Mount, 2006) to demonstrate the brain laterality suitability of the pharmacist's final choice. This was a discrete numerical variable.
13. Institute of graduation	Level of education offered to determine if there was an influence on work preference. This was a nominal categorical variable.
14. Work in the United Kingdom or South Africa	To determine if pharmacists in the UK and South Africa are behaviourally compatible regarding brain laterality and job choice and their work behaviour. This was a nominal categorical variable.
15. Work in own business or for someone else	To find the brain laterality which best suits the running of the pharmacist's own community pharmacy by observing the brain laterality of pharmacists in their own pharmacy, with the "best suits" aspect being determined by the length of time the pharmacist has owned his pharmacy. This was a nominal categorical variable.
16. Highest qualification obtained	To investigate the best combination of combining brain laterality and qualification. This was a nominal categorical variable.
17. Enjoyment level of current placement	Self-determined, subjective, nominal determination, of how much the pharmacists are enjoying their current placements. This was a discrete numerical variable.

Section B	
	Determined which brain laterality groups the pharmacist fell into using nominal categorical data. To determine this, the pharmacist was asked which ear, eye, hand and foot he preferred to use. Different variations produce 16 brain laterality groups.
Section C	
	Determined the pharmacist's brain laterality on a continuum. This was nominal categorical data determining a more accurate brain laterality due to a larger number of questions than the questions used in section B (13 questions vs 4 questions respectively).
Section D	
	Section D gives nominal categorical values to answers on two questions on global warming to demonstrate the pharmacists' interest in global warming. The global warming questions were also used to determine the pharmacist's emotion generation, giving insight into the correctness of either the Right Hemisphere Theory or the Valence Theory. A final question in Section D asked the pharmacists if they rush through their work (Type A Personality) or do it slowly (Type B Personality) to determine if this variable could be related to brain laterality. This was a nominal categorical variable. Type As were given the nominal number of 2 and Type Bs were given the nominal number of 1. Smith and Bryant (2012) discussed control and punishment, which was incorporated into this question in the questionnaire. All pharmacists who will not give up control, even though they stand a greater chance of being punished, will tend to do a task in a rush and are thus a Type A personality. All pharmacists who will give up control, to avoid being punished, will tend to do work slowly and are thus a Type B personality.

4.5.1 Independent and dependent variables

The independent variable is the variable that is varied by the researcher and the dependent variable is the response that is measured. An independent variable is the presumed cause, whereas the dependent variable is the presumed effect (Cohen et al., 2004). In this study, brain laterality, and all the reductionistic variables possibly influencing the variable of where the pharmacist actually worked, were the independent variables. The dependent variable was thus where the pharmacist actually worked.

4.5.2 Reliability and validity of the questionnaire

Reliability and validity are important aspects of questionnaire design. According to Suskie (1996), a perfectly reliable questionnaire elicits consistent responses. Although difficult to develop, it is possible to design a questionnaire that approaches a consistent level of response. Robson (1993) stated that high reliability of response is obtainable by providing all respondents with the exact same set of questions. This was achieved in this study.

Validity is more difficult to establish within a single measure. For a questionnaire to be perfectly valid, it must measure the inferences accurately.

4.5.2.1 Piloting steps

Suskie (1996) reported that reliability and validity are enhanced with the following precautionary steps which were taken into account in this study involving piloting.

- Each item was clearly and easily understood which was verified by asking a few pharmacists in South Africa what they thought of the questions in the questionnaire.
- Each item was interpreted in the intended way which was also verified by asking a few pharmacists in South Africa.
- The items had an intuitive relationship to the topic.
- Each item was clear to colleagues knowledgeable about the subject.
- The UWC ethics committee also gave approval of the survey response instrument before it was distributed to the pharmacists.

4.5.2.2 Reliability and validity quotients

Quotients demonstrate a relationship between one factor and another. For example in this research the relationship between brain laterality and ideal job placement, in conjunction with other reductionistic variables influencing job choice, are the factors potentially affecting each other.

Reliability and validity are important for defining and measuring bias and distortion. This brain laterality research is involved with data obtained from a questionnaire containing 20 questions. These questions were selected to determine a pharmacist's situation and beliefs affecting their choice of an ideal work environment. Data was collected from 255 pharmacists in South Africa and 255 pharmacists from the United Kingdom. This large sample size of 510 pharmacists validates the questionnaire establishing the measurement properties. Chi-square analysis will be used to determine the pharmacist's situation and beliefs with reconfirmation using an F test on imperative variable results. Reliability will be demonstrated by internal consistency using the alternate form method by comparing the South African pharmacists with the United Kingdom pharmacists. If the results in the two countries are similar the questionnaire is reliable. The extent to which the content of the questionnaire matches the instructional objectives defines the validity in this research (Cohen et al., 2004). The questions in the questionnaire encompass the requirements of the research objectives supported by Lee et al. (2016).

4.6 New continuum involvement

A new continuum was created to determine objective 1, found in Section C of the questionnaire. This continuum increased brain laterality determination accuracy as there were 13 questions from the literature (Coren et al., 1979 supported by Lee et al., 2016) compared with the four questions in Section B of the questionnaire. A correlation between these four and 13 questions was determined using Spearman's correlation coefficient. A correlation would mean that only four questions were effective to determine an individual's brain laterality. From these 13 questions an answer indicating the left hemisphere was given a nominal value of +1 and an answer indicating the right hemisphere was given a nominal value of -1; an answer indicating both hemispheres was given a nominal value of 0. The

answers were summed to give a value for each pharmacist. This created a new continuum to determine brain laterality with nominal values ranging from -13 to +13.

The pharmacist's nominal determined value from the continuum, Section C of the questionnaire, was compared to the 16 brain laterality groups they fell into, determined in Section B, as well as other variables investigated in the questionnaire, such as the actual job worked.

These brain laterality determinations were compared on the continuum for possible groupings into work areas by observing if pharmacists with the same brain laterality group on the continuum worked in the same nine mutually-exclusive work environments. Once the pharmacist's brain laterality value on the continuum was determined and it was found that many of the same brain laterality groups fall in that area, it was observed whether these values tied into regions of work environments on the continuum. The Null Hypothesis would have to be rejected for the brain laterality continuum to demonstrate regions of brain laterality groups of pharmacists for specific work environments; otherwise, if not rejected, brain laterality groups could appear anywhere on the continuum.

4.7 Methods of analysis

The data from the questionnaire were recorded and transferred to Excel. Incomplete questionnaires were discarded from the analysis. Due care was taken to avoid transcription errors.

Chi-square analysis using SPSS - 17, was used to analyse the nominal data from 17 variables, including brain laterality. Two manual F tests were also used for two important verification calculations. The two important variables related to brain laterality are age of the pharmacists and the actual work area which require reconfirmation with a stronger statistical

difference analysis between the 16 brain laterality groups hence an F test will be used as these two variables have a major influence in this research (Cohen et al., 2004).

The SPSS programme, based on Brace et al. (2009), was used to determine the relationships between the different columns in the Raw Data table, (see appendices), using the chi-square method, and correlated with the calculations obtained from Prof Richard Madsen of the University of the Western Cape Statistic Department.

The best method to determine statistical difference between the brain laterality groups was the chi-square method whereby a single hypothesis was tested at a 0.05 level of significance.

The Bonferroni method was used, where the usual significance level is divided by the number of tests done, to get the required significance level. Thus, in order to achieve a significant difference between the 16 brain laterality groups, a p-value lower than the chosen adjusted level of 0.005 would have to be obtained in the chi-square analysis.

Manual F tests were carried out on the major question in this study and on reductionistic variables that rejected the null hypothesis. These F tests gave increased accuracy to these investigations since if the means of several normally-distributed populations, with the same standard deviation are equal, an F test may be carried out to determine an accurate statistical difference between the means (Cohen et al., 2004; Kerlinger, 1986). This research was involved with parametric statistics which depends on the assumption of the population scores being normally distributed. This enabled the use of an F test (Cohen et al., 2004; Kerlinger, 1986).

In the case of a retired pharmacist a score of 99 (a transformed score) was given to the question on where the pharmacist currently worked, so that these questions could be left out of data analysis dealing with the pharmacists' current work.

4.8 Ethical considerations

The UWC Ethics Committee gave approval of the survey questionnaire before it was distributed to the pharmacists. The Ethics Committee Reference Number was 08/2/42.

Conducting research ethically implies treating research participants with care, sensitivity and respect. Ethical considerations are the cornerstone for carrying out effective and meaningful research. The primary responsibilities to participants of the current research involved obtaining informed consent, protection from harm and ensuring privacy.

Informed consent

Here the individual must be able to choose whether or not to participate in the research. The potential participants in the current study were given a complete understanding of the purpose, methods, risks and demands on the participants in a covering letter attached to the questionnaire. A direct consent method was adopted by asking the pharmacists to sign a permission form attached to the covering letter. Emailed questionnaires were considered to have been signed purely by having received the completed questionnaire. The pharmacists were informed in the covering letter that their information would remain anonymous. The participants had the ability to withdraw from the research at any time, without penalty, by either not submitting the questionnaire or getting the questionnaire back from the research university. Consent is not a permanent aspect; however, in the current research no consent was withdrawn. The three elements of informed consent: capacity, information and voluntariness have to be present for effective consent.

Capacity is where a person acquires and retains knowledge (Oliver 2004; Reber et al., 2009). The ability for the person to acquire and evaluate knowledge enables the person to be accepted as competent or incompetent. All the respondents in the current study were qualified pharmacists placing them in the category of competent on the strength of having at least a four year degree.

Information must be communicated to the participants effectively so that it can be clearly understood (Oliver 2004; Reber et al., 2009). The determination of emotion from the participants, utilizing global warming questions, complicated this ethical aspect due to being a secondary survey method of which the pharmacists were not informed. However, total anonymity ensured the emotional generation of the pharmacists was not related to individual pharmacists, thus excusing this complication of consent.

Voluntariness is involved with free choice, thus having no force, fraud, deceit, duress or any form of coercion, either explicit or implicit (Oliver 2004; Reber et al., 2009). The current study offered complete freedom of choice to commit to the research and the participants, being qualified pharmacists, were deemed competent to make a free choice as to respond to the research. Thus all the respondents for the current study appeared cognitively and emotionally able to partake of the research.

A few pharmacists submitted their data without signing the agreement. The researcher used these questionnaires, as the voluntariness could be implied. The pharmacist may not have been happy with releasing their signature to the research.

The pharmacists that submitted their questionnaires, via email, could not physically sign the second page of the covering letter. However, formal agreement to participate in the research can be granted here due to having returned the permission form which signifies their intent to participate in the research.

Harm

The most basic concern of the researcher is that no participant in the research is harmed in any way. Harm may be regarded as extreme physical pain or death, psychological stress, embarrassment or humiliation (Oliver, 2004). These factors were avoided in the current study by informing the participants what the research entailed and informing them that the research results would be accessible in future publications, which would alleviate any

discomfort participants may have had about the study. The current study was not classed as high risk for harm as the participants were all professional pharmacists therefore not considered vulnerable, and that data collection did not entail undue stress.

Privacy

Privacy is treasured in contemporary western society. Researchers have to guard against unnecessary invasion of the participants' privacy (Reber et al., 2009). Data was collected anonymously thereby obviating any fear of breach of confidentiality.

Deception

This involves the misrepresentation of facts involving omission or commission. An omission deception involves the researcher not fully informing participants and a commission deception involves the giving of false information (Reber et al., 2009). Regarding an omission deception, all participants were aware that research was being carried out, and regarding commission deception no false information was issued to the participants. Thus neither type of deception was perpetrated in the current study, verified by the ethics committee of the UWC.

Integrity

Integrity relates to the honesty of the researcher. Errors or falsification of the research data weakens or invalidates the research. Objective and accurate data about real phenomena is the basis of quantitative positivist research (Oliver, 2004). Being pressured into research may influence the researcher to lose track of the integrity of his research. In the current study the researcher had investigated brain laterality over many years, thus was not pressured into the current study, but strove for total integrity.

4.9 Summary

The purpose of this chapter was to describe the research methodology of this study. The research methodology established that a survey questionnaire was to be used on a specific population, that of pharmacists, identified by membership of the SAPC and the RPSGB. The sample size was determined from tables taking the population size into account as well as assistance from the UWC Statistic Department. The procedure for data collection was expanded upon. This included inclusion criteria; directions adopted; UK and South African procedures; data collection method for testing the propinquity principle; effectiveness of the questionnaire; classifying pharmacists into mutually-exclusive brain laterality groups. The questionnaire design was elaborated upon giving rationale for each question in the questionnaire. This instrument was discussed involving independent and dependent variables and reliability and validity of the questionnaire including piloting steps. The involvement of the new continuum was discussed. The methods of analysis were discussed pertaining to the use of the chi-square method on the nominal data and the rationale for the use of the F test. RHT or VT being correct, detection of emotion generation from the global warming questions, postal and email situations and the use of snowballing. Ethical considerations were discussed involving informed consent, protection from harm and ensuring privacy. Chapter 5 deals with the results.

CHAPTER 5: RESULTS

5.1 General overview

This chapter presents the results of each of the 5 objectives of the research individually by giving an overview of the objective followed by the results. The chapter concludes with a summary of all the results.

P-values below 0.005 demonstrated statistical significance.

Table 4 Descriptive statistics pertaining to sample

Population of pharmacists in the United Kingdom and South Africa	57000
Population of pharmacists in South Africa	11000
Population of pharmacists in the United Kingdom	46000
Total sample size in South Africa and the United Kingdom	510 (1% of total population)
Sample size in South Africa	255 (2% of SA population)
Sample size in the United Kingdom	255 (0.1% of UK population)
Number of female pharmacists in the SA sample (before completing 10 years of work – see objective 2 results)	153
Number of female pharmacists in the UK sample (before completing 10 years of work – see objective 2 results)	150
Number of male pharmacists in the SA sample	102
Number of male pharmacists in the UK sample	105
Number of pharmacists wearing glasses or contact lenses continuously in SA sample	117 (46%)
Number of pharmacists wearing glasses or contact lenses continuously in the UK sample	117 (46%)

5.2 Reporting results

The following sections give the results of the five objectives in this research. The objective will be cited followed by an overview of the objective and then the results.

5.2.1 Objective 1: To determine if brain laterality alone can match the pharmacists into their ideal work environments.

This section cites objective 1 above and gives an overview pertaining to this objective. The results are cited for both chi-square analysis and an F test. The calculations for the F test are demonstrated.

5.2.1.1 Overview

The first objective was to determine if brain laterality alone could successfully place pharmacists into their ideal work environments. Two variables were investigated from data collected from the questionnaires, namely brain laterality, and the pharmacists' actual job. Chi-square analysis and an F test were used to determine if there was a statistical difference between the 16 brain laterality groups of pharmacists and the actual job worked by pharmacists. If the means of several normally distributed populations, all having the same standard deviation, are equal, an F test may be carried out in order to determine an accurate statistical difference between the means.

The Right Hemisphere Theory was adopted.

5.2.1.2 Results

No statistical difference was found between the 16 brain laterality groups and pharmacists' actual jobs ($p = 0.5444$). The consequences of these findings demonstrated that the Null Hypothesis could not be rejected.

The F test supported the chi-square analysis that the mean values of actual work were statistically similar between the 16 brain laterality groups, thereby not rejecting the Null Hypothesis. This demonstrated that any work area can have pharmacists in any of the 16 brain laterality groups working in it.

Calculations with these means, demonstrating these findings, using the F test from the actual job environment follow and are indicated in Tables 5 and 6.

Table 5 F test for actual work area and brain laterality groups

Brain laterality group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total
Σ X	725	46	9	21	217	20	17	13	574	28	23	28	128	35	8	70	1962
$(\Sigma X)^2$	525625	2116	81	441	47089	400	289	169	329476	784	529	784	16384	1225	64	4900	3849444
Mean	3.08	3.83	1.1	3.5	3.88	2.5	2.8	3.25	7.18	3.11	4.6	4	3.37	3.5	1.33	3.5	
ΣX^2	4410	296	11	135	1507	76	85	87	1469	170	171	172	798	225	12	497	10121
n	235	12	8	6	56	8	6	4	80	9	5	7	38	10	6	20	510

Table 6 Final analysis of variance for actual work area and brain laterality groups

Source	Degrees of freedom	Sum of squares (SS)	Mean sum of squares (MS)	F
Between groups (b)	15	1162.72	77.51	27.196
Within groups	494	1410.35	2.85	
Total (t)	509	2573.07		

Calculation of the correlation ratio, η, of the means:

$$\eta = \sqrt{SSb/SSt} = 0.672$$

The F test table value, where alpha = 0.025, the numerator degrees of freedom were

15, and the denominator degrees of freedom used was infinity, gave a value of 2.395. It can therefore be seen that the means are not statistically different - for a statistical difference, the obtained F value, in this case 27.196, would have had to be less than the table value. In fact, the correlation ratio, η, demonstrates that the means are similar and well- correlated to each other. A value of 0.672 demonstrates the sameness of the means, as this value is almost 1.000 and hence no statistical difference between the means, where

$$\eta^2 = 0.672^2 = 0.452$$

η^2 demonstrates the proportion of the variance of the dependent variable, the actual work mean, determined by the variance of the independent variable (the 16 brain laterality groups). The greater the variance of the dependent variable, shared by the variance of the independent variable, the less difference between the groups of the dependent variable.

In order for there to be a difference between the means of the dependent variable, there must be hardly any influence from the independent variable. The independent brain laterality variable exerts influence on the actual job dependent mean variable, demonstrated by $\eta^2 = 0.452$, thus there is no statistical difference between the actual job dependent means by themselves. Any change in these dependent means is due to 45% of the change of the independent brain laterality groups.

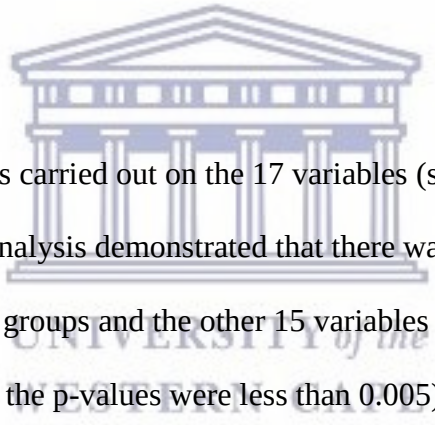
5.2.2 Objective 2: To determine if reductionistic variables by themselves and in conjunction with each other and brain laterality, can place pharmacists in their ideal work environment.

This section cites objective 2 above and gives an overview pertaining to this objective. The results are cited for both chi-square analysis of the reductionistic variables and including an F test for the age of the pharmacist variable. The calculations for the F test are demonstrated.

5.2.2.1 Overview

The second objective was to determine if reductionistic variables by themselves, and in conjunction with each other and brain laterality, can place pharmacists into their ideal work environments. Seventeen variables were selected owing to the dearth of literature regarding their influence.

Salient results were involved with: brain laterality changing with age; gender influences; the influence of wearing glasses related to Seasonal Affective Disorder and depression; enjoyment determination; the functioning of the corpus callosum by investigating actual and preferred placements; Type A personality influence; doctorate degree influence; and most likely community pharmacy owner.



5.2.2.2 Results

Chi-square analysis was carried out on the 17 variables (see Appendix, Section A in the Calculation section). The analysis demonstrated that there was no statistical difference between the 16 brain laterality groups and the other 15 variables for placing pharmacists into their ideal work areas (none of the p-values were less than 0.005). Thus the **Null Hypothesis** was not rejected.

There was, however, one exception and that was for the variable **age**, where a statistical difference was found between the 16 brain laterality groups and the variable age, ($p = 0.0029$), thus rejecting the Null Hypothesis only for the variable age. This result was supported by the literature (Jeeves & Moes, 1996) and demonstrated that brain laterality is not a static entity, but rather varies with age, which would affect a pharmacist's behaviour and decision making as where to work as he/she aged.

An **F test** was used to further demonstrate the importance of the finding, the statistical analysis is shown in Tables 7 and 8 below.

Table 7 F test for age and brain laterality groups

Brain laterality group	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
ΣX	1188	38	42	26	283	39	27	36	492	62	23	40	225	59	22	118
$(\Sigma X)^2$	1411344	1444	1764	676	80089	1521	729	1296	242064	3844	529	1600	50625	3481	484	13924
Mean	5.01	3.45	6	4.33	5.05	4.88	4.5	9	6.15	6.88	4.6	5.71	5.92	5.9	3.67	5.9
ΣX^2	8020	174	308	142	2006	239	163	344	3754	508	131	242	1561	423	102	758
n	237	11	7	6	56	8	6	4	80	9	5	7	38	10	6	20

Table 8 Final analysis of variance for age and brain laterality groups

Source	Degrees of freedom	Sum of squares (SS)	Mean sum of squares (MS)	F
Between Groups (b)	15	254.58	16.97	2.04
Within groups	494	4113.75	8.33	
Total (t)	509	4368.33		

The F value, from the research data, of 2.04 is less than the table value of 2.395, where the alpha value is 0.025, demonstrating that the mean age in each of the 16 brain laterality groups is statistically different. Conversely, it can be deduced that as age changes so may brain laterality.

The correlation ratio of the means is as follows:

$$\eta = \sqrt{SSb / SSt} = 0.241$$

Thus there is very little correlation between the means of the ages, demonstrating that the mean age in each of the 16 brain laterality groups is statistically different.

$\eta^2 = 0.058$ demonstrates that with the age dependent mean variable there was hardly any influence of the independent brain laterality variable, resulting in a statistical difference between the age dependent means by themselves. Any change in the age dependent means is

due to only 6% of the change of the independent brain laterality groups. Thus the dependent means of age are mostly not similar and are statistically different.

Regarding **gender**, the results showed that there are no gender differences between the 16 brain laterality groups (p = 0.5394). Male and female pharmacists can have any of the 16 brain laterality groups, and can work in any of the work areas investigated with equal confidence and proficiency. In the UK cohort, 59% were female; while in the South African cohort, 60% were female. After 10 years of working in their current work environments, the ratio of male to female pharmacists, both in the UK and South Africa, reduced from the 60% female pharmacists mentioned above, to 50%. In Table 9 below the percentages of male and female pharmacists, in each of the UK and South African cohorts, can be observed to be similar in each country, even though more pharmacists worked for longer than 10 years, in their current placements, in South Africa.

Table 9 Decrease in female pharmacist numbers after 10 years in current work (Pharmacists in their current placements for longer than 10 years)

	Male Pharmacists n (%)	Female Pharmacists n (%)	Totals n (%)
UK cohort	37 (23%)	30 (19%)	67 (42%)
S. A. cohort	46 (29%)	48 (30%)	94 (58%)
Totals n (%)	83 (52%)	78 (49%)	161 (100%)

Regarding **global warming**, Tables 10, 11, 12 and 13 show the influence of knowledge of global warming affecting drug supply and the enthusiasm for the prevention of global warming by male and female pharmacists in both the UK and South Africa. The male pharmacists in the UK have the lowest percentage of YES answers to both global warming questions, demonstrating the least knowledge and enthusiasm for preventing global warming. The female pharmacists in South Africa have the highest percentages of YES answers to both

global warming questions, demonstrating the most knowledge and enthusiasm for preventing global warming.

Any of the 16 brain laterality groups of pharmacists could have answered YES or NO to the two global warming questions (preventing p = 0.0658; knowledge p = 0.4606).

There were an equal number of extreme left hemisphere dominant Type A personality pharmacists to extreme right hemisphere dominant Type A personality pharmacists. This demonstrates a potential site for controlling emotion in the left hemisphere of the brain, supporting the Valence Theory.

Table 10 Female pharmacists' association to global warming in the UK

Preventing Global Warming		Global Warming affecting drugs	
108 YES answers	(72%)	116 YES answers	(77%)
43 NO answers	(28%)	35 NO answers	(23%)
151 Total		151 Total	

Table 11 Male pharmacists' association to global warming in the UK

Preventing Global Warming		Global Warming affecting drugs	
69 YES answers	(66%)	70 YES answers	(70%)
35 NO answers	(34%)	34 NO answers	(33%)
104 Total		104 Total	

Table 12 Female pharmacists' association to global warming in South Africa

Preventing Global Warming		Global Warming affecting drugs	
135 YES answers	(88%)	131 YES answers	(86%)
18 NO answers	(12%)	22 NO answers	(14%)
153 Total		153 Total	

Table 13 Male pharmacists' association to global warming in South Africa

Preventing Global Warming		Global Warming affecting drugs	
85 YES answers	(83%)	80 YES answers	(78%)
17 NO answers	(17%)	22 NO answers	(22%)
102 Total		102 Total	

The issue of the presence of **Seasonal Affective Disorder (SAD)** was also investigated by determining how many pharmacists enjoy their placements with an enjoyment value of 4 and less, and if they wore glasses or not, and what their brain laterality group was. Table 12 follows, demonstrating these influences. 46% of pharmacists wore glasses continuously in both countries and they could have been in any brain laterality group ($p = 0.3822$).

The **enjoyment level**, for the entire cohort of 510 was an average of 8 out of 10 which is demonstrated in Table 14. However, a total of 32 (6.3%) pharmacists enjoyed their placements to a value of ≤ 4 out of 10. Of the 6.3%, (38%) wore glasses all the time, and 20 (62%) did not. Thus 12 out of 510 pharmacists (2%) could be affected by Seasonal Affective Disorder, which would influence their work enjoyment since they could have been suffering from depression at work, SAD being induced by the wearing of glasses continually. Regarding level of enjoyment, there was no statistical difference between the 16 brain laterality groups and level of enjoyment ($p = 0.1595$).

Table 14 Pharmacists average self-assessed enjoyment level

Country	Self–assessed enjoyment levels
United Kingdom	7.42
South Africa	7.58

Table 15 demonstrated that the most frequent brain laterality groups of pharmacists are 1, 5 and 9, showing pharmacists least enjoying their work and wearing glasses. The pharmacist enjoying his/her work the least, with an enjoyment value of 1, had a brain laterality group 5 and wore glasses, thus there is a good likelihood that this pharmacist suffers from Seasonal Affective Disorder and depression.

Table 15. Enjoyment level, brain laterality groups and wearing glasses

Enjoyment Level	Brain Laterality Group	Number of Pharmacists n	Wearing Glasses	Not Wearing Glasses	% of Pharmacists per brain laterality group. n/32 = %
4	1	9	5	8	Brian laterality group 1 = 50.0%
4	5	1			Brain laterality group 3 = 6.3%
4	6	1			Brain laterality group 5 = 18.8%
4	11	1			Brain laterality group 6 = 3.1%
4	13	1			Brain laterality group 9 = 9.4%
3	1	4	5	6	Brain laterality group 11 = 6.3%
3	3	1			Brain laterality group 13 = 6.3%
3	5	2			
3	9	3			
3	13	1			
2	1	3	1	6	
2	3	1			
2	5	2			
2	11	1			
1	5	1	1		

Three questions in the questionnaire related to the **wearing of glasses**. The calculations showed that the same number of pharmacists in both countries wore glasses with an average value of 5 (See appendix section E).

In association with the pharmacists' brain laterality, the wearing of glasses or not had no influence on work behaviour or selection of the work environments, verified by the chi-

square calculations (p = 0.1595), and provided the enjoyment level of the pharmacists was above the self-assessed value of 4.

The results demonstrated that there is no statistical difference between different brain laterality groups and where pharmacists **actually worked or preferred to work**, even if these placements were the same or different (p = 0.046).

The research determined an age statistical difference for the pharmacists (p = 0.00292). In this research the age of the pharmacist may have produced a statistical difference between the brain laterality groups, but it was apparent that pharmacists that may have a changed brain laterality, who were over the age of 50, appeared to prefer their existing work environments thus not having a desire to change jobs for a more preferred placement. Changing a job could have taken place particularly over the age of 50 years according to the literature cited by Dargent–Pare et al. (1992), Pare et al. (1992), Jeeves and Moes (1996) and Ofte and Hugdahl (2002). It was hypothesised in this research that pharmacists would have found their preferred placements by the age of 50 years, unless their brain laterality changed as they got older, in which case their actual placements may no longer be the one preferred. Thus the **pharmacists greater than or equal to 50 years and below the age of 50 years** were compared, using the chi-square method, to see if there was a statistical difference between the 16 brain laterality groups of pharmacists changing placements and the similarity or difference between actual and preferred placements. (See Section B of the Calculations in the Appendices).

No statistical difference was found in any of the 16 brain laterality groups for below or ≥ 50 years old, implying that no pharmacists appeared to have a changing brain laterality that would affect their choice of actual or preferred placements. Thus the pharmacists with any brain laterality could work in any preferred or actual job, at any time in their life, with

competence and enjoyment, using the Right Hemisphere Theory. Thus, in this research, the influence of the corpus callosum was not detected from the data.

In the UK pharmacists in their **current job** had worked an average of 7.3 years.

In South Africa pharmacists in their **current job** had worked an average of 9.1 years. Pharmacists working in these current jobs, in both countries, could have any brain laterality group ($p = 0.3348$). There were 12 retired South African pharmacists who were not included in this calculation. Table 16 demonstrates the average time worked as a pharmacist which includes their current job and other work environments. The other work environments include any of the nine work environments chosen for this research.

Pharmacists from the UK and South Africa could belong to any brain laterality group ($p = 0.3085$).

Table 16. Average time worked as a pharmacist in this research sample

Country	Time worked as a pharmacist
United Kingdom	15.1 years
South Africa	24.6 years

Total number of placements worked by UK pharmacists for this UK cohort was 881, four jobs per pharmacist on average. Total number of placements worked by South African pharmacists for this South African cohort was 1183, five jobs per pharmacist on average. There was however no statistical difference between these two countries in any brain laterality group for number of placements worked ($p = 0.3571$).

The data for the figures on percentages of pharmacists working in each work environment are presented below (Figures 1 – 6) and were derived from the current study.

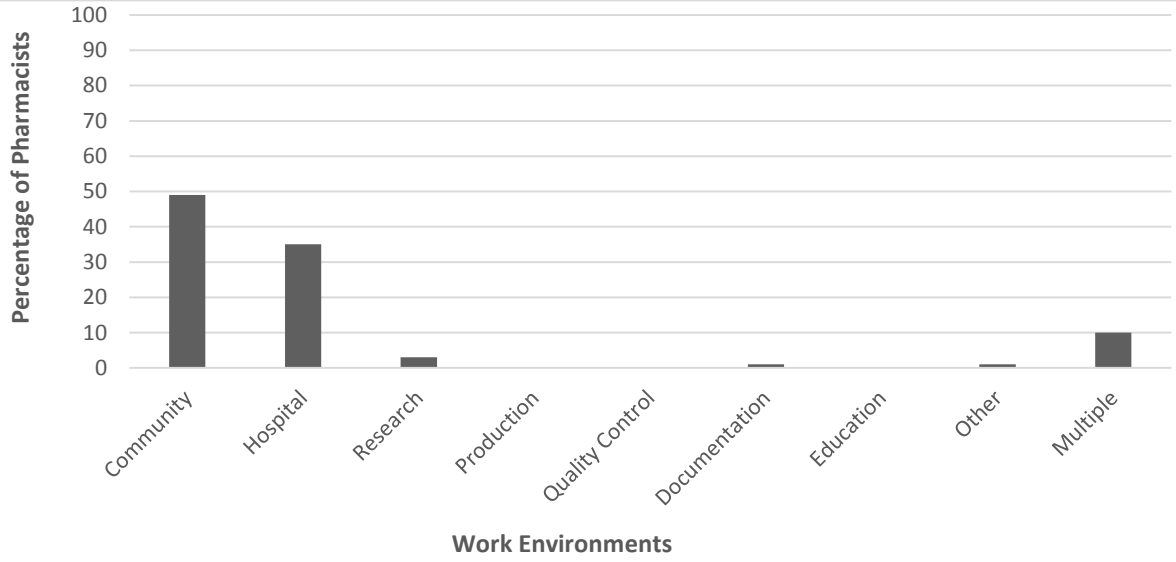


Figure 1. 20 - 39 year old pharmacists in the UK demonstraing the percentage of pharmacists working in each work environment

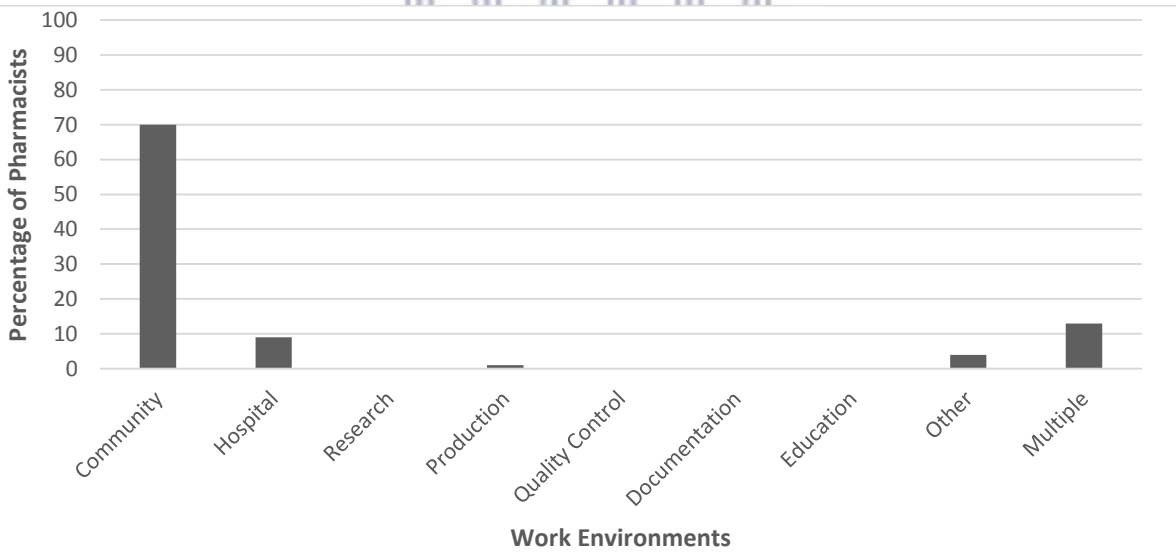


Figure 2. 40-60 year old pharmacists in the UK demonstraing the percentage of pharmacists working in each work environment

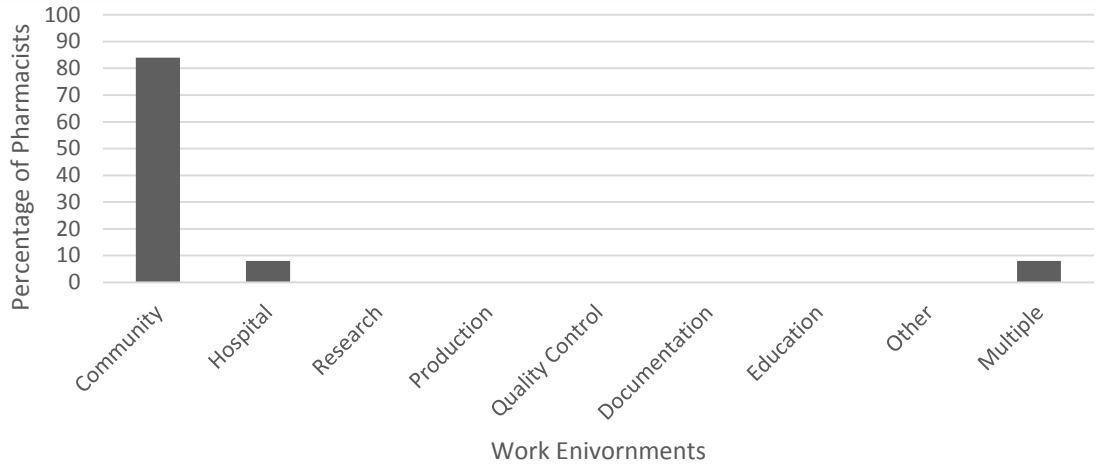


Figure 3. 61-80 year old pharmacists in the UK demonstating the percentage of pharmacists working in each work environment

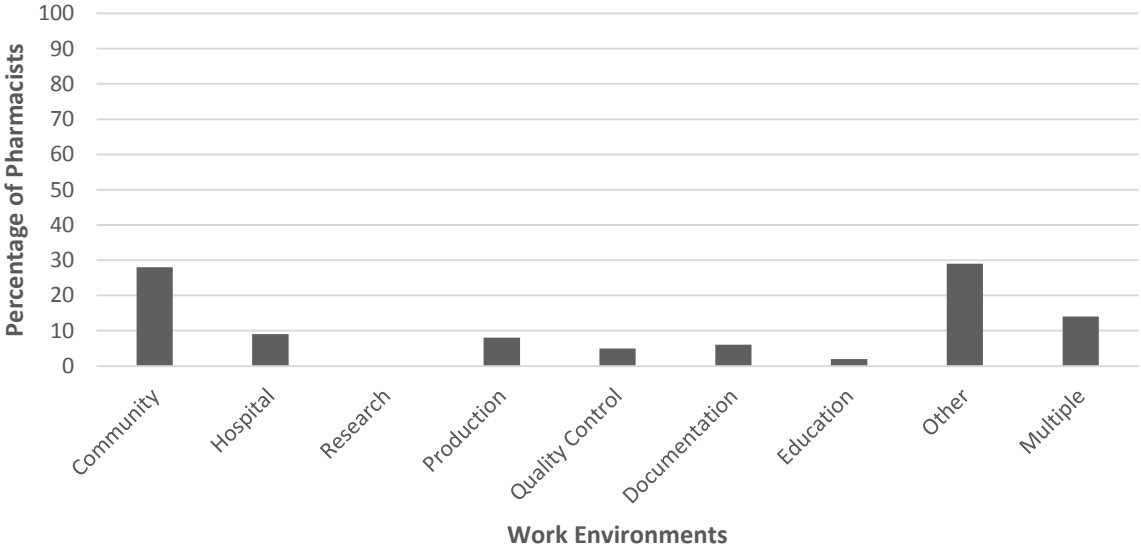


Figure 4. 20 - 39 year old pharmacists in South Africa demonstraing the percentage of pharmacists working in each work environment

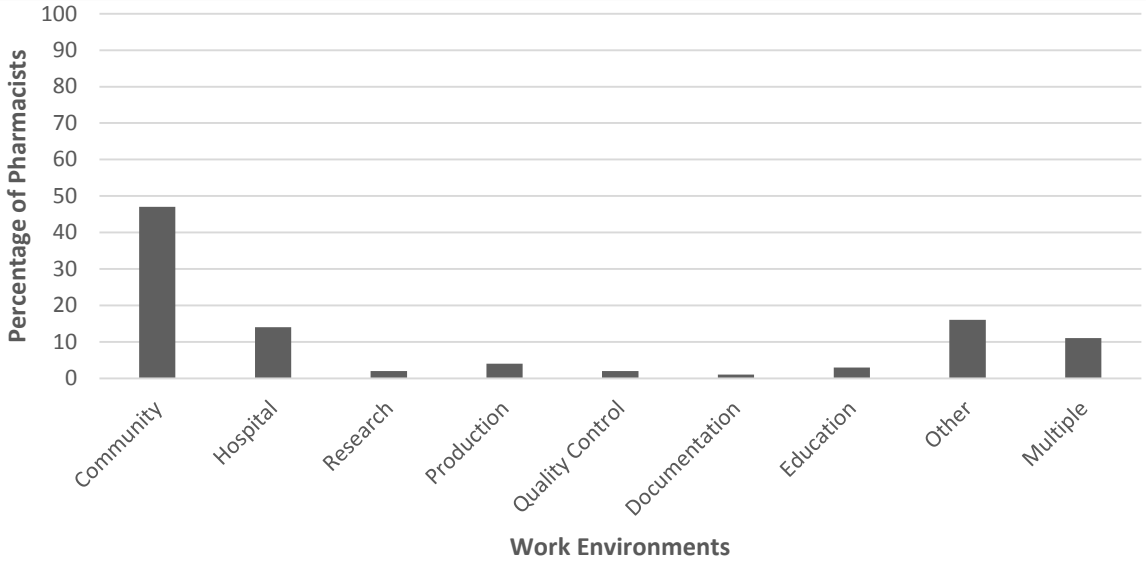


Figure 5. 40 - 60 year old pharmacists in South Africa demonstraing the percentage of pharmacists working in each work environment

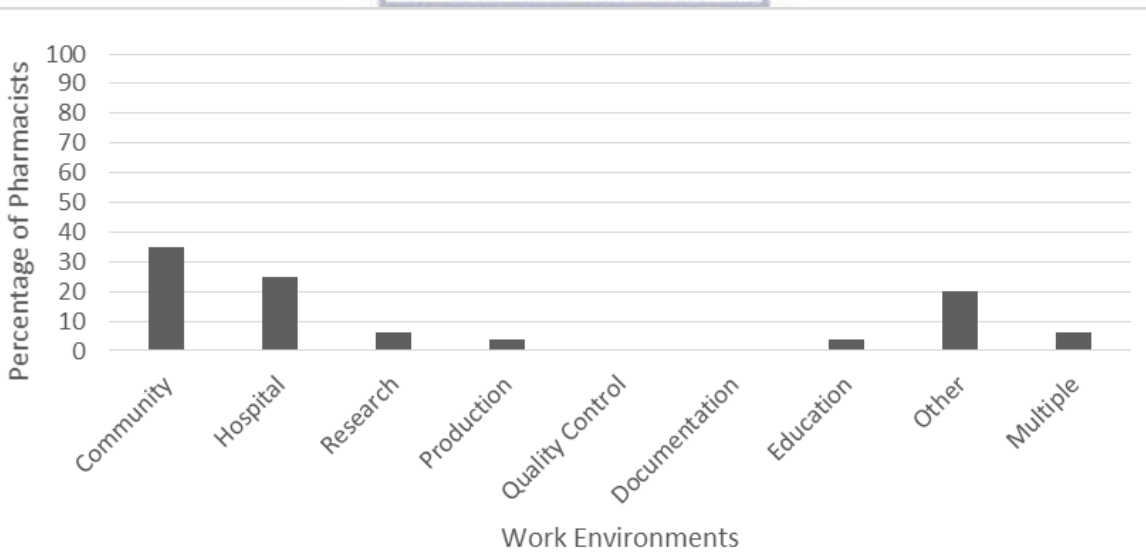


Figure 6. 61-80 year old pharmacists in South Africa demonstating the percentage of pharmacists working in each work environment

It can be seen from Figures 1 and 2 that in the UK there is a substantial **movement of pharmacists**, 49% to 70% respectively, into community pharmacy, from the 20 to 39 year old age group compared to the 40 to 60 year old age group. There is also a decrease in the

percentage of hospital pharmacists, 35% to 9% respectively. Figure 3, the 61 – 80 year group, demonstrates an increase in the percentage of community pharmacy pharmacists from 70% in Figure 2 to 83% in Figure 3. Thus this research demonstrated an increase in desire to work in community pharmacies with increasing age of the pharmacists in the United Kingdom.

There is a similar movement into community pharmacy of the South African pharmacists, demonstrated in Figures 4 and 5, from the 20 to 39 year old age groups compared to the 40 to 60 year old age groups, 28% to 47% respectively, with a slight increase in pharmacists into hospital pharmacy, 9% to 14% respectively, as the pharmacists move into the 40 to 60 year old age groups. Figure 6, the 61 – 80 year group, demonstrates a slight decrease of the community pharmacists with that of figure 5, 47% to 35% respectively, with an increase in hospital pharmacists, 14% to 25% respectively, as well as smaller percentages throughout the work environments maintained with Figure 5. A similar high percentage in the other work environment is observed for Figures 5 and 6 being roughly 20%. Thus there appeared a desired movement towards hospital pharmacy in South Africa with increasing age of the pharmacists. The South African pharmacists also worked in a greater variety of work environments than the United Kingdom pharmacists in the age group 61 – 80 years old.

Counting the number of nominal 2 values to the question on speed of doing work, to determine the **Type A personalities**, gave the following results:

In the UK, 137 Type As, (54%)

In South Africa, 141 Type As, (55%)

More than half the pharmacists in the UK and South Africa are stressed in their work environments since stress is part of the Type A personality behaviour.

Type A personality pharmacists could be found in any brain laterality group due to the Null Hypothesis not being rejected ($p = 0.4417$).

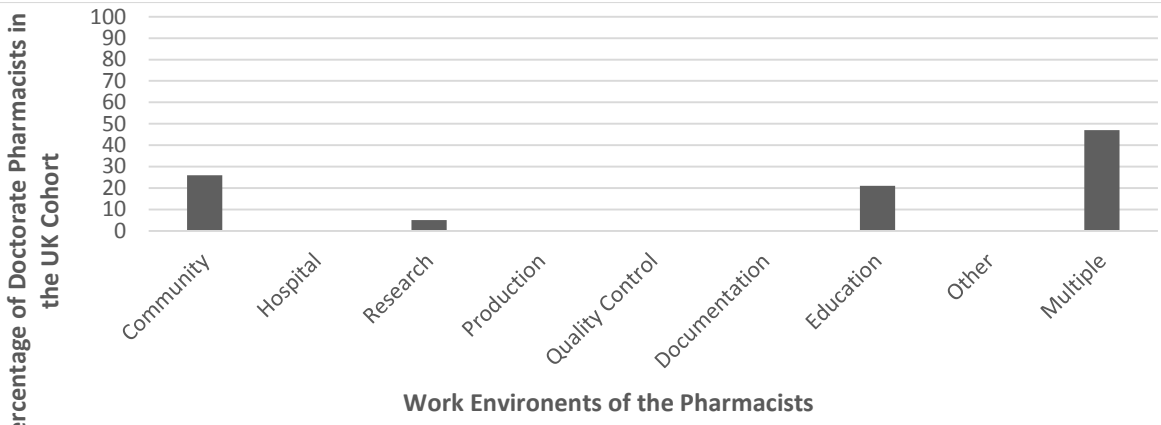


Figure 7. Percentage of UK Doctorate Pharmacists per actual work environent

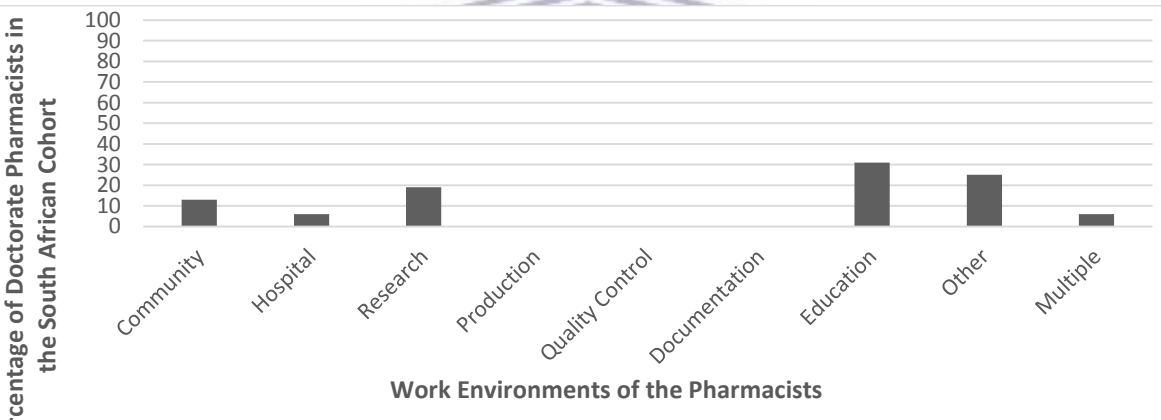


Figure 8. Percentage of South African Doctorate Pharmacists per actual work environment

Data for Figures 7 and 8 were obtained from the current study.

It can be seen from Figure 7 that pharmacists who worked in multiple environments in the UK had the most **doctorate degrees** (47%), however, these pharmacists tended to work in both research and education environments. In contrast, 26% work in community pharmacies.

Figure 8 shows that pharmacists in South Africa with doctorates are found in a more scattered variation of work environments than in the UK.

7.5% of the UK cohort had a doctorate compared to 6.3% in the South African cohort, giving a total of 6.9% across the entire population of pharmacists in the current study. It was determined that any of the pharmacists with any of the 16 brain laterality groups could have a doctorate, masters, bachelor degree or a diploma in pharmacy ($p = 0.4339$) and these pharmacists with any of the brain laterality groups could also achieve any of the pharmacy qualifications ($p = 0.2895$).

According to chi-square calculations demonstrated in the Appendices, any of the 16 brain laterality groups of pharmacists could **own a community pharmacy** ($p = 0.2045$) and one third of diploma pharmacists in both countries did own a community pharmacy. 1% of UK pharmacists and 28% of South African pharmacists had a diploma in pharmacy.

Table 17 Data from the 16 variables other than brain laterality

Other than brain laterality data			
Variable	**United Kingdom**	**South Africa**	**Average**
Age ranges	4 (33%)	6 (50%)	42%
Gender, females	151 (59%)	153 (60%)	60%
< 10 years work			
Wearing of glasses	126 (49%)	106 (42%)	46%
Number of jobs	682 (3)	1183 (5)	4
Enjoyment	7.4 (74%)	7.6 (76%)	8 (80%)
Self – assessed and averaged			
Preventing GW	177 (69%)	220 (86%)	78%
GW affecting drug supply	186 (73%)	211 (83%)	78%
Type A or B Personality	137 (54%)	141 (55%)	54.5%

Regarding the age ranges in Table 17 there were 6 age ranges obtained in South Africa and 4 age ranges obtained in the United Kingdom. Thus there was a greater number of older pharmacists in the South African sample compared to the United Kingdom sample.

Table 17 further demonstrates the reliability of this research as if the results in South Africa and the United Kingdom are similar the questionnaire was reliable. Similarity of results is demonstrated in Table 17 by there being equal numbers of female pharmacists in both countries as well as similar percentages of pharmacists wearing glasses continuously and the pharmacists in both countries also had the same high enjoyment level of 8. Further there was similarity demonstrated in Table 17 in the percentage of pharmacists (54.5%) that potentially could be a Type A personality in both countries strengthening the reliability of this research.

The South African pharmacists demonstrated in Table 17 had more jobs than the United Kingdom pharmacists possibly due to the South African pharmacists being on average older.

The two global warming questions results portrayed in Table 17 demonstrated the South African pharmacists to be more enthusiastic towards global warming than the United Kingdom pharmacists. The global warming questions were also used to determine positive and negative emotion of the pharmacists which makes these two global warming questions strongly related to objective 5 demonstrating validity of this research.

5.2.3 Objective 3: To create a new continuum of brain laterality to determine a Pharmacist's brain laterality accurately and determine correlation to a simpler brain laterality determination to be used in the current research.

5.2.3.1 Overview

The third objective involved the intra-investigation of the variable brain laterality, to determine the correlation between a simple determination of brain laterality and a more accurate, literature based, longer determination of brain laterality.

Two sections in the questionnaire were used in investigating objective 3. Section B represented the simpler approach to determining a pharmacist's brain laterality, with only 4

questions which produced the 16 brain laterality groups. Section C represented the more accurate means of determining a pharmacist's brain laterality, where 13 questions from Coren et al. (1979) were asked. This created the continuum of brain laterality with a range of -13 to +13.

5.2.3.2 Results

A significant correlation existed between the continuum and lateral 4, as demonstrated in Section A of the Calculation section in the Appendix, where the Spearman correlation (SC) test gave a value of $r = 0.72$ where $p < 0.0001$. A correlation between the 4 and 13 questions was expected but not as strong as 72%. The Null Hypothesis was not rejected in the research, thus the newly-designed continuum could not be used to its full potential to determine work area ranges for specific brain laterality groups. Thus any pharmacy placement could be found anywhere on the continuum.

5.2.4 Objective 4: To analyse the validity of the Propinquity Principle regarding enthusiasm to formally enter the research by returning the completed questionnaire.

5.2.4.1 Overview

Objective 4 focused on analysing the validity of the Propinquity Principle, regarding enthusiasm to formally enter the research, by returning the completed questionnaire. According to Reber et al. (2009) the Propinquity Principle is involved with physical proximity. The only question in the questionnaire related to objective 4 is question 14 in Section A enquiring if the pharmacist lives in the UK or South Africa.

5.2.4.2 Results

Although 255 reply questionnaires were obtained in the UK, the same as in South Africa, responses were harder to obtain. To test the Propinquity Principle in South Africa, on the reply envelopes the different stamps were manipulated to determine respondents from Cape Town and Johannesburg. Twice as many Cape Town pharmacists replied, compared to

the Johannesburg pharmacists. (28 vs 14 respondents respectively from 200 dispatched questionnaires, where 100 questionnaires were dispatched to each area).

In South Africa a total of 853 questionnaires were posted and yielded a response of 28% through this method. An additional 200 pharmacists were sent the questionnaire by electronic format via email, to obtain the remaining required respondents. The electronic method yielded 9% response. The postal method was more successful than the email method, but much slower as replies by post took up to two months.

In the UK four methods were used to obtain the required 255 completed questionnaires: snowballing, postal, email and convenience sampling in London.

Snowballing obtained 98% response rate.

Postal obtained 30.6% response rate.

Email obtained 10% response rate.

Convenience sampling obtained 97% response rate.

The most effective and cost-effective method in the UK was the snowballing method, which resulted in a response rate of 46% of the total UK reply questionnaires.

5.2.5 Objective 5: To explore the degree of correctness between the Right Hemisphere Theory and the Valence Theory regarding a brain laterality investigation using the data on global warming, as this control of emotion may place pharmacists into their best environments using the brain function of emotion only.

5.2.5.1 Overview

The questions related to objective 5 were the four questions involving the brain laterality group in Section B and the two global warming questions in Section D.

The brain function of emotion only may be able to place pharmacists into their ideal work environment. A matching of the positive or negative emotion generated by the

pharmacist with the positive or negative emotion required by the work environment may achieve this ideal work environment.

The longer a pharmacist has worked in a particular work environment the more suited their brain laterality would be to that work. Over 10 years was taken to be ideally suitable to that work (Hall, 1982; Stevens, 2005).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
P	81	67	63	50	82	63	33	75	78	78	100	71	79	90	33	75
A	81	83	100	50	80	63	66	75	70	78	80	57	74	90	67	80

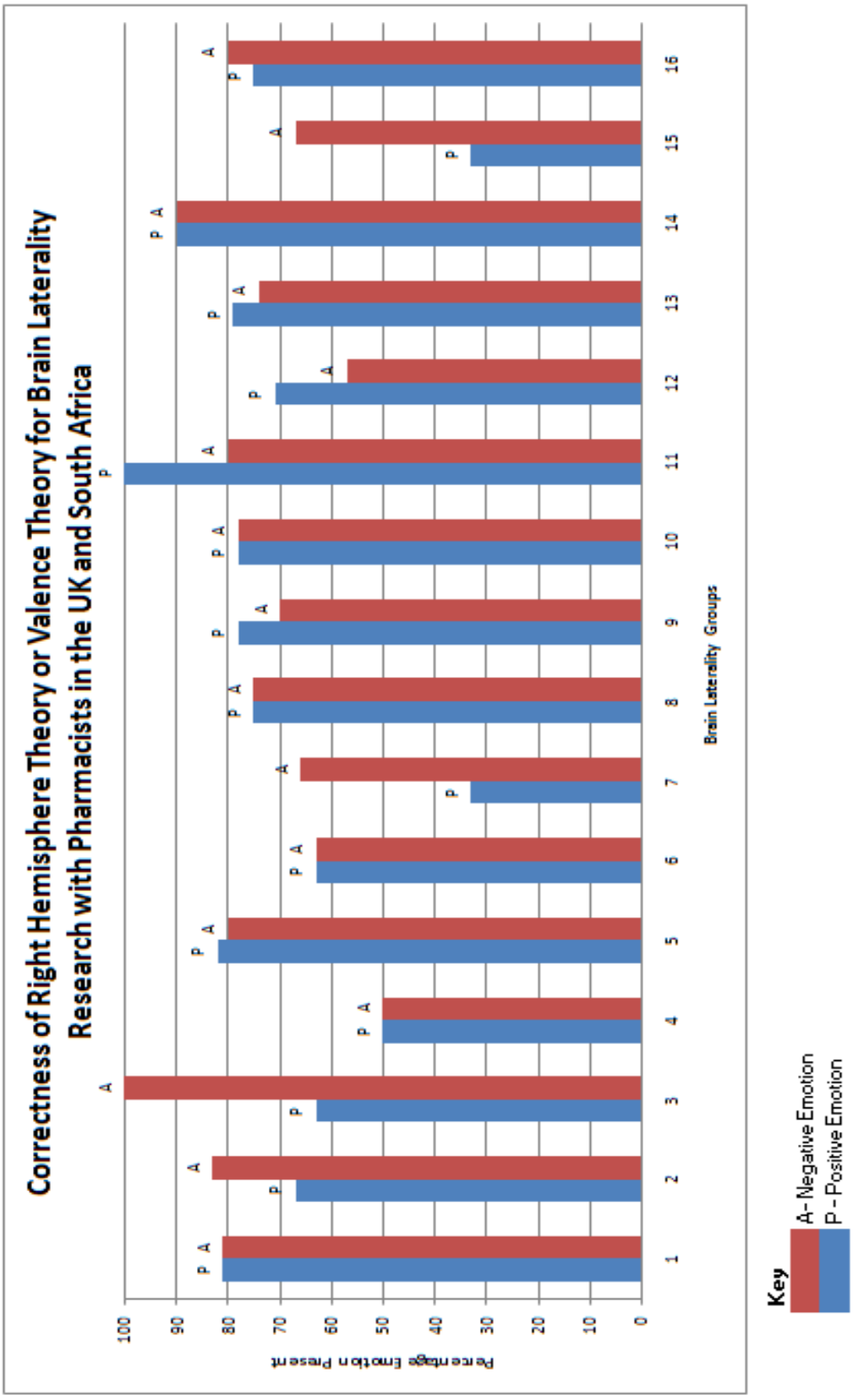


Figure 9 Correctness of the Right Hemisphere Theory or Valence Theory for Brain Laterality Research with Pharmacists in the UK and South Africa

5.2.5.2 Results

This section cites objective 5 and gives an overview and figure 9 above pertaining to this objective. The influence of Figure 9 deals with the following: sequencing of the brain laterality groups, reliability and validity assessments of emotion, discussing negative and positive emotion, the influence of each brain laterality group, ear dominance on emotion generation, emotion and 10 years work placing pharmacists, major brain laterality groups per work area after 10 years, major brain laterality groups of pharmacists working longer than 10 years, and enjoyment levels in the selected Valence Theory brain laterality groups.

5.2.5.2.1 Ear, eye, hand and foot dominance and sequencing in the brain laterality groups

The sequencing in each brain laterality group was ear, eye, hand and foot to determine dominance. What follows gives an indication of the dominance where R = right and L = left in the order of ear, eye, hand and foot for each brain laterality group in Figure 9 and throughout the research.

RRRR = 1; RRRL = 2; RRLR = 3; RRLL = 4;

RLRR = 5; RLRL = 6; RLLR = 7; RLLL = 8;

LRRR = 9; LRRL = 10; LRLR = 11; LRLL = 12;

LLRR = 13; LLRL = 14; LLLR = 15; LLLL = 16.

5.2.5.2.2 Reliability and validity assessment of positive and negative emotions

To determine the reliability of Figure 9 the first set of eight brain laterality groups were compared to the second set of eight brain laterality groups (internal consistency). The first set of eight brain laterality groups all had a right ear dominance and the second set of eight brain laterality groups all had a left ear dominance. Average values for emotion were

calculated and demonstrated in Table 18. Figure 9 is all about the dominant ear influencing the associated emotional site in the brain.

Table 18 Reliability and validity for emotion

	First set of eight in Fig. 9	Second set of eight in Fig. 9
	Right ear dominant	Left ear dominant
Positive emotion	64 (64.25) % emotion	76 (75.5) % emotion
Negative emotion	75 (74.75) % emotion	75 (74.5) % emotion
Average	70 (69.5) % emotion	75 (75.0) % emotion

A similarity of positive and negative emotional average values between the first and second sets in Table 18 demonstrates reliability of emotion being assessed from the two global warming questions. This reliability was thus determined using internal consistency (Cohen et al., 2004) between the right ear dominant and left ear dominant brain laterality groups.

The extent to which emotion is associated to the ear measures validity. Validity is thus determined by the extent of the dominant ear being associated to the contralateral emotional site in the brain which is supported in the literature by Helton et al. (2009) validating Figure 9. Thus a content type of validity is used (Cohen et al., 2004). Apart from the literature (Helton et al., 2009) supporting validity, Table 18 demonstrates a high percentage of positive (70%) and negative (75%) emotion generated by both the right and left ears which confirms validity.

5.2.5.2.3 Negative and positive emotion

The A value in Figure 9 stands for pharmacists stating that global warming would affect the future drug supply, thus determining negative emotion. The P value in Figure 9

stands for pharmacists stating that pharmacists should get involved in preventing global warming. This is proactive, thus demonstrating a positive emotional approach to global warming.

The brain laterality groups with right hemisphere dominance would be expected to have the greatest P and A values, assuming the Right Hemisphere Theory to be correct. This is clearly not the case when observing Figure 9. Brain laterality group 1, which is extremely left hemisphere dominant, has high P and A values of emotion, and brain laterality group 16, which is extremely right hemisphere dominant, also has high P and A emotional values. This means that the Valence Theory could be more appropriate when researching brain laterality, supported by Parr and Hopkins (2000).

For the Valence Theory to be more correct than the Right Hemisphere Theory, the P and A emotional values on Figure 9 would have to demonstrate a greater than 50% emotional value in all 16 brain laterality groups, which is almost the case in this study. A greater than 50% value would demonstrate a more than 50% probability that there was a positive emotional site in the left hemisphere of the brain, and a negative emotional site in the right hemisphere of the brain.

5.2.5.2.4 Influence of each brain laterality group

Brain laterality group 1, RRRR, is thus extremely left hemisphere dominant and generated equal positive and negative emotion.

Brain laterality group 2, RRRL, generated a greater negative emotion than positive emotion.

Brain laterality group 3, RRLR, generated a large amount of negative emotion due to these pharmacists being left handed.

Brain laterality group 4, RRLL, with equal positive and negative emotional values and with the lowest level of emotion generated amongst all the groups.

Brain laterality group 5, RLRR, with about equal amounts of positive and negative emotion, demonstrating that the dominance of the eye had little influence on emotional levels, but created more emotion than group 4.

Brain laterality group 6, RLRL, with equal positive and negative emotion, having the second lowest level of emotion, with the influence of the left foot dominance over brain laterality group 5 reducing the total emotion, both positive and negative.

Brain laterality group 7, RLLR, with a large negative emotion generated, due to the presence of left hand dominance, demonstrating a strong right hemisphere dominance.

Brain laterality group 8, RLLL, with equal positive and negative emotion generated.

Brain laterality group 9, LRRR, which created greater positive emotion than negative emotion.

Brain laterality group 10, LRRL, demonstrated equal positive and negative emotion, similar to brain laterality group 8.

Brain laterality group 11, LRLR, with more positive emotion than negative emotion and more emotion than brain laterality group 10.

Brain laterality group 12, LRLL, with more positive emotion than negative emotion and less emotion generated than brain laterality group 9.

Brain laterality group 13, LLRR, with only a slight positive emotion dominance over the negative emotion.

Brain laterality group 14, LLRL, the largest generating emotional brain laterality group, with an equal positive and negative emotional generation.

Brain laterality group 15, LLLR, with a large negative emotional level compared to the positive emotional level of brain laterality group 12.

Brain laterality group 16, LLLL, with a slight negative emotional increase over the positive emotional generation.

5.2.5.2.5 Influence of ear dominance on emotion generation

Up to and including brain laterality group 8 and also groups 15 and 16, the A emotional level appears to be greater than the P emotional level. Groups 9 to 14 appear to have P emotion levels greater than the A emotional levels.

The ear and hand dominance can be seen to produce the greatest emotional difference between the P and A values, within each brain laterality group. When the left ear is dominant it created a P emotional level dominance over the A emotional level dominance, except with brain laterality groups 15 and 16, where extreme right hemisphere dominance produced a greater negative emotion than positive emotion. The reason for brain laterality groups 3 and 7 demonstrating a greater negative emotional level than a positive level is due to the left hand dominance being introduced in each of these groups, introducing the right hemisphere to a greater extent, where the control of negative emotion is situated.

In addition, the switching off of the left hemisphere positive emotion controlling site by the dominant right ear, in brain laterality groups 3 and 7, allowed the influence of the negative emotion of the recessive right hemisphere to dominate. Brain laterality group 2 only had the influence of the left foot dominance to introduce the right hemisphere for an appearance of negative emotion, as well as the influence of the right dominant ear stopping the influence of the positive emotion controlling site. In brain laterality groups 9 to 13, with a greater positive emotion than any other brain laterality group there was an increase in positive emotion due to the introduction of the dominant left ear, which switches off the right hemisphere of the brain, where the site for controlling negative emotion is found, allowing the positive emotion to be generated from the recessive left hemisphere of the brain.

The ear and hand were the most influential (McManus, 2002) on the generation of the pharmacist's positive or negative emotion, with smaller influences from the dominant eye and foot (Helton et al., 2009).

5.2.5.2.6 Placing of pharmacists in their ideal work environments, using emotionality of brain laterality groups, incorporating 10 years work in their current work environments.

It was determined that 32% (161 pharmacists) of the entire cohort had worked over 10 years in their current work environments, thus demonstrating that these pharmacists were ideally suited, by virtue of time spent in those environments (Stevens, 2005). There were nine work areas in this research, and Table 19 demonstrates the number of pharmacists in each brain laterality group expressed as a percentage, working in each work area, for longer than 10 years.

Table 19 Work environments and brain laterality groups of pharmacists after 10 years work

Work environments	Brain laterality groups	Number of pharmacists per 161 total (n)	Percentage (%)
1 Community	1	44	27
	2	0	0
	3	4	3
	4	2	1
	5	10	6
	6	1	0.6
	7	2	1
	8	1	0.6
	9	14	9
	10	1	0.6
	11	1	0.6
	12	1	0.6
	13	10	6
	14	4	3
	15	3	2
	16	2	1

2 Hospital	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16	8 1 0 0 1 0 0 0 5 1 0 0 2 1 0 0	5 0.6 0 0 0.6 0 0 0 3 0.6 0 0 1 0.6 0 0
3 Research	1	1	0.6
4 Production	1 6 10 13	1 2 1 1	0.6 1 0.6 0.6
5 Quality Control	13	1	0.6
6 Documentation	none	0	0
7 Education	1 13	3 2	2 1
8 Other	1 4 5 7 9 13 14 16	3 1 5 1 1 2 1 1	2 0.6 3 0.6 0.6 1 0.6 0.6
9 Multiple work areas	1 2 5 9 12 14 16	5 1 2 2 1 1 3	3 0.6 1 1 0.6 0.6 2
TOTAL		161	98.2 + 1.8 = 100%

The error in the percentage value is due to the rounding off the 1.2% values to 1%

(9 x 0.2 = 1.8%).

From Table 19 it can be seen that brain laterality groups 1, six, nine and 13 were ideal for community pharmacies for 10 years or more with percentages of 27, six, nine, and six respectively being the highest percentages for this work area. With these brain laterality groups, emotion appears to be equal regarding positive and negative generation of emotions (shown in Figure 9). Thus it appears that equal emotional generation of positive and negative emotion would be best for community pharmacies. Similarly, brain laterality groups 1 and 9 were inferred to be the most competent in hospital pharmacies after 10 years work, with percentages five and three respectively. Thus equal emotional generation of positive and negative emotion would also be best for hospital pharmacies. For the work environment of research the best inferred brain laterality group was group 1, with a low percentage (0.6%) of pharmacists having worked longer than 10 years. Equal positive and negative emotion generation of brain laterality group 1 appeared to be ideal for research. With the production work environment, the brain laterality group 6 stood out, where positive and negative emotion are equal but had the lowest emotional generation of the brain laterality groups. The low generation of emotion is ideal for pharmacists in production, where there are fewer interpersonal interactions, than in for example community pharmacies.

Regarding the quality control work environment, brain laterality group 13 remaining after 10 years work had a low percentage of 0.6% and had a slight positive emotional bias generated by the pharmacists.

None of the brain laterality groups were found involved with documentation after 10 years of work, possibly due to the small cohort.

Regarding pharmaceutical work in education, brain laterality groups 1 (2%) and 13 (1%) remained in that environment after 10 years of work. Pharmacists with equal amounts

of negative and positive emotion, as well as those with a positive biased emotional generation, would feel competent in an education environment.

Pharmacists working in the other work environments to those mentioned above had the major brain laterality groups 1 (2%) and 5 (3%). Here brain laterality group 5 had a bias towards positive emotion as shown in Figure 9.

Pharmacists that worked in many different work environments, for 10 years or longer, had the highest percentages with brain laterality groups 1 (3%) and 16 (2%). Possibly negative emotion created an uncertainty as to which particular work environment to work in for brain laterality group 16. It appeared that brain laterality group 1 could work in most work environments, with an equal emotional generating bias, for longer than 10 years, maybe due to an adaptation to the work emotional requirements. Where a positive emotion is required the brain laterality of group 1 pharmacists generated this emotion, and where a negative emotion is required the pharmacists in group 1 generated this emotion. This may be the case with all the equal generating brain laterality groups of pharmacists.

5.2.5.2.7 The major brain laterality groups of pharmacists per work area after 10 years work

From Table 19 above, the major two brain laterality groups of pharmacists were extracted per work environment, as shown in Table 20.

Table 20 Assessing brain laterality dominance after 10 years work per work area

Work environment	Brain Laterality Group	Percentage
Community	1 9	27 9
Hospital	1 9	5 3
Research	1	0.6
Production	6	1
Quality Control	13	0.6
Documentation	None	0
Education	1 13	2 1
Other	1	1

	5	3
Multiple work areas	1 16	3 2

The conclusions derived from Table 20 are critical to this study and are summarised as follows:

From an emotional point of view, brain laterality group 1 appeared to be able to work in most work environments.

Brain laterality group 5 emotionally appeared to be able to work in other environments.

Brain laterality group 6 emotionally appeared to be suited to work in production.

Brain laterality group 9 emotionally appeared to be suited to work in community and hospital pharmacies.

Brain laterality group 13 emotionally appeared to be suited to work in quality control and education.

Brain laterality group 16 emotionally appeared to be suited to work in multiple work areas.

Only six brain laterality groups of pharmacists were working in the pharmacy profession after 10 years, in their current placements, for this cohort of pharmacists. This could mean that these brain laterality groups of pharmacists would be the best to work in the pharmacy profession (Stevens, 2005).

5.2.5.2.8 Major brain laterality groups and percentages of pharmacists working longer than 10 years

The major brain laterality groups working longer than 10 years were:-

1 = RRRR 38.6%.

5 = RLRR 4%.

6 = RLRL 1%.

9 = LRRR 12%.

13 = LLRR 1.6%.

16 = LLLL 2%

There were no left handers other than the 2% with brain laterality group 16. This group however did not generate a stable work environment by virtue of being involved in multiple work areas over 10 years. 43.6% of the pharmacists were right ear dominant and 15.6% were left ear dominant. The left ear dominant pharmacists could ideally work in community, hospital, quality control, education and multiple environments. The right ear dominant pharmacists could ideally work in community, hospital, research, education, other and multiple work environments. Brain laterality groups 6 and 16 were the only ones to have left-footed pharmacists who would ideally work in production or multiple environments respectively. Brain laterality groups 5, 6, 13 and 16, where the left eye was dominant, could ideally work in other areas (none of the work environments investigated in this study), production, education and multiple work environments.

5.2.5.2.9 Enjoyment levels incorporating the Valence Theory selected brain laterality groups

What follows are Figures 10 and 11 portraying the enjoyment levels of pharmacists in the UK and South Africa. Investigating the Valence Theory selected brain laterality groups 1, 5, 6, 9 and 13 enquiring if there was a greater enjoyment level than the other brain laterality groups. Regarding brain laterality group 16 pharmacists, selected by the Valence Theory, the average enjoyment level in the UK

was 8.3. There were however no South African pharmacists in brain laterality group 16 selected by the Valence Theory.

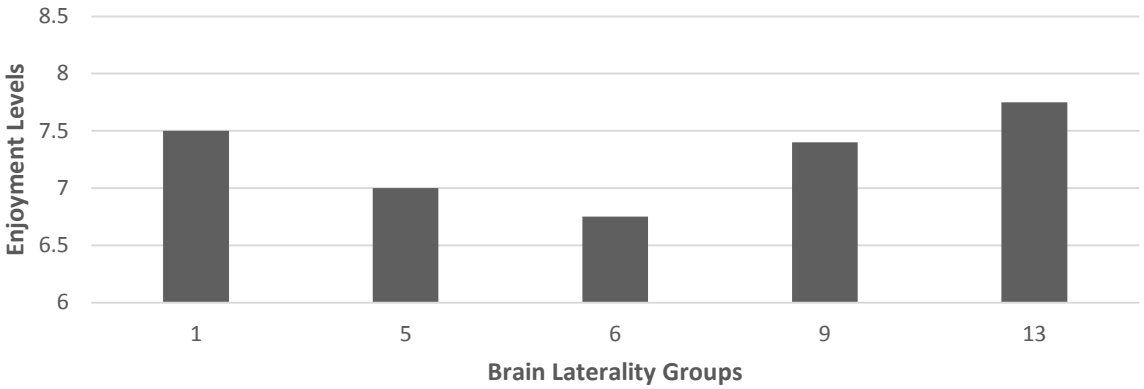


Figure 10. Enjoyment levels compared to Valence Theory selected brain laterality groups of UK Pharmacists

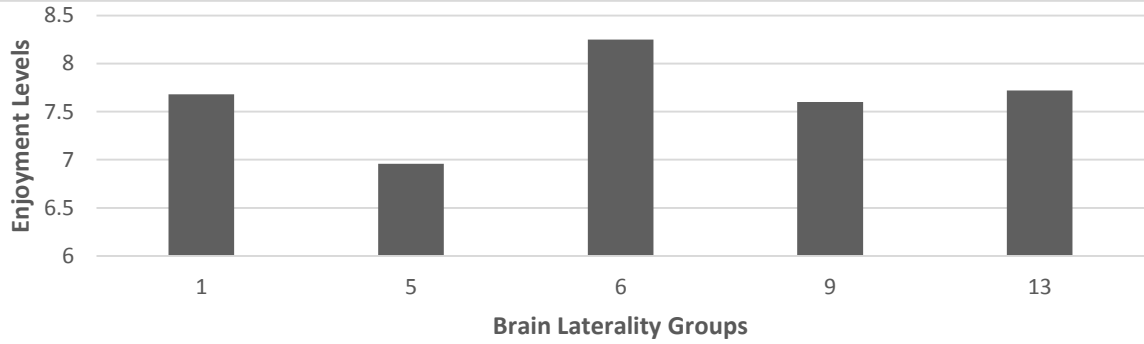


Figure 11. Enjoyment levels compared to Valence Theory selected brain laterality groups of South African Pharmacists

From Figure 10 and Figure 11 the enjoyment level appeared to be the same as the average of 8 determined in objective 2. The enjoyment level of the pharmacists, for the six brain laterality groups, selected by the Valence Theory, may have been expected to be higher than the average value of 8 out of 10, since these are the ideal brain laterality groups to work for the pharmacy profession in specific placements. Conclusions here could point to the

sample size of the six brain laterality groups of pharmacists not being large enough or the self-assessment method used to assess the enjoyment level of the pharmacists may not have been accurate enough.

5.3 Summary of chapter

Chapter 5 put forward the results of the five objectives of this study.

From objective 1, the major finding was that the Null Hypothesis was not rejected, adopting the Right Hemisphere Theory, which thus concluded that a pharmacist with any brain laterality group could work in any work environment with confidence and competence.

Regarding objective 2, only the age of the pharmacist reductionistic variable rejected the Null Hypothesis. This showed that as pharmacists got older their brain laterality may change which could be due to a decreasing functioning corpus callosum, which could in turn influence the pharmacist's job choice. Further salient findings in objective 2 include the wearing of glasses continually which may induce depression in SAD sufferers and would influence job choice; amblyopia due to interpersonal difficulties would affect job choice; having a doctorate degree would encourage enthusiasm for their placement or the desire for a placement may give rise to doing a PhD; male and female pharmacists could work in any environment successfully; most pharmacists worked in and enjoyed their preferred environments; South African female pharmacists were the most concerned with global warming.

Objective 3 was involved with a newly-designed accurate brain laterality determining continuum which proved successful in correlation to a simpler method of determining brain laterality, but did not isolate ideal jobs due to the Null hypothesis not being rejected.

The Propinquity Principle, objective 4, proved to be correct, thus responses further away from the research university in Cape Town proved more difficult to obtain.

Objective 5 used the global warming questions to successfully determine the pharmacist's emotional bias. Observing this emotional bias, within the 16 brain laterality groups, determined that the Valence Theory was more correct than the Right Hemisphere Theory and that pharmacists could be matched to their ideal work environments by using emotional generation of the pharmacists and emotional requirement of the placements. After 10 years work in the same environment, using the Valence Theory, six brain laterality groups proved dominant for the pharmacy profession.

Salient findings from this study include: (i) The ear and hand dominance proved stronger determinants for brain laterality than the eye and foot dominance. (ii) A new finding was demonstrated where the dominant ear inhibited its associated emotional site in the brain allowing the recessive emotional site to dominate.

CHAPTER 6: DISCUSSION OF FINDINGS AND CONCLUSIONS

6.1 Introduction and overview

The final chapter consolidates the findings. It also puts forward the importance of ear and hand dominance in emotion generation and how the Valence Theory (VT) is associated with pharmacists having worked longer than 10 years. The following are the key aspects of this chapter: research direction; major findings associated with the research; theoretical implications; policy implications; recommendations for future research, and the concluding statement.

6.2 Research direction

The study set out to explore the role of brain laterality of pharmacists being matched to their ideal interactive environments. Further reductionistic variables were also investigated for their influence on placing pharmacists into their ideal interactive environments, both by themselves, and, in conjunction with each other and brain laterality. The general theoretical literature on these directions was inconclusive, thus necessitating investigation for the enhancement of the pharmacy profession.

6.3 Major findings associated with the research

This section investigates the findings of this research under the following headings: Right Hemisphere Theory vs Valence Theory, brain laterality changing with age, a new continuum for brain laterality determination, Propinquity Principle, wearing of glasses, amblyopia, Type A and Type B influences, education, owning a community pharmacy, gender, global warming, enjoyment levels, corpus callosum functioning, emotional determination with resulting implications, number of jobs, inter-hemispheric interaction,

striving for multiple work environments, limitations and strengths, theoretical implications, policy implications, and recommendations for follow-up studies. A summary statement is articulated.

6.3.1 Right Hemisphere Theory vs Valence Theory

Pharmacists could not be placed into their ideal work environments using the Right Hemisphere Theory as the Null Hypothesis was not rejected. To rationalise objective 1, it had to be assumed that the Right Hemisphere Theory would be appropriate for this research, on the strength of information regarding amblyopia, hemiplegia and the WADA test. These literature investigations may not, however, have been reliable due to the small sample size of the studies. Both sides of the brain may be damaged in amblyopia and hemiplegia, where it was assumed that only one side of the brain was damaged. In addition, with the WADA test, the drug used, amylobarbitone, may have crossed both sides of the brain where it was expected to sedate only one brain hemisphere (Uijl et al., 2009). These influences were however ignored, as they were hypothesised to be too small to impact the results; thus the Right Hemisphere Theory (RHT) was assumed to be correct for objective 1.

Although the Null Hypothesis was not rejected for objective 1, it is important to note that the sample data regarding brain laterality was not static, similarly mentioned in the literature (Dargent-Pare et al., 1992). This could mean that if the same sample was to be assessed again at some time in the future, or indeed if a different sample were assessed, the results may not be the same, and therefore one cannot know if the Null Hypothesis would or would not be rejected in future research.

The Valence Theory did, however, find brain laterality groups that were ideally suited to specific work environments. Thus future brain laterality research should use the Valence Theory as the main theoretical framework rather than the Right Hemisphere Theory. The

results demonstrated that the emotion generated by brain laterality group 1 (RRRR) pharmacists was large and equivalent to brain laterality group 16 (LLLL) pharmacists in magnitude. If emotion generation was only generated in the right hemisphere of the brain, according to the RHT, then the emotion generated in brain laterality group 1 pharmacists should have been very small, as the only emotion found would have come across the corpus callosum from the right hemisphere. This was clearly not the case, with the large amount of emotion generated by brain laterality group 1 pharmacists demonstrating the validity of the Valence Theory. The Valence Theory could thus place pharmacists into their ideal work environments according to the pharmacists' emotional generation and the required emotional input of the work environments. Where pharmacists had worked 10 years or longer in their current environments, the Valence Theory supported only six brain laterality groups of pharmacists out of 16. These six groups were the major brain laterality groups of pharmacists for the pharmacy profession, and demonstrated which work environments best suited these selected six brain laterality groups. No left handers were included in five of the selected brain laterality groups of pharmacists, other than group 16, possibly due to being accident-prone or having a large negative emotion output. The negative emotion generated by group 16 pharmacists could be the cause of working in multiple environments for over 10 years. The ideal selected brain laterality groups of pharmacists in this research, according to the Valence Theory, were groups 1(RRRR), 5(RLRR), 6(RLRL), 9(LRRR), 13(LLRR) and 16(LLLL).

Brain laterality group 1 pharmacists were ideal for community pharmacy, hospital, research, education, other and multiple work areas. This group appeared to have the largest range of placements, possibly due to being the largest cohort of these five brain laterality groups, or the ability to work in these areas due to equal generation of positive and negative emotion allowing plasticity (where plasticity allows positive or negative emotion to be generated where needed) for work environments.

Brain laterality group 5 pharmacists were ideal for other work areas, possibly due to being left eye dominant and producing slightly more positive emotion, making them more enthusiastic yet unsure where exactly in the pharmacy profession would be best for them to work.

Brain laterality group 6 pharmacists were ideal for production work areas due to having a low emotional generation as these work areas do not require many emotional interactions.

Brain laterality group 9 pharmacists were ideal for community pharmacy and hospital work areas due to having a large emotional generation with a positive bias. This emotional bias would suit working with patients giving them motivation to improve.

Brain laterality group 13 pharmacists were ideal for quality control and education work areas due to being emotionally analytical with a large positive emotion generation having the left ear and left eye dominant.

Brain laterality group 16 pharmacists were ideal for multiple environments with a negative emotion generation; this negativity may have been responsible for the pharmacists moving between many placements concurrently, due to uncertainty of which specific work environment to work in.

These six ideal brain laterality groups of pharmacists appeared to consist of either positive emotion generation or equal positive and negative generation with only group 16 pharmacists generating negative emotion. The equal positive and negative emotion generating pharmacists may be best at adapting to their work environments, whichever emotion the work environment requires, over a long period of time due to their plasticity.

The results of this study thus demonstrated the validity of the Valence Theory for use in future brain laterality investigations.

6.3.2 Brain laterality changing with age

Only the reductionistic variable, age of the pharmacists, rejected the Null Hypothesis utilizing the Right Hemisphere Theory, demonstrating that as pharmacists get older, their brain laterality may change. These pharmacists, with a changed brain laterality, may not enjoy or feel competent in their work placement anymore and hence may require other work environments. An appreciation by the pharmacist of the changed brain laterality may help ease the stress induced by the feeling of no longer being in the correct work environment. This could be regarded as a cognitive awareness of the pharmacist for their changed brain laterality.

There appeared, in this study, to be a movement into different placements as the pharmacists got older. This could have been due to having the inappropriate brain laterality (according to the VT) for that placement or their brain laterality may have changed as they aged, giving rise to different desires. It was hypothesised that pharmacists who worked in environments different to those in which they preferred to work, would have less effective functioning of the corpus callosum than those working in environments they preferred. From the results in Calculations of Data in the Appendix Section B, it appears that only up to 15% of pharmacists in any brain laterality group, and of any age, fell into this group of being indecisive or possible decreased corpus callosum functioning.

However, as seen in Calculations of Data, Section B, chi-square analysis showed no statistical difference between over 50 year-old pharmacists and under 50 year-old pharmacists for effectiveness of the corpus callosum, in each of the 16 brain laterality groups. There appeared to be approximately a 15% chance of a decrease in the corpus callosum effective functioning, both above and below the age of 50, for all the brain laterality groups. According to the literature, (Jeeves & Moes, 1996), this 15% of the pharmacists should only

have been above the age of 60 years, but this research used above the age of 50 years to ensure more power to the available sample.

6.3.3 A new continuum for brain laterality determination

Creating a new continuum to determine brain laterality proved useful for correlation to a simpler brain laterality determination method. The simpler brain laterality determination method was useful in determining the brain laterality for both the RHT and the VT. The continuum and the simpler method may both be used in future brain laterality research, depending on the sample size. The simpler method may be better used with a very large sample size for ease of manipulation. Thus the new continuum, designed from literature-based questions to determine brain laterality of the pharmacists accurately and to determine correlation to a simpler brain laterality of pharmacists determination, did not demonstrate regions of work areas on the continuum due to the Null Hypothesis not being rejected. However, there was a strong correlation ($r = 0.72$) between the accurate literature-based new continuum and the simpler assessment of brain laterality of pharmacists, allowing the simpler determination method to be used with confidence in this research.

6.3.4 Propinquity Principle

The pharmacists' physical proximity to the research university created greater enthusiasm for the research the nearer the pharmacists were to the research university, giving a larger propinquity value. The Propinquity Principle proved valid in this research, demonstrated in South Africa where the Cape Town pharmacists were found to have a higher propinquity level than the Johannesburg cohort. The Cape Town pharmacists were found to be twice as enthusiastic to participate in the research compared to the Johannesburg pharmacists. The UK pharmacists were demonstrated to have a lower propinquity level than

the South African pharmacists, due to the distance from the research university. It took four methods to obtain the UK sample whereas it took two methods to obtain the South African sample. This number of methods demonstrates the degree of enthusiasm for the research to be twice as strong in South Africa compared to the UK.

6.3.5 Wearing of glasses

The wearing of glasses did not affect work choice, no matter which of the 16 brain laterality groups the pharmacists belonged to. The research results demonstrated that only 2% of the entire cohort could have suffered from Seasonal Affective Disorder with the possible consequences of depression. This low percentage could not have had an influence on the overall results of this research. Thus wearing of glasses did not influence where a pharmacist chose to work; however, the wearing of glasses had to be included in the study as the percentage of SAD sufferers was not known at first. These sufferers, if found to be a large percentage, could have influenced the effect of investigating brain laterality and the other variables for placing of pharmacists into their ideal work area. It may be advisable to include the wearing of glasses in future brain laterality studies in case of a large SAD population in that sample.

Thus the wearing of glasses did not affect work choice and 46% of the entire cohort wore glasses all the time. Depression was induced due to the continual wearing of glasses which may block blue light of about 470nm wavelength, which is needed to prevent SAD onset in susceptible pharmacists. It may have been assumed that SAD sufferers were more prevalent in the UK due to less light available than in South Africa. There were however, in this research sample, only a possibility of 2% SAD sufferers thus their influence to this research is negligible.

6.3.6 Amblyopia

Amblyopia was included in this study since a high percentage of pharmacists with amblyopia could have influenced the effect of brain laterality on ideal job choice as these pharmacists could suffer from interactional and prehension problems. These prehension problems would affect the pharmacists work choice due to the inability to do the work requiring fine hand-eye coordination. Fortunately, this research had fewer than 1% amblyopia pharmacists, thus their influence was negligible. The amblyopia pharmacists could have been in any brain laterality group. These pharmacists do deserve special mention, however, as their approach to the world differs from other pharmacists. Packwood et al. (1999) showed that people with amblyopia were more obsessive-compulsive in behaviour, were interpersonally sensitive, and suffered from depression and anxiety to a greater extent compared to control subjects. The differences between amblyopia persons and controls were significantly different ($p < 0.05$) in each category mentioned by Packwood et al. (1999). Thus, if there was a large enough sample of amblyopia pharmacists in each of the 16 brain laterality groups of pharmacists, there may have been a statistical difference between the 16 brain laterality groups, as to where they preferred working. However, due to lack of sufficient sample power of amblyopia pharmacists, no influence of job selection for amblyopia pharmacists could be determined in this research, but should be incorporated in future brain laterality research due to its importance and influence on job selection.

6.3.7 Type A and Type B influence

Any of the 16 brain laterality groups could have pharmacists that were either a Type A or Type B personality. These Type A and Type B personality pharmacists were determined by including the question on speed of doing work. The values from Table 17 (54% for the UK and 55% for SA) portraying Type A personality demonstrate reliability of the use of

speed questions for doing work. Using internal consistency it appears that the values are similar and hence reliability is demonstrated. The average value of 54.5% in Table 17 demonstrates that validity of the speed question is only 54.5% accurate. Thus applying internal consistency a high level of reliability is observed due to similar values between the UK and SA results, however, validity does not appear substantial with just over 50% determined with the use of content type validity application.

Even though there was a large Type A personality sample in both countries investigated, this did not influence the overall result. At least 55% of the pharmacists in the entire cohort suffered from stress, as this is associated with Type A personality. 55% of the entire cohort could be classified as Type A personality, determined from pharmacists stating that they do their work quickly. However, being a Type A or Type B personality did not influence choice of work in this study, possibly only the length of time worked in an environment being shorter for Type A pharmacists, perhaps due to their desire to achieve higher status. The length of time worked by Type A pharmacists compared to Type B pharmacists, in particular environments, did, however, not demonstrate a difference in this study. This lack of influence of Type A pharmacists in this research could be due to a weak validity of the speed question for determining the existence of a Type A personality. Possibly two or three questions to determine Type A personality would have been more accurate than one speed question in future research. This increase in the number of questions may increase the validity value to greater than 50% which may thus show an influence of Type A personality pharmacists affecting their job choice as expected in the literature (Smith & Bryant, 2012).

6.3.8 Education

It appeared that the doctorate pharmacists were better off than the masters, bachelor degree and diploma pharmacists since the doctorate pharmacists had a greater scope of work choice. The percentage of doctorate pharmacists is low in both countries, including in community pharmacies, compared to the situation in the USA (Watanabe et al., 2005) and Canada (Austin & Ensom, 2008) and should be increased to improve the standards of the pharmacy profession to the public. The Canadian and United States pharmacy departments have introduced doctorate degrees as a prerequisite to work as a pharmacist, so the value of 6.9% demonstrated a greater need for doctorates in pharmacy in the UK and South Africa to strengthen the profession.

In this research there were no doctorate pharmacists in the UK in community pharmacies that owned their own community pharmacy, only 12.5% of the South African doctorate community pharmacists owned their own community pharmacy, which should be rectified to improve pharmacy professionalism. This improvement should come about as the literature cited doctorate pharmacists as being more enthusiastic in whichever area of pharmacy they work in (Fjortoft & Lee, 1995; Ofte, 2002).

6.3.9 Owning a community pharmacy

No brain laterality group was found to be suited to community pharmacy ownership, however, in this research one third of the diploma-graduated pharmacists in the UK and one third of the diploma-graduated pharmacists in South Africa owned their own community pharmacy. This could have been due to these diploma-graduated pharmacists compensating for an inability to work in academia or research, due to the inability to obtain a masters or doctorate degree on the strength of a diploma. Two thirds of any pharmacists with a degree also owned a community pharmacy.

According to the Valence Theory this research determined that the best brain laterality groups to work in a community pharmacy were 1 (RRRR) and 9 (LRRR). Thus pharmacists with these brain laterality groups would be best to own a community pharmacy. This research determined that these pharmacists with brain laterality groups 1 or 9 were most likely to own their own pharmacy for at least 10 years. Having the pharmacy for 10 years or more demonstrates stability of the pharmacist (Stevens, 2005), with brain laterality groups 1 or 9, in this community pharmacy.

6.3.10 Gender

Either gender, as determined in this research, in any of the 16 brain laterality groups of pharmacists, could competently work in any of the nine mutually-exclusive work areas. 60% of the respondents were female in both the UK and South Africa. This research also demonstrated that there was a 10% decrease of female pharmacists after 10 years concurrent work, which pointed to the necessity to increase the number of male pharmacists to cope with the increasing population, or to attempt to maintain the number of female pharmacists. Catering more for a female pharmacist's needs at work, regarding psychosocial pressures, may be what is required to maintain their presence in the work place, a factor which would have to be researched in the future along with the influences of the Valence Theory. Selecting female pharmacists that belong to the six major brain laterality groups of pharmacists remaining after 10 years work may have credibility.

According to the Valence Theory brain laterality groups most suited to ideal work environments were 1, 5, 6, 9, 13 and 16 in this research. The values obtained in Table 20 also represent 60% female pharmacists. To maintain female pharmacists in work placements according to their Valence Theory brain laterality group after 10 years (Stevens, 2005) work should be applied. From the results of this research, brain laterality groups 1 and 9 should

ideally be placed in Community, Hospital or Research environments. Brain laterality group 5 should work in other, group 6 should work in production, group 13 in quality control or education, and group 16 in multiple work areas. This research thus recommends female pharmacists to work according to this Valence Theory grouping to possible maintain their maximum working time.

6.3.11 Global warming

There was no statistical difference between the 16 brain laterality groups of pharmacists and the answers to the global warming questions. The South African pharmacists were more enthusiastic than the UK pharmacists, both with preventing global warming: 86% compared to 69% respectively; and with global warming affecting drug supply: 83% compared to 73% respectively. The most enthusiastic pharmacists regarding prevention of global warming were the South African female pharmacists. The male UK pharmacists were the least enthusiastic in this regard. The South African female pharmacists were the most concerned with global warming affecting future drug supply, with the male UK pharmacists being the least concerned. The enthusiasm of the female pharmacists towards global warming may encourage them to work for longer periods if the profession became more involved with global warming.

Using internal consistency between South Africa and the United Kingdom to determine reliability of the global warming questions the percentages are not very similar thus not resulting in a strong reliability. The reliability does however fall within a 10 percent range thus demonstrating some reliability. The average value for each question, in both countries, is the same (78% from Table 20) demonstrating strong validity. A demonstration of reliability and validity for these global warming questions substantiates there use for emotion determination.

6.3.12 Enjoyment levels

The mean enjoyment level was very high for the entire cohort (80%). Self-assessment may have been the influencing factor. A very high mean enjoyment value for the average value did not allow for extremely high values. Had a lower mean enjoyment level been evident, it may have given more meaning to the value. It appeared that most of the pharmacists enjoyed their work where ever they worked. Even the five selected ideal Valence Theory brain laterality groups of pharmacists had an average enjoyment level of 80% in both countries; although it was expected to be higher than the average, this could not be achieved possibly due to the level of accuracy of a self-assessment of enjoyment levels.

The values demonstrated in Table 20 show similarity between the UK and SA (74% vs 76% respectively). This similarity gives a strong reliability for the enjoyment question. The average value of 80% demonstrates a strong validity of this enjoyment question even though self-assessment was used.

6.3.13 Corpus callosum functioning

A correlation between the pharmacists' preferred work area and their actual work area was in this research related to the functioning of the corpus callosum, where this was assumed to be decreased if the preferred and actual work environments were not the same. However, 75% of the total cohort worked in their preferred area, thus the influence of the corpus callosum decreasing in functioning was less than 25% of this cohort. Chi-square analysis showed that no decreased functioning of the corpus callosum was detected for pharmacists younger or older than 50 years. From section 5.2.2.2 regarding pharmacists greater than or equal to 50 years and below the age of 50 years it was found that no pharmacist appeared to have a changing brain laterality that would affect their choice of actual or preferred placements. Thus from these results reliability and validity of this

investigation are negligible and in doubt. This could have been due to the selected sample of pharmacists and that possibly another sample of pharmacists would generate reliable and valid results. The power of this investigating may just not have been able to detect a decrease in the functioning of the corpus callosum. Brain scanning of the corpus callosum would have given more accurate results, but was not part of this research as this would not have been practicable.

6.3.14 Emotion determination with resulting implications

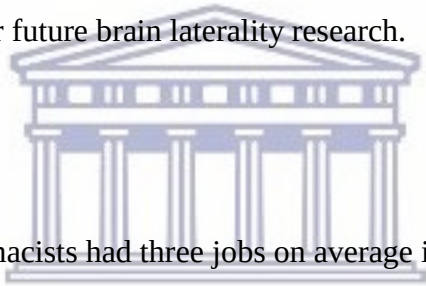
Determination of the pharmacists' emotional bias was carried out from the global warming questions. The importance here is the new finding of the dominant ear inhibiting the associated emotional site in the hemisphere. This was observed from Figure 9 where the dominant right ear in the first eight brain laterality groups inhibited the positive emotional site in the left hemisphere, consequently portraying negative emotion from the recessive right hemisphere. The second eight brain laterality groups in Figure 9 demonstrate the dominant left ear inhibiting the negative emotional site in the right hemisphere, consequently portraying positive emotion from the recessive left hemisphere. Brain laterality groups 15 and 16 in Figure 9 demonstrate negative emotion possibly due to extreme right hemisphere dominance. These findings are supported by the studies of Parr and Hopkins (2000) and Propper et al. (2010) where the influence of the ear on the emotional site is demonstrated by tympanic membrane temperature increase when the related emotional site is stimulated. This could mean that the pharmacists' dominant ear, when hearing sound, inhibited its emotional site in the dominant hemisphere of the brain, allowing the recessive brain hemisphere's emotional site to dominate. If no sound is heard, the dominant emotional site will function. This finding has significant implications since an individual's dominant emotions may be influenced by the individual hearing sound. This could for example be implemented into

psychotherapy and education. In psychotherapy a person with depression that was right ear dominant would require silence to generate positive emotion out of the depression. A left ear dominant depressed person would require music, for example, to inhibit their dominant negative emotion generation, allowing the positive emotion in the recessive hemisphere to dominate, thus giving direction out of the depression. Van Assche et al. (2015) demonstrated a positive approach to music in reducing symptoms of depression, however, they stated that more research is needed in this regard. Possibly brain laterality as demonstrated above is involved. Similar rationale with education could be assumed with exam writing, where right ear dominant individuals would require silence to maintain their positive emotional site, while left ear dominant individuals would require headphones and relaxing music to inhibit their negative emotions towards the exams.

The introduction of the left hand, as dominant, to the brain laterality group, such as in brain laterality groups 3 and 15, demonstrated nearly double the negative emotion from the right hemisphere of the brain observed in Figure 9. Thus by knowing the pharmacists' ear and hand dominance only, one could put the pharmacists into their ideal work environments by matching the emotional generation of the pharmacists to the work's emotional requirements. It can be observed from Figure 9 that the first set of eight brain laterality groups generate negative emotion and the second set of eight brain laterality groups generate positive emotion mostly due to ear dominance. The nine different work areas investigated in this research require either positive or negative emotion for competence in the required work (Giorgianni, 2002). Thus from this research if a particular work area required a negative emotional generating pharmacist the pharmacist ideally should come from the first eight brain laterality groups in Figure 9 and if the work area required a positive emotional generating pharmacist the pharmacist ideally should come from the second eight brain laterality groups in Figure 9. The exception being brain laterality groups 15 and 16 where pharmacists with these brain

laterality groups generate negative emotion; due to extreme right hemisphere dominance, these pharmacists should also ideally work in negative emotion requiring work areas as with the first set of eight brain laterality groups.

The existing findings from Figure 9 demonstrates reliability and validity shown in Table 18. Reliability is demonstrated by internal consistency comparing the average positive and negative emotion generated from the first eight brain laterality groups to the average positive and negative emotion generated by the second eight brain laterality groups. Similar values demonstrated a strong reliability in Table 18. The average positive and negative percentage of emotion generated throughout the 16 brain laterality groups, shown in Table 18, demonstrated a strong validity (70% and 75% respectively). Thus Figure 9 portrays powerful scientific findings for future brain laterality research.



6.3.15 Number of jobs

United Kingdom pharmacists had three jobs on average in their working life, and the South African pharmacists had five. This could be due to the fact that the South African cohort of pharmacists was older on average than the UK cohort as well as there being more jobs available in South Africa, due to there being four times as many pharmacists in the UK for a similar-sized population, according to values obtained from the RPSGB and the SAPC. Internal consistency determined reliability between South Africa and UK pharmacists even though the number of jobs differed marginally. Content demonstrated validity of the number of jobs question. If the pharmacists in South Africa had been within the same age range as the UK pharmacists the average number of jobs may have been closer.

6.3.16 Inter-hemispheric interaction

Leavengood and Weekes (2000) examined the effects of stress on hemispheric specialization and the corpus callosum. They concluded that anxiety enhanced the corpus callosum transfer time, without affecting the hemispheric specialization. This means that if a pharmacist is under stress at work, the hemispheres interact to a greater extent and ultimately the pharmacist would be able to tolerate any work environment. Hoptman and Davidson (1994) found that pathological variations in the inter-hemispheric transfer time had cognitive consequences. The literature showed that if someone had a difficult task to perform, there was a benefit to inter-hemispheric interaction (Hoptman & Davidson, 1994). It was better to have both hemispheres interact over a problem, than just one hemisphere. This gives support to the Valence Theory, where positive and negative emotional sites connected for better emotional control with interaction of the pharmacist's right and left hemispheres of the brain. From Figure 9 an association of the degree of laterality of emotional function is probable. The extreme brain laterality groups of group 1 and group 16 may demonstrate little lateralization of the emotion function and hence these brain laterality groups could work in a variety of environments shown in Table 19. Brain laterality groups 2, 3, 4, 13, 14, and 15 have an increased laterality of emotion function compared to groups 1 and 16, thus working in fewer work environments. However, where there is similar laterality of the emotion function in both hemispheres, such as with brain laterality groups 5 to 12 inclusive, only one specialized work environment is adopted, demonstrated in Table 19. Greater inter-hemispheric transfer of emotional stimuli may create greater homeostasis in the decision were to work, however, when there is a large amount of laterality, as with brain laterality groups 1 and 16 these groups will be less sure of an ideal work environment.

6.3.17 Striving for multiple work environments

Due to the finding that pharmacists with brain laterality group 16 were ideally suited to multiple work environments, for more than 10 years, it may be reasonable to assume that the more right hemisphere dominant the person is, the more likely they would be suited to a multiple work set up. Thus brain laterality groups 1, 5, and 6 (left hemisphere dominated), 9 and 13 (right hemisphere dominated) were found to be involved with specific work environments at any one time, whereas brain laterality group 16 (right hemisphere dominated) was involved with multiple work environments at any one time. Table 20 demonstrates that although brain laterality group 1 pharmacists can work in many environments at different times, brain laterality group 16 pharmacists work in many work environments at the same time. Thus Table 20 demonstrates that brain laterality group 1 can work in almost all work areas selected for this research, brain laterality group 9 can work in community and hospital, and brain laterality group 13 can work in quality control or education. Brain laterality group 16 pharmacists work in many work areas at the same time, possibly due to a large negative emotional generation creating uncertainty as to which their ideal work area should be. On the opposite side of the emotional generating continuum is brain laterality group 1 with a large positive emotional generation observed in Figure 9. This large positive emotion of group 1 pharmacists gives the pharmacists a positive approach to almost all the work environments in this research observed in Table 20.

6.4 Theoretical implications

This research agreed with the findings of Coren et al. (1979) for the use of the ear, eye, hand and foot dominance for the determination of brain laterality. This method was adopted throughout the literature to determine brain laterality. The method also has the

backing of physiological functioning with the ear, eye, hand and foot being contralaterally controlled by the brain.

Karelitz (2008) emphasised the correctness of the Right Hemisphere Theory, (RHT), in a Torah study, whereas this study demonstrated that the Valence Theory (VT) may have been more correct. Similarly, Mintzberg (1976) demonstrated that the RHT was more correct in the work environment. Thus this study has contributed to the direction of the Valence Theory being more appropriate than the RHT.

Further salient support for the RHT was given by Tompkins and Flowers (1985), working on hemiplegia; however, a small sample size may have cast doubt over their conclusions.

Research work on aggression, however, by Propper et al. (2010) supported the VT as they demonstrated that both sides of the brain were involved with controlling aggression. Aggression is involved with emotion, thus demonstrating that emotion may be found in both hemispheres of the brain

6.5 Policy implications

The Valence Theory was demonstrated to be more appropriate than the Right Hemisphere Theory, with six main brain laterality groups being ideal for the pharmacy profession. Adoption of the VT could give more direction to the placing of pharmacists into their ideal work environments which would create a more competent pharmacy profession.

6.6 Limitations and strengths

A limitation with self-assessment involved **assessing hand dominance**. Grip strength would have been a better method than self-assessment to assess the dominant hand of the pharmacist supported by Gedela et al. (2008) where they determined right handers to have a

10% greater grip strength in their right hand than in their non-dominant left hand and that left handers had a 8% greater grip strength in their left hand than in their non-dominant right hand. They used an interview method and a dynamometer to determine 40 subjects' grip strength. The current study used a questionnaire, thus access to a dynamometer was not practical, necessitating self-assessment for grip strength determination. The large cohort size of 510 in this study would have nullified any error caused by the self-assessment method, however this may have produced a limitation in this research design (Cohen et al., 2004; Kerlinger, 1986).

The research used the **Right Hemisphere Theory**, RHT, over the **Valence Theory**, VT, since initially the researcher hypothesised that the Null Hypothesis would be rejected for the RHT, which would have demonstrated the correctness of the RHT for the research. This was a limitation if the RHT proved to be incorrect by the Null Hypothesis not being rejected. However, if the Null Hypothesis was not rejected the VT may be more accurate for the current research. Furthermore, if the research demonstrated that the Null Hypothesis could be rejected for the variable age of the pharmacist only, when using the RHT, this would mean that the RHT could be correct. The limitation would be the demonstration of only part of the Null Hypothesis being rejected to partly accept the RHT, whereas the strength demonstrates the correctness of the VT if positive emotion and negative emotion are taken into account as the pharmacist aged. If the results of the research are not able to reject the Null Hypothesis for the Alternative Hypothesis, this could be due to two factors. Firstly, the RHT could be incorrect and the VT could be correct, which hypothesises that the site for negative emotion is found in the right hemisphere of the brain and the site for positive emotion is found in the left hemisphere of the brain (Parr & Hopkins, 2000). Secondly, the influence of the corpus callosum, which could mask the influence of a RHT by allowing the two hemispheres of the brain to interact with each other, in both an excitatory and inhibitory manner (Bloom &

Hynd, 2005). If the variable for age rejected the Null Hypothesis regarding a statistical difference between the 16 brain laterality groups of the pharmacists, this would involve the influence of the corpus callosum, as the corpus callosum can decrease in its functioning with age.

The **global warming questions** in the questionnaire were also used to assess the pharmacist's **positive and negative emotions** without overtly disclosing this intention. If these questions were found to be answered positively, in all 16 brain laterality groups, where the Null Hypothesis was not rejected, the Valence Theory would be more correct for brain laterality research, as emotion would be demonstrated on both hemispheres of the brain. If the Null Hypothesis was rejected, then emotion would be demonstrated as being controlled in the right hemisphere of the brain only. The strength here is with the use of global warming questions to determine the pharmacists' emotional dominance. In particular, the question asking the pharmacists if they wished to help in the prevention of global warming assessed positive emotion, and the question asking pharmacists if they were aware that global warming will affect future drug supply assessed negative emotion. If the Null Hypothesis was not rejected for the variable global warming, this would demonstrate that positive and negative emotion would be found on the left and right hemispheres of the brain respectively. If the Null Hypothesis was rejected, both positive and negative emotion would be found in the right hemisphere of the brain in line with the Right Hemisphere Theory. These two global warming questions demonstrated strength to the research design with positive findings.

A questionnaire can be sent by **post** to a large number of participants and these participants are more truthful while responding to a questionnaire due to anonymity. Limitations with the use of a posted questionnaire is that only up to 30% responded (Power et al., 2008), and that the response time can take up to three months.

Emailing a questionnaire can reach a large number of participants cheaper and quicker than using the postal system. The limitations here include an exclusion of participants who do not have a computer and only about 9% of the participants responded (Russel et al., 2010). These participants were rapid to reply, within two weeks, being a strength, which was the case in the current study (Akl et al., 2005; Leece et al., 2004; Seguin et al., 2004).

Strengths of the **snowball sampling** procedure were a possibility for the researcher to include people in the survey that would otherwise not have been included; to locate people for a specific population when there were no lists or other obvious sources for locating members of the population. Limitations included possible inaccurate results as the chance of being selected was unknown; it was not random; the researcher had very little control over the sampling method (Cohen et al., 2004).

Possibly an extra question to more accurately determine **Type A personality** should have been added to the questionnaire. This question should have determined another important trait of Type A personality such as desire to achieve senior placements. The Type A personality could have confounded the results due to potentially having a larger impact on job choice than the pharmacist's brain laterality. The 55% of the sample that possibly were Type A could have thus prevented rejection of the Null Hypothesis. There was also not a large enough sample size of Type B personality pharmacists, in each brain laterality group, to determine if they alone could reject the Null Hypothesis. Thus had it been know that such a large percentage of Type A pharmacists existed a larger sample size should have been taken to assess the Type B personality pharmacists and an extra question should have been added to determine the degree of being a Type A personality. The degree of Type A personality would have been measured by the number of pharmacists answering two or one question positively.

Cultural effects investigated by Porac (2009) may have an influence on brain laterality for example left handers may be influenced to become right hander by their culture

(Martin & Porac, 2007). However, due to the large sample size of 510 over a variety of cultures this cultural influence may have been alleviated.

6.7 Recommendations for follow-up studies

There are several recommendations for follow-up studies as follows:

- To determine hand dominance by grip strength with a dynamometer in brain laterality research, as better results are obtained than with self-assessment, to a value of 10% more accurate (Gedela et al., 2008). The hand has a large influence on brain laterality determination, determined in this research, thus ambidextrous people may be placed in a left or right hand dominant group using a dynamometer.
- To investigate the use of brain laterality in placing professionals other than pharmacists into their ideal work environments. For example the placing of doctors, psychologists and teachers into their ideal work environments.
- Using the Valence Theory to determine ideal brain laterality groups for doctors, psychologists and teachers and compare these groups to those found in this research.
- Confirm the correctness of the WADA test, amblyopia and hemiplegia in support of the Right Hemisphere Theory with a larger cohort than has been available in the literature.
- Demonstrate that brain laterality is not static by repeating this research to verify if the Null Hypothesis will be continually rejected.
- Determine which ideal profession is ideally suited to left handers / right brain dominance.
- Determine the rationale behind the plasticity of equal emotion generating brain laterality groups being able to work in different areas adapting to the required work.
- Determine, with other professions, if the more right-hemisphere dominant a person is, whether this means the person will be working in more than one placement concurrently.

- Determine if a changing brain laterality, over 10 years work, results in other professions not liking their work anymore.
- Determine if the new continuum in this research for brain laterality determination can find other professions which determine potential work area regions.
- Determine if the global warming questions can be used to determine emotion generation in other professions.
- Investigate the inhibition of the dominant ear, when hearing sound, on the dominant emotional site in the brain in psychotherapy and exam writing conditions.

6.8 Summary of this research

The Right Hemisphere Theory did not reject the Null Hypothesis except for the variable age of the pharmacists, which means that any pharmacist, with any of the 16 brain laterality groups, can work in any of the nine mutually-exclusive work environments with confidence. The Valence Theory was found to be more appropriate than the Right Hemisphere Theory, with six out of 16 ideal brain laterality groups and no left handers except for brain laterality group 16. This allowed pharmacists to be placed into suited work environments, according to the matching of positive or negative emotion generated by the pharmacists, and either positive or negative emotion required by the work environments. A large negative emotional generation by a pharmacist (brain laterality group 16) appeared to be suited to multiple work environments, giving the possibility of increasing right hemisphere dominance leading to multiple work environments. The emotional dominance of the pharmacists is mostly determined by their ear dominance, with a large influence of the hand dominance and only a minor influence of the eye and foot dominance. The dominant ear was found to inhibit its associated emotional site in the brain, allowing the recessive emotional site to dominate. This has an important new influence on psychotherapy and education as

well as future brain laterality research. In psychotherapy sound such as music given to a depressed left ear dominant person would inhibit the person's negative emotions, according to the Valence Theory, possibly allowing the positive emotional site in the brain to counter the depression. With a right ear dominant person with depression, silence would generate positive emotion as there will be no inhibition of the positive emotional site in the brain. Similarly, with education, during exams a right ear dominant student should have silence to generate a positive effort and a left ear dominant student should hear music (with headphones) to generate a positive effort. These psychotherapy and educational considerations, deduced from this research, should be further investigated due to their considerable importance.

6.9 Conclusions of this research

There are a lot of positive findings to extract from this research for science and the betterment of the pharmacy profession. For example, as pharmacists aged, their brain laterality may change, demonstrating brain laterality to be fluid. This fluidity created difficulties in determining the influence for ideal work environments with this cohort but maybe not so with another cohort, thus further research may have to be carried out to confirm the findings. The Valence Theory proved more applicable to this research than the Right Hemisphere Theory demonstrating brain laterality groups 1, 5, 6, 9, 13 and 16 to be ideal for specific job placement. This would require verification in future research.

From Figure 9 demonstrating emotional generation of the pharmacists, the dominant ear inhibits their contralateral emotional site when hearing sound, which gives important rationale for emotional studies in the future with large consequences for education and psychotherapy.

Even though the null hypothesis was not rejected in this research the use of the ear, eye, hand and foot dominance to determine brain laterality as well as the investigation of reductionistic variables proved reliable utilising internal consistency, and valid due to content analysis. The age variable which did reject the null hypothesis gave statistical support to the rationale for this research. This research thus gave credibility to the use of the ear, eye, hand and foot dominance to determine brain laterality for future research.

The results of the Valence Theory in this research, if verified with further research, could give ideal work direction to potential pharmacists at the university level developing a more competent pharmacist and the potential to maintain female pharmacists in work, thus strengthening the pharmacy profession.

REFERENCES

Achuff, P. (2001). The Lateralization of Emotion. Brain & Mind Magazine. Nov. 04.

Agrawal, D., Mohanty, B.B., Kumar, S., & Chinara, P.K. (2014). Split brain syndrome: One brain but two conscious minds? Journal of Health Research & Reviews. (1): 27 – 33. DOI: 10.4103/2394 – 2010.150793

Ahmed, S.M., Tolera, M., & Angamo, M.T. (2013). Assessment of job satisfaction among Pharmacy professionals in Southwest Ethiopia. Int J Pharm Sci Res. 4(6); 2351 - 2358 DOI: 10.13040/IJPSR.0975-8232.4(6).2351-58

Akl, E.A., Maroun, N., Klocke, R.A., Montori, V., & Schunemann, H.J. (2005). Electronic mail was not better than postal mail for surveying residents and faculty. J Clin Epidemiol. Apr; 58(4): 425 - 9. DOI: 10.1016/j.jclinepi.2004.10.006

Alfano, K.M., & Cimino, C.R. (2008). Alteration of expected hemispheric asymmetries: valence and arousal effects in neuropsychological models of emotion. Brain Cogn. Apr; 66(3): 213 – 20.

Ali, N., & Cimino, CR. (1997). Hemispheric lateralization of perception and memory for emotional verbal stimuli in normal individuals. Neuropsychology. Jan; 11(1): 114-25. PMID: 9055275

Altizer, S., Ostfeld, R.S., Johnson, P.T.J., Kutz, S., & Harvell, D. (2013). Climate Change and Infectious Diseases: From Evidence to a Predictive Framework. Science. Aug 02; 341(6145): 514 – 519. DOI: 10.1126/science.1239401

American Psychological Association (APA) (2014). Dictionary.com Unabridged. Retrieved February 03, 2014, from Dictionary.com website. Viewed at http://dictionary.reference.com/browse/reductionism

Austin, Z., & Ensom, M.H. (2008). Education of pharmacists in Canada. Am J Pharm Educ. Dec 15; 72(6): 128. PMID: 19325948

Aygul, R., Dane, S., & Ulvi, H. (2005). Handedness, eyedness, and crossed hand-eye dominance in male and female patients with migraine with and without aura: a pilot study. Percept Mot Skills. Jun; 100(3 Pt 2): 1137 - 42.
DOI: 10.2466/pms.100.3c.1137-1142

Batut, A.C., Gounot, D., Namer, I.J., Hirsch, E., Kehrli, P., & Metz-Lutz, M.N. (2006). Neural responses associated with positive and negative emotion processing in patients with left verses right temporal lobe epilepsy. Epilepsy Behav. Nov; 9(3): 415 – 23.
DOI: 10.1016/j.yebeh. 2006.07.013

Bhushan, B., & Khan, S.M. (2006). Laterality and accident proneness: a study of locomotive drivers. Laterality. Sep; 11(5): 395 - 404. DOI: 10.1080/13576500500457458

Bloom, J.S., & Hynd, G.W. (2005). The role of the corpus callosum in interhemispheric transfer of information: excitation or inhibition? Neuropsychol Rev. Jun; 15(2): 59 - 71.
DOI: 10.1007/s11065-005-6252-y

Bogen, J.E., & Vogel, P.J. (1974). Neurological status in the long term following complete cerebral commissurotomy. F.Michel and B.Schott (eds.), Les Syndromes de Disconnexion Calleuse chez L'Homme, Hopital Lyon.

Bonati, B., Csermely, D., Lopez, P., & Martin, J. (2010). Lateralization in the escape behaviour of the common wall lizard (Podarcismuralis). Behav Brain Res. Feb 11; 207(1): 1 – 6.
DOI: 10.1016/j.bbr.2009.09.002

Bond, C.A., Pitterle, M.E., & Raehl, C.L. (1994). Evaluation of recent pharmacy graduate's practice patterns, professional lifelong learning, pharmacy organization memberships, and salary. Ann Pharmacother. Jan; 28(1): 21 - 8.
DOI: 10.1177/106002809402800103

Borod, J.C. (1992). Interhemispheric and intrahemispheric control of emotion: a focus on unilateral brain damage. J Consult Clin Psychol. Jun; 60(3): 339 - 48. PMID: 1619088

Borritz, M., Bultmann, U., Rugulies, R., Christensen, K.B., Villadsen, E., & Kristensen, T.S. (2005). Psychosocial work characteristics as predictors for burnout: findings from 3 year follow up of the PUMA Study. J Occup Environ Med. Oct; 47(10): 1015 - 25. PMID: 16217242

Brace, N., Kemp, R., & Snelgar, R. (2009). SPSS for psychologists. (4th Ed). Hampshire: Palgrave and Macmillan.

Brizzolara, D., Ferretti, G., Brovedani, P., Casalini, C., & Sbrana, B. (1994). Is interhemispheric transfer time related to age? A developmental study. Behav Brain Res. Oct 20; 64(1-2): 179 - 84. PMID: 7840885

Bryden, M.P., & Bulman-Fleming, M.B. (1994). Laterality effects in normal subjects: evidence for interhemispheric interactions. Behav Brain Res. Oct 20; 64(1-2): 119 - 29.
DOI: org/10.1016/0166-4328(94)90124-4

Carlson, N.R. (1991). Physiology of Behaviour (4th Ed). Massachusetts:Allyn and Bacon.

Cherbuin, N., & Brinkman, C. (2006). Efficiency of callosal transfer and hemispheric interaction. Neuropsychology. Mar; 20(2): 178 - 84.
DOI: 10.1037/0894-4105.20.2.178

Clark, B.E., & Mount, J.K. (2006). Pharmacy Service Orientation: a measure of organizational culture in pharmacy practice sites. Res Social Adm Pharm. Mar; 2(1): 110 - 128.

DOI: org/10.1016/j.sapharm.2005.12.003

Clarke, J.M., & Zaidel, E. (1994). Anatomical-behavioral relationships: corpus callosum morphometry and hemispheric specialization. Behav Brain Res. Oct 20; 64(1-2): 185-202. PMID: 7840886

Cohen, L., Manion, L., & Morrison, K. (2004). Research Methods in Education (5th Ed). London: RoutledgeFalmer.

Collins, H. (2003). English Dictionary and Thesaurus. 21st Edition. Glasgow: Harper Collins Publishers.

Corballis, M.C. (2009). The evolution and genetics of cerebral asymmetry. Biological Sciences. April 12; 364(1519); 1 -37. DOI: 10.1098/rstb.2008.0232

Corballis, M.C. (2014). Left Brain, Right Brain: Facts and Fantasies. PLoS Biol 12(1): e1001767. DOI: 10.1371/journal.pbio.1001767

Coren, S. (1993). The lateral preference inventory for measurement of handedness, footedness, eyedness, and earedness: Norms for young adults. Bull. Psychon. Soc. Jan; 31(1): 1 – 3. DOI: 10.3758/BF03334122

Coren, S., Porac, C., & Duncan, P. (1979). A Behaviourally Validated Self- Report Inventory to Assess Four Types of Lateral Preference. Journal of Clinical Neuropsychology. Vol 1, No. 1, 55 - 64. DOI: 10.1080/01688637908401098

Cox, E.R., & Fitzpatrick, V. (1999). Pharmacist's job satisfaction and perceived utilization of skills. Am J Health Syst Pharm. Sep 1; 56(17): 1733-7.

Csermely, D., Bonati, B., Lopez, P., & Martin, J. (2011). Is the Podarcis muralis lizard left-eye lateralised when exploring a new environment? Laterality. Mar; 16(2): 240 - 55.

DOI: org/10.1080/13576501003614827

Dambisya, Y.M., Modipa, I.S., & Legodi, M.G. (2007). Factors influencing the distribution of pharmacy graduates of the University of the North, South Africa. East Afr Med J. Oct; 84(10): 481 - 8. PMID: 18232269

Dane, S., Yildirim, S., Ozan, E., Aydin, N., Oral, E., Ustaoglu, N., & Kirpinar, I. (2009). Handedness, eyedness, and hand-eye crossed dominance in patients with schizophrenia: sex-related lateralization abnormalities. Laterality. Jan; 14(1): 55 - 65. DOI: 10.1080/13576500802061883

Dargent-Pare, C., De Agostini, M., Mesbah, M., & Dellatolas, G. (1992). Foot and eye preferences in adults: relationship with handedness, sex and age. Cortex. Sep; 28(3): 343 - 51. PMID: 1395638

David, A.S. (1994). Schizophrenia and the corpus callosum: developmental, structural and functional relationships. Behav Brain Res. Oct20; 64(1-2): 203 - 11. PMID: 78400887

Davidson, R.J. (2004). Well-being and effective style: neural substrates and biobehavioural correlates. Phil. Trans. R.Soc. B. 359, 1395-1411. DOI: 10.1098/rstb.2004.1510

De Oliveira, D.R., & Shoemaker, S.J. (2003). Achieving patient centeredness in pharmacy practice: openness and the pharmacist's natural attitude. J Am Pharm Assoc. Jan-Feb; 46(1): 56 – 64. PMID: 16529341

Denny, K. (2009). Handedness and depression: evidence from a large population survey. Laterality. May; 14(3): 246 - 55. DOI: 10.1080/13576500802362869

Dittmar, M. (2002). Functional and postural lateral preferences in humans: interrelations and life-span age differences. Hum Biol. Aug; 74(4): 569 – 85. PMID: 12371683

Droege, M. (2003). The role of reflective practice in pharmacy. Educ Health (Abingdon). Mar; 16(1): 68 - 74. DOI: 10.1080/1357628031000066778

Fasmer, O.B., Akiskal, H.S., Hugdal, K., & Oedegaard, K.J. (2008). Non-right-handedness is associated with migraine and soft bipolarity in patients with mood disorders. J Affect Disord. Jun; 108(3): 217 - 24. DOI: 10.1016/j.jad.2007.10.028

Fernandez-Carriba, S., Loeches, A., Morcillo, A., & Hopkins, W.D. (2002). Functional asymmetry of emotions in primates: new findings in chimpanzees. Brain Res Bull. Feb-Mar 1; 57(3-4): 561 - 4. PMID: 11923029

Fjortoft, N. (2003). Identifying caring behaviours of pharmacists through observations and interviews. J Am Pharm Assoc. Sep-Oct; 46(5): 582 - 8. PMID: 17036644

Fjortoft, N.F., & Lee, M.W. (1995). Comparison of activities and attitudes of baccalaureate level and entry-level doctor of pharmacy graduates of the University of Illinois at Chicago. Ann Pharmacother. Oct; 29(10): 977 - 82. DOI: 10.1177/106002809502901003

Fjortoft, N., & Zgarrick, D. (2003). An assessment of pharmacist's caring ability. J Am Pharm Assoc. Jul-Aug; 43(4): 483-7. PMID: 12952312

Fournier, J.C., DeRubeis, R.J., Amsterdam, J., Shelton, R.C., & Hollon, S.D. (2015). Gains in employment status following antidepressant medication or cognitive therapy for depression. The British Journal of Psychiatry. Apr; 206(4): 332 - 338. DOI: 10.1192/bjp.bp.113.133694

Gainotti, G. (1983). Emotions and hemispheric lateralization. Review of the literature. Encephale. 9(4): 345 - 64. PMID: 6368198

Gainotti, G., (2013). Lateral effects in normal subjects' recognition of familiar faces, voices and names. Perceptual and representational components. Neuropsychologia. Jan; 51(7): 1151 – 60. DOI: 10.1016/j.neuropsychologia. 2013.03.009

Gainotti, G. (2015). Implications of recent findings for current cognitive models of familiar people recognition. Neuropsychologia. Oct; 77: 279 – 87.

DOI: 10.1016/j.neuropsychologia.2015.09.002

Gaither, C.A. (1999). Career commitment: a mediator of the effects of job stress on pharmacist's work-related attitudes. J Am Pharm Assoc (Wash). May-Jun; 39(3): 353 - 61. PMID: 10363462

Gaither, C.A., Kahaleh, A.A., Doucette, W.R., Mott, D.A., Pederson, C.A., & Schommer, J.C. (2008). A modified model of pharmacist's job stress: the role of organizational, extra-role, and individual factors on work-related outcomes. Res Social Adm Pharm. Sep; 4(3): 231 - 43. DOI: 10.1016/j.sapharm.2008.04.001

Gaither, C.A., Nadkarni, A., Mott, D.A., Schommer, J.C., Doucette, W.R., Kreling, D.H., & Pedersen, C.A. (2003). Should I stay or should I go? The influence of individual and organizational factors on pharmacist's future work plans. J Am Pharm Assoc. Mar-Apr; 47(2): 165 - 73. DOI: 10.1331/6J64-7101-5470-62GW

Gazzaniga, M.S. (1970). The bisected brain. New York: Appleton – Century – Crofts.

Gazzaniga, M.S. (1998). Brain and conscious experience. Adv Neurol. 77: 181 - 92. PMID: 9709824

Gazzaniga, M.S. (2000). Cerebral specialization and interhemispheric communication: does the corpus callosum enable the human condition? Brain. Jul; 123 (Pt 7): 1293 - 326. DOI: org/10.1093/brain/123.7.1293

Gedela, R.K., Kirby, A., & Huhtala, H. (2008). Does the dominant hand possess 10% greater grip strength than the non-dominant hand? Indian Journal of Physiotherapy. Vol. 45, No 2 (March): 116 – 121.

Gilbert, L. (1998). Community pharmacy in South Africa: a changing profession in a society in transition. Health Place. Sep; 4(3): 273 - 85. PMID: 10670977

Giorgianni, S.J. (2002). Full preparation: the Pfizer guide to careers in pharmacy. New York: Pfizer Pharmaceuticals Group, Pfizer Inc.

Goto, A., Okuda, S., Ito, S., Matsuoka, L., Ito, E., Takahashi, A., & Sobue, G. (2009). Locomotion outcome in hemiplegic patients with middle cerebral artery infarction: the difference between right- and left-sided lesions. J Stroke Cerebrovasc Dis. Jan; 18(1): 60 - 7. DOI: 10.1016/j.jstrokecerebrovasdis.2008.09.003

Grant, S., Melmoth, D.R., Morgan, M.J., & Finlay, A.L. (2007). Prehension deficits in amblyopia. Invest Ophthalmol Vis Sci. Mar; 48(3): 1139 - 48. DOI: 10.1167/iovs.06-0976

Gray, A., Riddin, J., & Jugathpal, J. (2016). Health Care and Pharmacy Practice in South Africa. Can J Hosp Pharm. Jan-Feb; 69(1): 36 - 41. PMC 4777579

Grouios, G., Ypsilanti, A., & Koidou, I. (2013). Laterality Exposed: Atypical Hemispheric Dominance in Down Syndrome. INTECH Open Science / Open Minds. Aristotle University of Thessaloniki. Greece. DOI: org/10.5772/53829

Gupta, N., Sanyal, S., & Babbar, R. (2008). Sensory nerve conduction velocity is greater in left handed persons. Indian J Physiol Pharmacol. Apr-Jun; 52(2): 189 - 92. PMID:19130864

Guyton, A.C., & Hall, J.E. (13th Ed) ((2016). Textbook of Medical Physiology. USA. Elsevier. p 661.

Hagemann, D., Hewig, J., Seifert, J., Naumann, E., & Bartussek, D. (2005). The latent state-trait structure of resting EEG asymmetry: Replication and extension. Psychophysiology. Nov; 42(6): 740 – 752. DOI: 10.1111/j.1469-8986.2005.00367.x

Hall, R.E. (1982). The Importance of Lifetime Jobs in the U.S. Economy. The American Economic Review. Sept; 72(4): 716 – 724 DOI: 10.3386/w0560

Hardin, E.E., Donaldson, I., & James, R. (2014). Predicting job satisfaction: A new perspective on person-environment fit. Journal of Counseling Psychology. Oct; 61(4): 634 – 640. DOI: org/10.1037/cou0000039

Hartman, S.E. (1997). Personality, hemispheric dominance, and cognitive style. Journal of College Reading and Learning. March 22.
DOI: org/10.1080/10790195.1997.10850040

Hartman, S.E., Hylton, J., & Sanders, R.F. (1997). The influence of Hemispheric Dominance on Scores of the Myers – Biggs Type Indicator. Educational and Psychological Measurement. June; 57(3): 440 – 449.
DOI: 10.1177/0013164497057003005

Hashim, Y.A. (2010). Determining sufficiency of sample size in management survey research activities. International Journal of Organisational Management and Entrepreneurship. Vol. 6 (1), pp: 119 – 130.

Hassel, K. (2006). Destination, future intentions and views on practice of British-based pharmacists 5 and 10 years after qualifying. Pharm World Sci. Jun; 28(3): 116 - 22.
DOI: 10.1007/s11096-006-9007-9

Hawthorne, N., & Anderson, C. (2009). The global pharmacy workforce: a systematic review of the literature. Hum Resour Health. Jun 19; 7: 48. DOI: 10.1186/1478-4491-7-48

Hebbal, G.V., & Mysorekar, V.R. (2003). Anatomical and behavioural asymmetries in right and left handers from India. Ann Anat. Jun; 185(3): 267 - 75.
DOI: 10.1016/S0940-9602(03)80038-9

Hellige, J.B., Taylor, K.B., Lesmes, L., & Peterson, S. (1998). Relationships between brain morphology and behavioural measures of hemispheric asymmetry and interhemispheric interaction. Brain Cogn. Mar; 36(2): 158 - 92.
DOI: 10.1006/brcg.1997.0951

Helton, W. S., Kern, R.P., & Walker, D.R. (2009). Tympanic membrane temperature, exposure to emotional stimuli and the sustained attention to response tasks. J Clin Exp Neuropsychol. Jul; 31(5): 611 - 6. DOI: 10.1080/13803390802375565

Helton, W.S. (2010). The relationship between lateral differences in tympanic membrane temperature and behavioural impulsivity. Brain Cogn. Nov; 74(2): 75 – 8. DOI: 10.1016/j.bandc.2010.06.008

Helton, W.S., Carter, J.R., & Carter, J.R. (2011). The effects of investigator gender on lateral tympanic membrane temperature. Laterality. Mar; 16(2): 156 – 63. DOI: 10.1080/13576500903468896

Henderson, B.A., & Grimes, K.J. (2010). Blue-blocking IOLs: a complete review of the literature. Surv Ophthalmol. May-Jun; 55(3): 284 - 9. PMID: 20499436

Holtgraves, T., & Felton, A. (2011). Hemispheric asymmetry in the processing of negative and positive words: a divided field study. CognEmot. Jun; 25(4): 691-9. DOI: 10.1080/02699931.2010.493758

Hoptman, M.J., & Davidson, R.J. (1994). How and why do the two cerebral hemispheres interact? Psychol Bull. Sep; 116(2): 195 - 219. PMID: 7972590

Hovis, J.K., Lovasik, J.V., Cullen, A.P., & Kothe, A.C. (1989). Physical characteristics and perceptual effects of "blue-blocking" lenses. Optom Vis Sci. Oct; 66(10): 682 - 9. PMID: 2587033

Hubel, D.H., & Wiesel, T.N. (1965). Comparison of the effects of unilateral and bilateral eye closure on cortical unit responses in kittens. J Neurophysiol. Nov; 28(6): 1029 - 40. PMID: 5883730

Hubel, D.H., & Wiesel, T.N, (2005). Brain and visual perception: the story of a 25-year collaboration. Oxford University Press US. p. 106.

Huysamen, G.K. (1987). Introductory statistics and research design for the Behavioural Sciences. Volume 1. Bloemfontein: Huysamen.

Ida, Y., Dutta, T., & Mandal, M.K. (2001). Side bias and accidents in Japan and India. Int J Neurosci. 111(1-2): 89 - 98. PMID: 11913339

Jackson, S.R., Newport, R., & Shaw, A. (2002). Monocular vision leads to a dissociation between grip force and grip aperture scaling during reach-to-grasp movement. Curr Biol. Feb 5; 12(3): 237 - 40. PMID: 11839278

Jeeves, M.A., & Moes, P. (1996). Interhemispheric transfer time differences related to aging and gender. Neuropsychologia. Jul; 34(7): 627 - 36. PMID: 8783215

Johnson, S.B., Blum, R.W., & Giedd, J.N. (2009). Adolescent Maturity and the Brain: The Promise and Pitfalls of Neuroscience Research in Adolescent Health Policy. J Adolesc Health. Sep; 45(3): 216 – 221. DOI: 10.1016/j.jadohealth.2009.05.016

Johnson, S.J., O'Connor, E.M., Jacobs, S., Hassell, K., & Ashcroft, D.M. (2014). The relationship among work stress, strain and self-reported errors in UK community pharmacy. Res Social Adm Pharm. Nov – Dec; 10(6): 885 – 95. DOI: 10.1016/j.sapharm.2013.12.003

Jones, E.G., & Mendell, L.M. (1999). Assessing the Decade of the Brain. Science. Apr 30; 284(5415): 739. DOI: 10.1126/science.284.5415.739

Karelitz, A.Y. (2008). Faith and Trust. (1st Ed.). Israel: A.M Asafer

Kasprian, G., Langs, G., Brugger, P.C., Bittner, M., Weber, M., Arantes, M., & Player, D., (2011). The Prenatal Origen of Hemispheric Asymmetry: An In Utero Neuroimaging Study. Cereb Cortex. 21(5): 1076 – 1083. DOI: org/10.1093/cercor/bhq179

Keary, C.J., Minshew, N.J., Bansal, R., Goradia, D., Fedorov, S., Keshavan, M.S., & Hardan, A.Y. (2009). Corpus callosum volume and neurocognition in autism. J Autism Dev Disord. Jun; 39(6): 834 - 41. DOI: 10.1007/s10803-009-0689-4

Kedziora, D.J., Abeysuriya, R.G., Phillips, A.J., & Robinson, P.A. (2012). Physiologically based quantitative modelling of unihemispheric sleep. J Theor Biol. Dec 7; 314: 109 - 19. DOI: 10.1016/j.jtbi2012.08.031

Kensinger, E. A., & Choi, E.S. (2009). When Side Matters: Hemispheric Processing and the Visual Specificity of Emotional Memories. Journal of Experimental Psychology: Learning, Memory, and Cognition. 35(1); 247 – 253. DOI: 10.1037/a0013414

Kerlinger, F.N. (1986). Foundations of Behavioural Research. (3rdEd.). New York: Holt, Rinehard and Winston.

Koda-Kimble, M.A., Herfindal, E.T., Shimomura, S.K., Adler, D.S., & Bernstein, L.R. (1985). Practice patterns, attitudes, and activities of University of California Pharm. D. graduates. Am J Hosp Pharm. Nov; 42(11): 2463 - 71. PMID: 4073063

Krejcie, R.V., & Morgan, D.W. (1970). Determining sample size for research activities. Educational and Psychological Measurement. 30: 607 – 10.

Kreling, D.H., Doucette, W.R., Mott, D.A., Gaither, C.A., Pedersen, C.A., & Schommer, J.C. (2006). Community pharmacists' work environments: evidence from the 2004 National Pharmacist Workforce Study. J Am Pharm Assoc. 2006 May-Jun; 46(3): 331 - 9. PMID: 16739754

Kucharska-Pietura, K. (2006). Disordered emotional processing in schizophrenia and one sided brain damage. Prog Brain Res. 156: 467 - 79. DOI: 10.1016/S0079-6123(06)56026-1

Kumar, V., & Sharma, R.R.K. (2016). Relating Left/Right Brained Dominance Types of Leaders to TQM Focus: A Preliminary Study. Conference on Industrial Engineering and Operations Management. March 8 – 10.

Laloo, U.G., Bobat, R.A., Pillay, S., & Wassenaar, D. (2014). A Strategy for Developing Future Academic Leaders for South Africa in a Resource-Constrained Environment. Acad Med. Aug; 89(8 O): 855 – 859. DOI: 10.1097/ACM.0000000000000354

Lapane, K.L., & Hughes, C.M. (2006). Job satisfaction and stress among pharmacists in the long-term care sector. Consult Pharm. Apr; 21(4): 287 - 92. DOI: org/10.4140/TCP.n.2006.287

Lawrence, A. (1994) The relationship of handedness to depression in male and female college students. APA Psyc Net. Apr; 16(4): 537 – 541. DOI: org/10.1016/0191-8869(94)90181-3

Lea, V.M., Corlett, S.A., & Rogers, R.M. (2012). Workload and its impact on community pharmacists' job satisfaction and stress: a review of the literature. Int J Pharm Pract. Aug; 20(4) 259 – 71. DOI: 10.1111/j.2042-7174.2012.00192.X

Leary, M.R. (1995). Introduction to Behavioral Research Methods. (2nd Ed). Pacific Grove, CA: Brooks/Cole Publishing Company.

Leavengood, A., & Weekes, N.Y. (2000). The association between stress, hemispheric specialization, and callosal interactions. Brain Cogn. Jun-Aug; 43(1-3): 306 - 10. PMID: 10857714

Lee, S., Oh, S., Yu, S.J., Lee, K., Son, S., Kwon, Y.H., & Kim, Y. (2016). Association between brain lateralization and mixing ability of chewing side. Journal of Dental Science. DOI: org/10.1016/j.jds.2016.09.004

Leece, P., Bhandari, M., Sprague, S., Swiontkowski, M.F., Schemitsch, E.H., Tornetta, P., Devereaux, P.J., & Guyatt, G.H. (2004). Internet versus mailed questionnaires: a controlled comparison (2). J Med Internet Res. Oct 29; 6(4):e39. DOI: 10.2196/jmir.6.4.e39

Levinthal, C.F. (1983). Introduction to Physiological Psychology . (2nd Ed). New Jersey: Prentice – Hall.

Lindblom, K.M., Linton, S.J., Fedeli, C., & Bryngelsson, I.L. (2006). Burnout in the working population: relations to psychosocial work factors. Int J Behav Med. 13(1): 51 - 9.

DOI: 10.1207/s15327558ijbm1301.7

Lindell, A.K. (2013). Continuities in Emotion Lateralization in Humans and Non-Human Primates. Front Hum Neurosci. Aug 8; 7: 464. DOI: 10.3389/fnhum.2013.00464

Lindell, A.K., & Savill, N.J. (2010). Time to turn the other cheek? The influence of left and right poses on perceptions of academic specialisation. Laterality. Nov; 15(6): 639 – 50. DOI: 10.1080/13576500903201784

Loftus, A., Servos, P., Goodale, M.A., Mendarozqueta, N., & Mon-Williams, M. (2004). When two eyes are better than one in prehension: monocular viewing and end-point variance. Exp Brain Res. Oct; 158(3): 317 - 27. DOI: 10.1007/s00221-004-1905-2

Lombardi, D., & Sinatra, G.M. (2013). Emotions about Teaching about Human-Induced Climate Change. International Journal of Science Education. Nov 05; 35(1): 167 – 191. DOI: org/10.1080/09500693.2012.738372

Lonie, J.M. (2006). From counting and pouring to caring: the empathic developmental process of community pharmacists. Res Social Adm Pharm. Dec: 2(4): 439 - 57. DOI: 10.1016/jsapharm.2006.01.002

Lyamin, O., Pryaslova, J., Kosenko, P., & Seigel, J. (2007). Behavioural aspects of sleep in bottlenose dolphin mothers and their calves. Physiol Behav. Nov 23; 92(4): 725 - 33. DOI: 10.1016/j.physbeh.2007.05.064

Mak, P.W., & Singleton, J. (2017). Burning questions: Exploring the impact of natural disasters on community pharmacies. Research in Social & Administrative Pharmacy. Jan – Feb; 13(1): 162 – 171. DOI: org/10.1016/jsapharm.2015.12.015

Malangu, N. (2014). The Future of Community Pharmacy Practice in South Africa in the Light of the Proposed New Qualification for Pharmacists: Implications and Challenges. Glob J Health Sci. Nov; 6(6): 226 – 233. DOI: 10.5539/gjhs.v6n6p226

Mandal, M.K. Saur, D., & Bhattacharya, T. (2001). Side bias and accidents: are they related? Int J Neurosci. Jul; 109(1-2): 139-46.

Martin, W.L., & Porac, C. (2007). Patterns of handedness and footedness in switched and nonswitched Brazilian left – handers: cultural effects on the development of lateral preferences. Dev. Neuropsychol. 31 (2): 159 – 79. DOI: 10.1080/565640701190734

Mavis, B.E., & Brocato, J.J. (1998). Postal surveys versus electronic mail surveys. The tortoise and the hare revisited. Eval Health Prof. Sep; 21(3): 395 - 408. DOI: 10.1177/016327879802100306

Mazerolle, E.L., D'Arcy R.C., & Beyea, S.D. (2008). Detecting functional magnetic resonance imaging activation in white matter: interhemispheric transfer across the corpus callosum. BMC Neurosci. Sep 12; 9: 84. DOI: 10.1186/1471-2202-9-84

McCann, L., Hughes, C.M., Adair, C.G., & Cardwell, C. (2009). Assessing job satisfaction and stress among pharmacists in Northern Ireland. Pharm World Sci. Apr; 31(2): 188 - 94. DOI: 10.1007/s11096-008-9277-5

McManus, C. (2002). Right hand, left hand. The Origins of Asymmetry in Brains, Bodies, Atoms and Cultures. London: Weidenfeld and Nicolson.

Mendez, M.F., & Lim, G.T. (2004). Alterations of the sense of "humanness" in right hemisphere predominant frontotemporal dementia patients. Cogn Behav Neurol. Sep; 17(3): 133 - 8. PMID: 15536300

Miller, N.B., Valsangkar-Smyth, M., Newman, S., Dumont, H., & Wolford, G. (2005). Brain activations associated with probability matching. Neuropsychologia. Apr; 43(11): 1598 - 608. DOI: 10.1016/j.neuropsychologia.2005.01.021

Mintzberg, H. (1976). Planning on the left side and managing on the right. Harvard Business Review. Jul; 49-58. org/1976/07/planning-on-the-left-side-and-managing-on-the-right.

Mneimne, M., Powers, A.S. Walton, K.E., Kosson, D.S., Fonda, S., & Simonetti, J. (2010). Emotional valence and arousal effects on memory and hemispheric asymmetries. Brain Cogn. Oct: 74(1): 10 - 7. DOI: 10.1016/j.bandc.2010.05.011

Modipa, S.I., & Dambisya, Y.M. (2008). Profile and career preferences of pharmacy students at the University of Limpopo, Turfloop Campus, South Africa. Educ Health (Abingdon). Dec; 21(3): 164. PMID: 19967636

Mooshagian, E., Iacoboni, M., & Zaidel, E. (2009). Spatial attention and interhemispheric visuomotor integration in the absence of the corpus callosum. Neuropsychologia. Feb; 47(3): 933 -7. DOI: 10.1016/j.neuropsychologia.2008.12.005

Morris, M.H. (2015). Entrepreneurship as Experience. Wiley Encyclopedia of Management. Jan 21; 3. DOI: 10.1002/9781118785317.weom030039

Mott, D.A., Doucette, W.R., Gaither, C.A., Pedersen, C.A., & Schommer, J.C. (2003). Pharmacist's attitudes towards worklife: results from a national survey of pharmacists. J Am Pharm Assoc. May-Jun; 44(3): 326 - 36. PMID: 15191243

Muhammad, P.J. (2016). The Parents' Parenting Patterns, Education, Jobs, and Assistance to Their Children in Watching Television, and Children's Aggressive Behaviour. International Education Studies. 9(2): 89 – 94. ERIC number: EJ1093373

Muijrers, P.E., Knottnerus, J.A., Sijbrandij, J., Janknegt, R., & Grol, R.P. (2004). Pharmacists in primary care. Determinants of the care-providing function of Dutch community pharmacists in primary care. Pharm World Sci. Oct; 26(5): 256 - 62. DOI: 10.1023/B:PHAR.0000042866.39002.d5

Nielsen, J.A., Zielinski, B.A., Ferguson, M.A., Lainhart, J.E., & Anderson, J.S. (2013). An Evaluation of the Left-Brain vs. Right-Brain Hypothesis with Resting State Functional Connectivity Magnetic Resonance Imaging. PLoS ONE 8(8): e71275 DOI: 10.1371/journal.pone.0071275

O'Hara, G.L., Kirk, K.W., & Sperandio, G.J. (1978). Perceived benefits of the Pharm D as a second pharmacy degree. Am J Hosp Pharm. Apr; 35(4): 423 - 5. PMID: 645713

O'Neill, J.L., & Gaither, C.A. (2007). Investigating the relationship between the practice of pharmaceutical care, construed external image, organizational identification, and job turnover intention of community pharmacists. Res Social Adm Pharm. Dec; 3(4): 438 - 63. DOI: 10.1016/j.sapharm.2006.10.006

O'Shea, T. (2014). Career Paths for a Graduating PharmD. Pharmacy Times. October 13.

Ocklenburg, S., Korte, S.M., Peterburs, J., Wolf, O.T., & Gunturkun, O. (2016). Stress and laterality – The comparative perspective. Physiol Behav. Oct 1; 164(Pt A): 321 – 9. DOI: 10.1016/j.physbeh.2016.06.020.

Ofte, S.H. (2002). Right-left discrimination: effects of handedness and educational background. Scand J Psychol. Jul; 43(3): 213 - 9. PMID: 12184476

Ofte, S.H., & Hugdahl, K. (2002). Right-left discrimination in male and female, young and old subjects. J Clin Exp Neuropsychol. Feb; 24(1): 82 - 92. DOI: 10.1076/jcen.24.1.82.966

Ohlsson, J. (2005). Defining amblyopia: the need for a joint classification. Strabismus. Mar; 13(1): 15 - 20. DOI: 10.1080/09273970590890949

Oldfield, E. (2015). Clinical Empathy Key to Pharmacist-Patient Interactions. Pharmacy Times. March 19.

Oliver, P. (2004). Writing Your Thesis. London: Sage Publications.

Olson, D.S., & Lawson, K.A. (1996). Relationship between hospital pharmacist's job satisfaction and involvement in clinical activities. Am J Health Syst Pharm. Feb 1; 53(3): 281 - 4. PMID: 8808024

Packwood, E.A., Cruz, O.A., Rychwalski, P.J., & Keech, R.V. (1999). The psychosocial effects of amblyopia study. J AAPOS. Feb; 3(1): 15 - 7. PMID: 10071896

Parker, S.K. (2014). Beyond motivation: job and work design for development, health, ambidexterity, and more. Annu Rev Psychol. 65: 661 – 91.
DOI: 10.1146/annurev-psych-010213-115208

Parr, L.A., & Hopkins, W.D. (2000). Brain temperature asymmetries and emotional perception in chimpanzees, Pan troglodytes. Physiol Behav. Nov 1-15; 71(3-4): 363 - 71.
PMID: 11150569

Patz, J.A., Campbell-Lendrum, D., Holloway, T., & Foley, J.A. (2005). Impact of regional climate change on human health. Nature. Nov; 438: 310 – 317.
DOI: 10.1038/nature04188

Perry, R.J., Rosen, H.R., Kramer, J.H., Beer, J.S., Levinson, R.L., & Miller, B.L. (2001). Hemispheric dominance for emotions, empathy and social behaviour: evidence from right and left handers with frontotemporal dementia. Neurocase. 7(2): 145 - 60.
DOI: 10.1093/neucas/7.2.145

Porac, C. (2009). Hand preference and skilled hand performance among individuals with successful rightward conversions of the writing hand. Laterality. Mar; 14(2): 105 – 21. DOI: 10.1080/13576500802299418

Potter, V., (2008). Integrative Thinking Using the Head and the Heart. OpenStax-CNX. Apr 9. Version 1.2

Propper, R.E., Brunye, T.T., Christman, S.D., & Bologna, J. (2010). Negative emotional valence is associated with non-right-handedness and increased imbalance of hemispheric activation as measured by tympanic membrane temperature. J Nerv Ment Dis. Sep; 198(9): 691 - 4. DOI: 10.1097/NMD.0b013e3181ef1f35

Propper, R.E., Januszewski, A., Christman, S.D., & Brunye, T.T. (2011). Increased anger is associated with increased hemispheric asymmetry: support for anger-tympanic membrane relationships. J Nerv Ment Dis. Sep; 199(9): 716 - 20. DOI: 10.1097/NMD.0b013e318229d95a

Quandt, W.G., & McKercher, P.L. (1982). Perceptions of work among men and women pharmacists in nonadministrative positions. Am J Hosp Pharm. Nov; 39(11): 1948 - 51. PMID: 7148868

Quaranta, A., Siniscalchi, M., & Vallortigara, G. (2007). Asymmetric tail-wagging responses by dogs to different emotive stimuli. Curr. Biol. 17, R199-R201. DOI: 10.1016/j.cub.2007.02.008.

Rastad, C., Ulfberg, J., & Lindberg, P. (2008). Light room therapy effective in mild forms of seasonal affective disorder – a randomized controlled study. J Affect Disord. Jun; 108(3): 291 - 6. DOI: 10.1016/j.jad.2007.10.009

Raziano, D.B., Jayadevappa, R., Valenzula, D., Weiner, M., & Lavizzo-Mourey, R. (2001). E-mail versus conventional postal mail survey of geriatric chiefs. Gerontologist. Dec; 41(6): 799 - 804. PMID: 11723348

Reber, A.S., Allen, R., & Reber, E.S. (2009). (4th Ed). Dictionary of Psychology. New York: Viking Penguin.

Reid, L. D., & McGhan, W.F. (1986). Pharm D or BS: does the degree really make a difference in pharmacist's job satisfaction? Am J Pharm Educ. Spring; 50(1): 1 - 5. PMID: 10281554

Reynolds, J.E.F. (1996). Martindale. The Extra Pharmacopoeia. (31st Ed). London: The Pharmaceutical Press.

Robson, C. (1993). Real World Research: A Resource for Social Scientists and Practitioner-Researchers. Malden, MA: Blackwell Publishers, Inc.

Rogers, L.J. (2003). Seeking the Right Answers About Right Brain-Left Brain. The DANA Foundation. Wednesday. October 01.

Root, T.L., Price, J.T., Hall, K.R., Schneider, S.H., Rosenzweig, C., & Pound, J.A. (2003). Fingerprints of global warming on wild animals and plants. Nature 421, Jan. 57 - 60. DOI: 10.1038/nature01333

Rossi, P.H., Wright, J.D., & Anderson, A.B. (1983). Handbook of Survey Research. San Diego, CA: Academic Press, Inc.

Rothmann, S., & Malan, M. (2011). Work-related well-being of South African hospital pharmacists. SA Journal of Industrial Psychology. Jan; 37(1). DOI: 10.4102/sajip.v37i1.895

Sajatovic, M., Hatters-Friedman, S., & Schuermeyer, I. (2004). Women in the Health Professions. Encyclopaedia of Women's Health. USA. Springer. pp 7 – 9. DOI: 10.1007/978-0-306-48113-0_3

Sakai, M., Hishii, T., Takeda, S., & Kohshima, S. (2006). Laterality of flipper rubbing behaviour in wild bottlenose dolphins (Tursiops aduncus): caused by asymmetry of eye use? Behav Brain Res. Jun 30; 170(2): 204 - 10. DOI: 10.1016/j.bbr.2006.02.018

Sathiamoorthy, A., & Sathiamoorthy, S.S. (1990). Limb dominance and motor conduction velocity of median and ulnar nerves. Indian J Physiol Pharmacol. Jan; 34(1): 51 - 3. PMID: 2361726

Sauerwein, H.C., & Lassonde, M. (1994). Cognitive and sensori-motor functioning in the absence of the corpus callosum: neuropsychological studies in callosal agenesis and callosotomized patients. Behav Brain Res. Oct 20; 64(1-2): 229 - 40. PMID: 7840889

Savage, L.M., Beall, J.W., & Woolley, T.W. (2009). Factors that influence the career goals of pharmacy students. Am J Pharm Educ. Apr 7; 73(2): 28. PMID: 19513167

Scahill, S., Harrison, J., & Sheridan, J. (2010). Pharmacy under the spotlight: New Zealand pharmacist's perceptions of current and future roles and the need for accreditation. Int J Pharm Pract. Feb; 18(1): 59 - 62. DOI: 10.1211/ijpp.18.01.0010

Schaafsma, S.M., Riedstra, J.B., Pfannkuche, K.A., Bouma, A., & Groothuis, G.G.T. (2009). Epigenesis of behavioural lateralization in humans and other animals. Phil Trans R Soc. B 364, 915 – 927. DOI: 10.1098/rstb.2008.0244

Schiffer, F., Anderson, C.M., & Teicher, M.H. (1999). Electroencephalogram, bilateral ear temperature, and affect changes induced by lateral visual field stimulation. Compr Psychiatry. May-Jun; 40(3): 221 - 5. DOI: org/10.1016/s0010-440X(99)90007-X

Schommer, J.C., Brown, L.M., & Sogol, E.M. (2007). Career Pathway Evaluation Program 2007. Pharmacist Profile Survey. June.

Seguin, R., Godwin, M., MacDonald, S., & McCall, M. (2004). E-mail or snail mail? Randomized controlled trial on which works better for surveys. Can Fam Physician. Mar; 50: 414 - 9. PMID: 15318679

Serino, A., De Filippo, L., Casavecchia, C., Coccia, M., Shiffrar, M., & Ladavas, E. (2010). Lesions to the Motor System Affect Action Perception. J Cogn Neurosci. Mar 22(3): 413 - 26. DOI: 10.1162/jocn.2009.21206

Shi, H., Yang, X., Wang, J., Xi, H., Huang, C., He, J., Chu, M., & Zhuang, G. (2013). Type A personality, hostility, time urgency and unintentional injuries among Chinese undergraduates: a matched case-control study. BMC Public Health. Nov 12; 13: 1066.

DOI: 10.1186/1471-2458-13-1066

Shoaf, P.R., & Gagnon, J.P. (1980). A comparison of female and male pharmacists' employment benefits, salary, and job satisfaction. Contemp. Pharm Pract. Winter; 3(1): 47 - 51. PMID: 10245112

Shobe, E., & Desimone, K. (2015). Inconsistent handers show higher psychopathy than consistent handers. Laterality. Oct; 21(2): 143 – 160. DOI: org/10.1080/1357650X.2015.1089879

Shorter Oxford English Dictionary on Historical Principles. (2007). (6th Ed) Vol. 2 Oxford University Press Inc. New York.

Siengthai, B., Kritz-Silverstein, D., & Barrett-Connor, E. (2008). Handedness and cognitive function in older men and women: a comparison of methods. J Nutr Health Aging. Nov; 12(9): 641 - 7. PMID: 18953462

Silberman, E.K., & Weingartner, H. (1986). Hemispheric lateralization of functions related to emotion. Brain Cogn. Jul; 5(3): 322 - 53. PMID: 3530287

Smith, J.L., & Bryant, F.B. (2012). Are we having fun yet? Savoring, Type A behaviour, and vacation enjoyment. International Journal of Wellbeing. 3(1): 1 – 19. DOI: 10.5502/ijw.v3i1.1

Soares, J.J., Grossi, G., & Sundin, O. (2007). Burnout among women: associations with demographic/socio-ecomonic, work, life-style and health factors. Arch Womens Ment Health. 10(2): 61 - 71. DOI: 10.1007/s00737-007-0170-3

Sperry, R.W. (1974). Lateral specialization in the surgically separated hemispheres. In F. Schmitt & F. Worden (Eds.). The Neurosciences: Third study program. Cambridge, Massachusetts: The MIT Press. pp 5 - 19.

Spivak, B., Segal, M., Mester, R., & Weizman, A. (1998). Lateral preference in post-traumatic stress disorder. Psychol Med. Jan; 28(1): 229 - 32. PMID: 9483701

Spreng, R.N., Rosen, H.J., Strother, S., Chow, T.W., Diehl,-Schmid, J., Freedman, M., Graff-Radford, N.R., Hodges, J.R., Lipton, A.M., Mendez, M.F., Morelli, S.A., Black, S.E., Miller, B.L., & Levine, B. (2010). Occupation attributes related to location of atrophy in frontotemporal lobar degeneration. Neuropsychologia. Oct; 48(12): 3634 – 41. DOI: 10.1016/j.neuropsychologia.2010.08.020

Spurk, D., Kauffeld, S., Meinecke, A.L., & Ebner, K. (2015). Why Do Adaptable People Feel Less Insecure? Indirect Effects of Career Adaptability on Job and Career Insecurity via Two Types of Perceived Marketability. Journal of Career Assessment. April 12; 24(2): 289 – 306.

Stevens, A.H. (2005). The More Things Change, The More They Stay the Same: Trends in Long-term Employment in the United States, 1969-2002. National Bureau of Economic Research. Working Paper No. 11878. Dec. DOI: 10.3386/w11878

Stout, J.H. (2000). The Human Handbook. Virtualis. Viewed at http://stout.mybravenet.com/public_html/h/>

Strong, R.E., Marchant, B.K., Reimherr, F.W., Williams, S., Soni, P., & Mestas, R. (2009). Narrow-band blue-light treatment of seasonal affective disorder in adults and the influence of additional nonseasonal symptoms. Depress Anxiety. 26(3): 273 - 8. DOI: 10.1002/da.20538

Sullivan, R.M. (2004). Hemispheric asymmetry in stress processing in rat prefrontal cortex and the role of mesocortical dopamine. Stress. Jun; 7(2): 131 - 43. DOI: 10.1080/10253890410001679310

Suskie, L.A. (1996). Questionnaire Survey Research: What Works. Tallahassee, FL: Association for Institutional Research.

Swedo, S.E., Allen, A.J., Glod, C.A., Clark, C.H., Teicher,, M.H., Richter, D., Hoffman, C., Hamburger, S.D., Dow, S., Brown, C., & Rosenthal, N.E. (1997). A controlled trial of

light therapy for the treatment of pediatric seasonal affective disorder. J Am Acad Child Adolesc Psychiatry. Jun; 36(6): 816 - 21.
DOI: 10.1097/00004583-199706000-00019

Tan. U. (1993). Sensory nerve conduction velocities are higher on the left than the right hand and motor conduction is faster on the right hand than the left in right-handed normal subjects. Int J Neurosci. Nov; 73(1-2): 85 - 91. PMID: 8132422

Tandon, P.N. (2000). The decade of the brain : a brief review. Neurol India. 48(3): 199 – 207.

Tavor, I., Jones, O.P., Mars, R.B., Smith, S.M., Behrens, T.E., & Jbabdi, S. (2016). Task-free MRI predicts individual differences in brain activity during task performance. Science. Apr 08: Vol 352 Issue 6282; 216 – 220. DOI: 10.1126/science.aad8127

Taylor, S.J., Maharaj, P., Williams, K., & Sheldrake, C. (2009). Pharmacy student's intention to practise in a rural setting: measuring the impact of a rural curriculum, rural campus and rural placement on a predominantly metropolitan student cohort. Aust J Rural Health. Dec; 17(6): 305 - 9. DOI: 10.1111/j.1440-1584.2009.01102x

Tekin, A.K., & Kotaman, H. (2013). The Epistemological Perspectives on Action Research. Journal of Educational and Social Research. Jan; 3(1): 81 – 91.
DOI: 10.5901/jesr.2013.v3n1p81

Terroni, L., & Fraguas, R. (2010). Depression affecting moral judgment. Behavioural and Brain Sciences. Aug; 33(4): 352. DOI: org/10.1017/S0140525X10001895

The South African Pharmacy Council. (2013). Statistics for registered persons and organisations. Viewed at http://www.pharmcouncil.co.za/B_Statistics.asp

Tiwari, G., & Mandal, M.K. (1998). Side bias in schizophrenia: hand, foot, eye and ear. J Gen Psychol. Jan; 125(1): 39 - 46. DOI: 10.1080/00221309809595575

Tompkins, C.A., & Flowers, C.R. (1985). Perception of emotional intonation by brain-damaged adults: the influence of task processing levels. J Speech Hear Res. Dec; 28(4): 527-38. PMID: 4087888

Tooley, P. (1971). Food and Drugs. London: John Murray Ltd.

Trease, G.E., & Evans, W.C. (1980). Pharmacognosy (11th Ed). London: Macmillan Ltd.

Ugwu, F.O., Onvishi, I.E., Ugwu, C., & Onvishi, C.N. (2015). Type A Behavior pattern, accident optimism and fatalism: an investigation into non-compliance with safety work behaviors among hospital nurses. Int J Occup Saf Ergon. 21(4): 464 – 70. DOI: 10.1080/10803548.2015.1085165

Uijl, S.G., Leijten, F.S., Arends, J.B., Parra, J., van Huffelen, A.C., van Rijen, P.C., & Moons, K.G. (2009). The intracarotid amobarbital or Wada test: unilateral or bilateral? Acta Neurol Scand. Mar; 119(3): 199 - 206. DOI: 10.1111/j.1600-0404.2008.01079.x

Van Assche, E., De Backer, J., & Vermote, R. (2015). Music therapy and depression. Tijdschr Psychiatr. 57(11): 823 - 9. PMID: 26552929

Watanabe, T., Ohtani, Y., Yamamoto, T., Nemoto, Y., Ida, Y., & Bachynsky, J.A. (2005). The case for a shift in pharmacist's activities and education. Yakugaku Zasshi. Mar; 125(3): 283 - 92. PMID: 15738627

Westrin, A., & Lam, R.W. (2007). Long-term and preventative treatment for seasonal affective disorder. CNS Drugs. 21(11): 901 - 9. DOI: 10.2165/00023210-200721110-00003

Wineman, N., & Fisher, E.M. (2009). Conceptualizing compensatory responses: Implications for treatment and research. Biol Res Nurs. Apr; 10(4): 400 - 8. DOI: abs/10.1177/1099800408324612

Witterman, J., van Lizendoom, M.H., van de Velde, D., van Heuven, V.J., & Schiller, N.O. (2011). The nature of hemispheric specialization for linguistic and emotional prosodic perception: a meta – analysis of the lesion literature. Neuropsychologia. Nov; 49(13): 3722 – 38. DOI: 10.1016/j.neuropsychologia.2011.09.028

Wong, C.W. (2000). Corpus callosum and cerebral laterality in a modular brain model. Med Hypotheses. Aug; 55(2): 177 - 82. DOI: 10.1054/mehy.1999.0934

Woodward, J.M., & Chen, I.C. (1994). Effect of "mood of the day" on pharmacists' job and career satisfaction. Psychol Rep. Apr; 74(2): 393-4.

Zgarrick, D.P., & MacKinnon, G.E. (1998). Motivations and practice-area preferences of pharmacists interested in pursuing a Pharm D degree through a non-traditional program. Am J Health Syst Pharm. Jun 15; 55(12): 1281 - 7. PMID: 9640468

Zucca, P., Baciadonna, L., Masci, S., & Mariscoli, M. (2011). Illness as a source of variation of laterality in lions (Panthera leo). Laterality. May; 16(3): 356 - 66. DOI: 10.1080/13576501003690025

APPENDICES

A. Covering Letter

FACULTY *of* NATURAL SCIENCES

School of Pharmacy

UNIVERSITY *of the* WESTERN CAPE

Dear Pharmacist,

I am a PhD student, Student Number 2835047, with the Department of Pharmacy Practice, School of Pharmacy, Faculty of Natural Sciences, University of the Western Cape. My mentor for this PhD is the discipline head, Prof Nadine Butler.

The research I am undertaking will investigate the relationship between the Brain Laterality of the pharmacist and the best environment a pharmacist should ideally work in. This research will be conducted both in South Africa and England. If you are willing to participate in this research study, you would be required to fill in a questionnaire which should take not more than 15 min. of your time. Brain Laterality is involved with the brain being divided into two halves but connected. From birth one side starts to play a dominant roll with the consequences of different behaviour and approach to the world of the individual. The different developed behaviour is normal for that persons developed brain laterality.

This research will use the ear, eye, hand and foot preferences to determine the brain laterality of the pharmacist and how this can help in putting the pharmacist in their correct work environment, which would only strengthen the pharmacy profession. Your name and the address of the pharmacy will not be recorded, only whether the pharmacy is in South Africa or England, thus the questionnaire will be totally anonymous. Should you be interested, the results of this research will be made available once the study is completed. I hope you enjoy filling in the questionnaire for this useful and important investigation. On completion of the questionnaire, please return it, with this letter, in the supplied envelope.

Thank you in anticipation for your participation.

Many thanks,

Bernard Symon

MSc (Psychology)(Leicester U)., Honours BSc (Psychology)(UNISA)., B.PHARM., BSc (Microbiology & Botany)(Rhodes U).

B. Permission to do the research by the pharmacist

I……(PRINT NAME) am willing to participate in the research study investigating Brain Laterality.

Signature: ……..
Date: ……..

C. Questionnaire

Pharmacists Brain Laterality Study

By Bernard Symon

MSc (Psychology) (Leicester U)., Honours BSc (Psychology) (UNISA).,

B.PHARM., BSc (Microbiology & Botany) (Rhodes U).

Mentor Prof. Nadine Butler

Please tick the appropriate box:

Section A: General

1. What is your age range?

20 – 25 years	❑		51 – 55 years	❑
26 – 30 years	❑		56 – 60 years	❑
31 – 35 years	❑		61 – 65 years	❑
36 – 40 years	❑		66 – 70 years	❑
41 – 45 years	❑		71 – 75 years	❑
46 – 50 years	❑		76 – 80 years	❑

2. Gender?	Male	❑	Female	❑
3. Are you 100% deaf in one or both ears?	Yes	❑	No	❑
4. Do you have an eye problem eg. 100% blind in an eye?	Yes	❑	No	❑
5. Do you need to wear glasses or contact lenses all the time?	Yes	❑	No	❑
6. Do you need to wear glasses for reading only?	Yes	❑	No	❑
7. Do you need to wear glasses for distant situations only?	Yes	❑	No	❑

8. Which area of pharmacy do you <u>prefer</u> to work in?

Retail	❑
Hospital	❑
Research	❑
Production	❑
Quality Control	❑

Documentation	❑
Education	❑
Other (State) ……	

9. Which area of pharmacy do you work in?

Retail	❑
Hospital	❑
Research	❑
Production	❑
Quality Control	❑

Documentation	❑
Education	❑
Other (State) …….	

10. How long have you been in your current position? ……

11. How long have you worked as a pharmacist? ……....

12. How many different pharmacy positions have you had since qualifying? …….

13. At which University or Institution did you graduate? …….

14. Where do you live and work?

United Kingdom	❑		South Africa	❑

15. Do you have your own pharmacy business or work for someone else?

Own business	❑		Work for someone	❑

16. What is your highest qualification in pharmacy? …….

17. On a scale of 0-10 with 10 being the maximum, how much do you enjoy your work? (Please circle)

1 2 3 4 5 6 7 8 9 10

Section B Brain Laterality Summary

1. Which ear do you prefer to use on the telephone? Right ❑ Left ❑
2. Which eye do you prefer to use when looking down a microscope? Right ❑ Left ❑
3. Are you left or right handed? Right ❑ Left ❑
4. Are you left or right footed? Right ❑ Left ❑

Section C Expanded Brain laterality Determination

With which hand would you throw a ball to hit a target?	Right	❑	Both	❑	Left	❑
With which hand do you draw?	Right	❑	Both	❑	Left	❑
With which hand do you use an eraser on paper?	Right	❑	Both	❑	Left	❑
With which hand do you remove the top card when dealing?	Right	❑	Both	❑	Left	❑
With which foot do you kick a ball?	Right	❑	Both	❑	Left	❑
If you want to pick up a pebble with your toes, which foot would you use?	Right	❑	Both	❑	Left	❑
If you had to step up onto a chair, which foot would you place on the chair first?	Right	❑	Both	❑	Left	❑
Which eye would you use to peep through a keyhole?	Right	❑	Both	❑	Left	❑
If you had to look into a dark bottle to see how full it was, which eye would you use?	Right	❑	Both	❑	Left	❑
Which eye would you use to sight down a rifle?	Right	❑	Both	❑	Left	❑
If you wanted to listen in on a conversation going on behind a closed door, which ear would you place against the door?	Right	❑	Both	❑	Left	❑
If you wanted to hear someone's heartbeat, which ear would you place against their chest?	Right	❑	Both	❑	Left	❑
Into which ear would you place the earphone of an old transistor radio?	Right	❑	Both	❑	Left	❑

Section D Further Investigation

1. Do you think pharmacists have a role to play in preventing global warming? Yes ❑ No ❑
2. Will Global Warming affect the future drug supply? Yes ❑ No ❑
3. Do you tend to rush through your work or do it slowly? Rush ❑ Slow ❑

D. Marking the questionnaire using nominal numbers

Section A:

1. Age range.
    a) 20-25 years = 1
    b) 26-30 years = 2
    c) 31-35 years = 3
    d) etc.
2. Gender.
    a) Male = 1
    b) Female = 2
3. If both question 3 and 4 were answered YES the questionnaire was rejected.
4. However, if either of the questions was answered YES the questionnaire was used.

    NO = 2 and YES = 1
5. The wearing of glasses YES = 1 NO = 2
6. Wear glasses for reading only YES = 1 NO = 2
7. Wear glasses for distant situations only YES = 1 NO = 2
8. Prefer to work in.
    a) Retail = 1
    b) Hospital = 2
    c) Research = 3
    d) Production = 4
    e) Quality Control = 5
    f) Documentation = 6
    g) Education = 7
    h) Other = 8

i) Multiple work areas = 9

9. Work in.

a) Same as 8 above.

10. The no. of years worked. eg. 3 years = 3

11. Same as 10 above

12. No. of jobs equals the nominal value.

13. Technikon = 1 Universities = 2

14. United Kingdom = 1 South Africa = 2

15. Work for someone = 1 Own Business = 2

16. Diploma in Pharmacy = 1 Bachelor and Honours Bachelor = 2 Masters = 3 PhD level = 4

17. As chosen

Section B:

1. R or L
2. R or L
3. R or L
4. R or L

This produced 16 groups and each group was numbered with a nominal number as follows:-

RRRR = 1; RRRL = 2; RRLR = 3; RRLL = 4;

RLRR = 5; RLRL = 6; RLLR = 7; RLLL = 8;

LRRR = 9; LRRL = 10; LRLR = 11; LRLL = 12;

LLRR = 13; LLRL = 14; LLLR = 15; LLLL = 16.

Section C:

Continuum produced using nominal numbers. Right = +1; Both = 0; Left = -1. To find the place on the continuum for each pharmacist, the values were added up on each questionnaire and a value between -13 and +13 was recorded.

Section D:

1. YES = 1 NO = 0
2. YES = 1 NO = 0
3. Slow = 1 Rush = 2

E. Wearing of glasses

If any of the questions had an answer of YES, a nominal value of 1 was given. Thus the nominal range value to the 3 questions was 3 - 6. If glasses were not used at all, the total of the 3 questions would give a nominal value of 6 (3 x 2).

F. Calculations from Table 5 for creation of Table 6

N = 510

K = 16 (number of brain laterality groups)

$\Sigma X_t = 1962$

$(\Sigma X_t)^2 = 3849444$

$M_t = 3.41$

$\Sigma X_t^2 = 10121$

$C = (\Sigma X_t)^2 / N = 3849444/510 = 7547.93$

Total Variance = $\Sigma X_t^2 - C = 10121 - 7547.93 = 2573.07$

Between Group Variance = [525625/235 + 2116/12 + 81/8 + 441/6 + 47089/56 + 400/8 + 289/6 + 169/4 + 329476/80 + 784/9 + 529/5 + 784/7 + 16384/38 + 1225/10 + 64/6 + 4900/20] – C

= 8710.65 – 7547.93

= 1162.72

Within Group Variance = 2573.07 – 1162.72 = 1410.35

G. Calculations from Table 7 for creation of Table 8

N = 510

K = 16 (number of brain laterality groups)

$\Sigma X_t = 2720$

$(\Sigma X_t)^2 = 7398400$

$M_t = 5.43$

$\Sigma X_t^2 = 18875$

$C = (\Sigma X_t)^2 / N = 7398400 / 510 = 14506.67$

Total Variance = $\Sigma X_t^2 – C = 18875 – 14506.67 = 4368.33$

Between Group Variance = [1411344/237 + 1444/11 + 1764/7 + 676/6 + 80089/56 + 1521/8 + 729/6 + 1296/4 + 242064/80 + 3844/9 + 529/5 + 1600/7 + 50625/38 + 3481/10 + 484/6 + 13924/20] – C

= [5955.03 + 131.27 + 252 + 112.67 + 1430.16 + 190.13 + 121.5 + 324 + 3025.8 + 427.11 + 105.8 + 228.57 + 1332.24 + 348.1 + 80.67 + 696.2] – 14506.67

= 14761.25 – 14506.67

= 254.58

Within Group Variance = 4368.33 – 254.58 = 4113.75

H. Calculations of Data

The following results were determined by Prof. Richard Madsen of the Statistics Department at the University of the Western Cape from the data I sent him.

Section A

Lateral 4	Obs	Variable	N	Mean	Median	St. Dev	Minimum	Maximum
-4	20	Continuum	20	-8.35	-9.5	5.4122	-13.0000	7.0000
		Age	20	5.9	6.5	2.49	2.0000	10.0000
-2	27	Continuum	27	-1.963	-2	5.3384	-12.0000	9.0000
		Age	27	5.8148	6	2.7601	1.0000	12.0000
0	72	Continuum	72	2.4861	2.5	4.5964	-11.0000	11.0000
		Age	72	5.6389	6	2.6394	1.0000	12.0000
2	156	Continuum	156	6.0256	6	4.1003	-9.0000	13.0000
		Age	156	5.5449	6	2.9781	1.0000	12.0000
4	235	Continuum	235	10.5489	11	2.8346	1.0000	13.0000
		Age	235	5.0213	5	2.9125	1.0000	12.0000

Comparison of Continuum scores with Lateral 16 scores

The Means Procedure: Analysis Variable : Continuum N

Lateral 16	Obs	N	Mean	Median	St. Dev	Minimum	Maximum
1	235	235	10.5489	11.0000	2.8346	1.0000	13.0000
2	12	12	7.4167	8.0000	4.4611	-1.0000	13.0000
3	8	8	6.125	7.0000	5.8904	-3.0000	13.0000
4	6	6	-3	-2.5000	5.831	-11.0000	4.0000
5	56	56	4.9643	5.5000	3.4953	-3.0000	13.0000
6	8	8	4.375	6.0000	4.8972	-4.0000	9.0000
7	6	6	1.5	2.5000	3.1464	-4.0000	5.0000
8	4	4	-9	-9.5000	2.1602	-11.0000	-6.0000
9	80	80	6.55	6.0000	4.1549	-9.0000	13.0000
10	9	9	5.4444	4.0000	3.1269	1.0000	9.0000
11	5	5	2.4	3.0000	2.9665	-2.0000	5.0000
12	7	7	-4.5714	-3.0000	3.6904	-12.0000	-1.0000
13	38	38	2.4211	2.0000	4.3659	-6.0000	11.0000
14	10	10	0.7	-0.5000	3.9735	-5.0000	9.0000
15	6	6	1.3333	1.0000	4.9261	-4.0000	7.0000
16	20	20	-8.35	-9.5000	5.4122	-13.0000	7.0000

Hypothesis 1,5,7,10

Obs	Variable	Name 1	Label 1	Value 1	n Value 1
3	Current_time	P_KW	Pr > Chi-Square	0.3348	0.33479
6	Age	P_KW	Pr > Chi-Square	0.0029	0.00292
9	Enjoyment	P_KW	Pr > Chi-Square	0.1595	0.159518
12	Pharm_positions	P_KW	Pr > Chi-Square	0.3571	0.357067

Hypothesis 13

Obs	Variable	Name 1	Label 1	Value 1	n Value 1
3	Continuum	P_KW	Pr > Chi-Square	0.379	0.378959
6	lateral4	P_KW	Pr > Chi-Square	0.5444	0.544422

Hypothesis 2,5: Comparison of Continuum and Age scores with Lateral 4 scores 10:19 Tuesday, April 13, 2010 18

The CORR Procedure			
2	with variables	lateral 4	Age
2	Variables	Continuum	Age

Pearson Correlation Coefficients, N = 510
Prob > |r| under H0: Rho=0

	Continuum	Age
Lateral 4	0.77795	-0.09879
	<.0001	0.0257
Age	-0.12775	1.00000
	0.0039	

Spearman Correlation Coefficients, N = 510
Prob > |r| under H0: Rho=0

	Continuum	Age
Lateral 4	0.72352	-0.1211
	<.0001	0.0062
Age	-0.13289	1.00000
	0.0026	

Hypotheses 3,4,6,8,9,11,12,13,14

Obs	Table	Statistic	DF	Value	P-value
1	Table Lateral16 * Rush_Slow	Chi-Square	15	15.1358	0.4417
7	Table Lateral16 * Glasses1	Chi-Square	15	15.9977	0.3822
13	Table Lateral16 * Glasses2	Chi-Square	15	14.8935	0.4591
19	Table Lateral16 * Glasses3	Chi-Square	15	18.6181	0.2316
25	Table Lateral16 * Gender	Chi-Square	15	13.8174	0.5394
31	Table Lateral16 * country	Chi-Square	15	17.1754	0.3085
37	Table Lateral16 * Own_business	Chi-Square	30	36.1085	0.2045
43	Table Lateral16 * Qualification	Chi-Square	45	49.7598	0.2895
49	Table Lateral16 * degree_diploma	Chi-Square	15	15.2451	0.4339
55	Table Lateral16 * work_preference	Chi-Square	105	130.5851	0.046
61	Table Lateral16 * GW1	Chi-Square	15	23.9583	0.0658
67	Table Lateral16 * GW2	Chi-Square	15	14.8726	0.4606

Section B

Agreement of Work/Preference and being over 50, **47** Lateral 16 = 1

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	117 87.97	16 12.03	133
51-80	57 89.06	7 10.94	64
Total	174	23	197

Frequency Missing = 38

Agreement of Work/Preference and being over 50, **48,** Lateral 16 = 2

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	8 72.73	3 27.27	11
Total	8	3	11

Frequency Missing = 1

Agreement of Work/Preference and being over 50, **49** Lateral 16 = 3

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	3 75	1 25	4
51-80	3 100	0 0	3
Total	6	1	7

Frequency Missing = 1

Agreement of Work/Preference and being over 50, **50** Lateral 16 = 4

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	2 66.67	1 33.33	3
51-80	2 100	0 0	2
Total	4	1	5

Frequency Missing = 1

Agreement of Work/Preference and being over 50, **51** Lateral 16 = 5

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	21 80.77	5 19.23	26
51-80	10 83.33	2 16.67	12
Total	31	7	38

Frequency Missing = 18

Agreement of Work/Preference and being over 50, **52** Lateral 16 = 6

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Total
20-50	4 100	4
51-80	2 100	2
Total	6	6

Frequency Missing = 2

Agreement of Work/Preference and being over 50, **53** Lateral 16 = 7

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	4 80	1 20	5
51-80	1 100	0 0	1
Total	5	1	6

Agreement of Work/Preference and being over 50, **54** Lateral 16 = 8

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Total
20-50	0 -	0
51-80	3 100	3
Total	3	3

Frequency Missing = 1

Agreement of Work/Preference and being over 50, **55** Lateral 16 = 9

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	34 87.18	5 12.82	39
51-80	27 84.38	5 15.63	32
Total	61	10	71

Frequency Missing = 9

Agreement of Work/Preference and being over 50, **56** Lateral 16 = 10

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	1 100	0.00 0.00	1
51-80	6 85.71	1 14.29	7
Total	7	1	8

Frequency Missing = 1

Agreement of Work/Preference and being over 50, **57** Lateral 16 = 11

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Total
20-50	3 100	3
51-80	0 -	0
Total	3	3

Frequency Missing = 2

Agreement of Work/Preference and being over 50, **58** Lateral 16 = 12

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	3 75	1.00 25.00	4
51-80	1 50	1 50	2
Total	4	2	6

Frequency Missing = 1

Agreement of Work/Preference and being over 50, **59** Lateral 16 = 13

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	14 93.33	1 6.67	15
51-80	13 86.67	2 13.33	15
Total	27	3	30

Frequency Missing = 8

Agreement of Work/Preference and being over 50, **60** Lateral 16 = 14

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Total
20-50	4 100	4
51-80	3 100	3
Total	7	7

Frequency Missing = 3

Agreement of Work/Preference and being over 50, **61** Lateral 16 = 15

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Do not Agree	Total
20-50	4 80	1 20	5
Total	4	1	5

Frequency Missing = 1

Agreement of Work/Preference and being over 50, **62** Lateral 16 = 16

The FREQ Procedure Table of over50 by agree over50 agree

Frequency	Preference/Area Agree	Total
20-50	6 100	6
51-80	8 100	8
Total	14	14

Frequency Missing = 6

Agreement of Work/Preference and being over 50, **63**

Obs	Lateral16	Table	Statistic	DF	Prob
1	1	Table over50 * agree	Chi-Square	1	0.823
8	3	Table over50 * agree	Chi-Square	1	0.3496
15	4	Table over50 * agree	Chi-Square	1	0.3613
22	5	Table over50 * agree	Chi-Square	1	0.8497
29	7	Table over50 * agree	Chi-Square	1	0.6242
36	9	Table over50 * agree	Chi-Square	1	0.7354
43	10	Table over50 * agree	Chi-Square	1	0.6862
50	12	Table over50 * agree	Chi-Square	1	0.5403
57	13	Table over50 * agree	Chi-Square	1	0.5428

Summary frequency counts 12:49 Monday, May 3, 2010 **64**

The FREQ Procedure

over50	Frequency	Percent	Cumulative Frequency	Cumulative Percent
20-50	334	65.49	334	65.49
51-80	176	34.51	510	100

agree	Frequency	Percent	Cumulative Frequency	Cumulative Percent
Preference/Area agree	364	87.29	364	87.29
Do not agree	53	12.71	417	100

Frequency Missing = 93

Frequency Missing refers to the pharmacists that worked in more than one area or preferred more than one area or both. These pharmacists were left out of the calculations.

I. Summary of South African postings

Date	Place Posted	Place sent to	Quantity	Type of Envelope and Questionnaire paper	Total
15th Oct 2008	Illovo JHB	JHB	133	A4 brown envelope	262
		GHT	27		
		Cape Town	102		
22nd Jan 2009	Illovo JHB	JHB	26	A4 white envelope	53
		Cape Town	27		
5th May 2009	Illovo JHB	Cape Town	100	C5 brown envelopes	200
		JHB	100		
10th Aug 2009	Illovo JHB	Cape Town	37	C5 good quality white envelope	
		JHB	39		
		Cape Town	35	C5 cheap brown envelope	
		JHB	35		
		Cape Town	65	C5 cheap brown envelope	276
		JHB	65		
23rd Oct 2009	Cape Town	Cape Town (only)	50	C5 good quality white envelope	50
10th Nov 2009	Edgware	Cape Town	6	C5 brown envelopes C5 brown envelopes	12
		JHB	6		
Grand total posted in South Africa					853

Table 21 Summary of South African postings

J. Results of the four methods used in the UK regarding sampling

1. Four randomly acquired pharmacists obtained completed questionnaires as follows:-
    i. A pharmacist working for a pharmaceutical company, Masters, obtained 48 completed questionnaires.
    ii. A PhD pharmacy student at the London School of Pharmacy obtained 31 completed questionnaires.
    iii. A pharmacist working for Barnet Hospital, obtained 21 completed questionnaires from Barnet and Chase Farm Hospitals.
    iv. A pharmacist working for the Maudsley Hospital, with contacts at the Aberdeen Hospital, obtained 17 completed questionnaires.
2. Post to community pharmacists in towns in the UK.

    Plymouth yielded 32% replied questionnaires.

    Folkestone yielded 25% replied questionnaires.

    Oxford yielded 33% replied questionnaires.

    Manchester yielded 32% replied questionnaires.

    This gave a total of 31% postal response.
3. Emailed to pharmacists in the UK.

Aberdeen Hospital Dispensary	11 replies
Bath Pharmacy Department	1 reply
Cardiff Pharmacy Department	1 reply
Kings College London Pharmacy Department	4 replies
Nottingham Pharmacy Department	7 replies

Maudsley Hospital Dispensary 6 replies

4. Obtained in London and just north of London.

Retail pharmacies 84 replied questionnaires

Edgware General Hospital 3 replied questionnaires

Royal National Orthopaedic Hospital 1 replied questionnaire

University College London Hospital 1 replied questionnaire

Sigma Pharmaceuticals 5 replied questionnaires.

K. Raw Data from Questionnaires

Age	Gender	Glasses or Contact lenses	Glasses for Reading	Glasses for Distant	Prefer to work in	Area work in	Current work	Worked as a Pharmacist	Number of Jobs	University degree or diploma	Live and work	Own or someone else	Qualification	Enjoyment	Brain Laterality	Continuum	Preventing GW	GW affecting drug supply	Rush or Slow
4	2	2	2	1	1	1	12	12	1	2	1	1	2	9	1	13	1	1	2
6	2	2	2	1	2	1&2	1	27	3	2	1	1	3	8	13	2	1	0	1
4	2	1	2	2	1&2	2	3	8	2	2	1	1	2	8	16	-9	1	1	2
3	2	1	2	2	2	2	0.08	6	3	2	1	1	2	8	1	10	1	1	2
8	2	1	2	2	1	1	30	34	2	2	1	1	2	9	13	2	1	1	2
1	2	2	2	2	1	1	1.5	3	2	2	1	1	3	6	1	13	0	1	2
2	1	1	2	2	1	1	0.5	2	3	2	1	1	3	5	1	12	1	1	2
10	1	2	1	2	1	1	4	40	4	2	1	1	4	8	9	-9	0	0	2
1	2	1	2	2	1	1	2	2	1	2	1	1	3	8	6	9	1	1	2
7	1	1	2	2	1	1	27	27	2	2	1	2	2	9	4	1	0	0	2

5	2	2	2	2	1	1	20	20	2	2	1	1	2	10	1	12	1	1	1
2	1	2	2	2	1	1	4	4	3	2	1	1	3	8	9	5	1	1	2
9	1	2	1	2	1	1	21	42	3	2	1	2	2	9	5	9	1	1	2
7	1	2	2	1	8	1&8	25	30	3	2	1	2	2	7	16	-7	1	1	2
7	1	2	1	2	1	1	25	27	2	2	1	2	2	9	1	13	0	0	1
3	2	2	2	1	1&3&4&5	1	5	5	1	2	1	1	3	7	5	7	1	1	2
3	2	2	2	2	1&2	1	3	4	2	2	1	1	3	9	1	13	1	1	2
8	1	1	2	2	1	1	2	34	4	2	1	1	3	8	9	3	1	1	2
2	2	1	2	2	1	1	6	6	2	2	1	1	3	10	9	13	0	0	1
6	1	2	2	1	1	1	15	16	2	2	1	1	2	8	1	11	1	1	1
5	1	1	2	1	1	1	1	15	3	2	1	1	2	7	9	12	1	0	2
8	1	2	2	1	1	1	20	30	2	2	1	2	3	5	13	1	0	0	1
6	2	1	2	2	1	1	3	30	3	2	1	1	2	9	9	7	0	0	1
6	1	2	2	2	1&7	1&8	12	22	5	2	1	1	2	7	1	13	1	1	2
2	2	1	2	2	1	1	2	4	3	2	1	1	3	6	1	10	1	1	1
2	2	2	2	1	1	1	0.04	2.5	3	2	1	1	3	6	9	6	1	0	2
3	2	2	2	2	1	1	2	10	3	2	1	1	4	5	1	13	1	1	1
3	2	1	2	2	1	1	9	9	1	2	1	1	2	9	1	13	1	1	1
2	2	2	2	2	1	1	1	1.5	2	2	1	1	3	7	1	9	1	1	1
1	2	2	2	2	1	1	0.5	2.5	4	2	1	1	3	6	5	13	1	1	2
2	2	1	2	1	1&2	1	1	1.5	2	2	1	1	3	8	5	7	1	1	2
7	2	2	2	1	1	1	12	22	4	2	1	1	3	9	9	6	0	0	2
3	1	2	2	2	5	1	4	11	3	2	1	1	2	6	2	7	1	1	2
1	1	2	2	1	1	1	0.5	0.5	3	2	1	1	3	7	9	1	1	1	2
5	2	1	2	2	1	1	20	20	1	2	1	1	2	6	1	10	1	1	1
8	1	1	2	2	1	1	30	32	2	2	1	1	2	8	13	0	1	1	2
7	1	1	2	2	1	1	5	27	4	2	1	1	2	10	13	11	1	0	1
3	2	2	2	2	1	1	7	7	5	2	1	1	2	9	1	10	1	1	1
8	1	1	2	2	1	1	39	41	4	2	1	2	2	8	9	3	0	0	2
4	1	1	2	1	1	1	4	18	4	2	1	2	2	7	1	13	0	0	2

10	1	1	2	2	1	1	5	46	6	2	1	1	2	8	9	1	0	0	2
7	1	1	2	2	1	1	6	21	6	2	1	1	3	8	5	4	1	1	2
1	2	1	2	1	1	1	1	1	1	2	1	1	3	10	1	11	1	1	1
1	1	1	1	2	1&2&3	1	2	2	1	2	1	1	3	7	15	7	0	1	2
3	2	2	2	1	1	1	3	13	3	2	1	1	2	8	9	6	1	1	2
3	2	1	2	1	6	1&5	1	10	4	2	1	1	3	9	5	3	1	1	2
7	1	1	2	2	3	8	0.5	30	6	2	1	1	2	10	1	8	0	0	1
7	2	2	1	2	2	1	30	30	4	2	1	1	2	9	1	13	1	1	1
8	1	1	2	2	1	1	35	37	4	2	1	2	2	9	8	-9	0	0	2
3	2	2	2	2	1	1	1	5	3	2	1	1	3	8	1	12	0	0	1
2	2	1	2	1	1&7	1&7	3	3	4	2	1	1	3	7	5	0	1	1	2
3	2	1	2	2	1	1	2	5	2	2	1	1	3	4	1	13	0	0	1
1	2	2	2	1	7	1	0.16	1.5	3	2	1	1	3	3	5	5	1	1	2
1	2	1	2	1	1	1	0.5	0.5	1	2	1	1	3	7	9	6	0	0	1
1	2	2	2	2	1	1	0.5	0.5	1	2	1	1	3	8	1	13	1	1	1
7	2	2	1	2	1	1	14	33	4	2	1	1	3	7	9	2	1	1	2
7	2	2	2	2	1	1	5	29	4	2	1	1	2	8	13	3	1	1	1
7	1	1	2	2	1	1	25	25	1	2	1	2	2	10	1	13	1	0	2
3	1	2	2	2	2	2	0.5	10	10	2	1	1	3	6	1	12	0	0	1
2	2	2	2	2	1	1	6	6	1	2	1	1	3	7	5	7	0	0	2
2	1	1	2	2	1	1	2	5	2	2	1	1	3	9	1	7	1	0	1
1	2	2	2	2	1	1	0.75	0.75	1	2	1	1	3	7	1	13	0	0	2
5	1	2	2	2	1	1	9	20	5	2	1	1	3	2	1	13	1	1	1
7	2	2	1	2	1	1	5	20	5	2	1	1	2	8	1	12	0	0	2
4	1	1	2	2	1	1	2	8.5	3	2	1	1	2	4	1	8	1	1	2
1	2	2	2	2	1	1	0.5	1.5	2	2	1	1	3	7	13	-1	1	1	1
2	2	1	2	2	2	1	2	6	3	2	1	1	2	6	1	13	1	0	1
7	1	1	2	2	1	1	5	15	8	2	1	1	3	7	10	1	0	1	1
6	1	2	2	2	1	1	1.5	22.5	8	2	1	1	2	6	9	6	0	1	1
4	2	2	2	2	1	1	3	13	5	2	1	1	2	7	16	-9	0	0	2

3	1	2	2	2	1	1	5	7	2	2	1	1	3	8	1	13	1	1	2
6	1	1	2	2	1	1	20	26	3	2	1	2	2	10	1	8	1	1	1
6	2	2	1	2	1	1	22	25	2	2	1	2	2	3	9	-1	1	1	2
3	1	2	2	2	1	1	10	10	3	2	1	1	2	8	11	5	1	0	1
7	2	2	1	2	1	1	10	30	4	2	1	1	2	7	9	7	1	0	2
3	1	2	2	2	3	1	2	8	4	2	1	1	4	9	13	-6	1	1	2
9	1	2	1	2	1&8	1&8	3	39	4	2	1	1	2	9	11	5	1	1	2
2	2	2	2	2	1	1	1.5	3	3	2	1	1	3	8	13	6	1	1	2
9	1	1	2	2	1&8	1&8	40	40	1	2	1	2	2	10	16	-10	0	0	2
6	1	2	1	2	1	1	11	28	6	2	1	1	2	7	7	3	0	0	1
3	1	1	2	1	1	1&7	1.5	10	6	2	1	1	3	3	5	-1	0	0	1
7	1	2	2	1	1	1	26	32	6	2	1	2	2	8	1	13	1	1	2
4	2	2	2	1	1	1	2	10	4	2	1	1	3	8	1	13	1	1	1
6	2	1	2	1	1	1	15	26	3	2	1	2	3	9	15	-4	0	0	1
3	1	2	2	2	1	1	7	8	1	2	1	1	2	5	5	10	0	1	2
6	1	1	2	2	1	1	20	26	4	2	1	2	2	8	9	13	1	1	2
2	2	2	2	2	1	1	2	7	3	2	1	1	3	6	1	13	1	1	2
7	1	1	2	2	1	1	30	30	1	2	1	2	2	8	1	13	1	1	2
10	1	1	2	2	1	1	8	47	4	2	1	1	2	8	1	12	1	1	2
1	2	2	1	2	1	1	0.5	0.75	2	2	1	1	3	8	1	11	0	0	1
9	1	2	2	2	1	1	5.5	43	5	2	1	1	2	5	9	8	0	0	2
5	2	2	2	1	1	1	2	8	2	2	1	1	3	9	6	-1	0	1	2
2	2	1	2	1	1	1	8	11	3	2	1	1	3	6	16	-2	1	1	2
6	1	2	2	1	1	1	7	25	4	2	1	1	2	6	9	5	0	1	1
1	1	1	2	1	1&2&3&4&5	1&2	0.5	0.5	1	2	1	1	2	7	13	1	1	1	2
5	1	1	2	1	1	1	3	22	12	2	1	1	2	7	5	7	1	1	2
1	2	1	2	2	2	2	0.5	0.5	1	2	1	1	3	7	2	11	1	1	2
7	2	2	1	2	3&5&6	1	13	29	3	2	1	2	2	9	13	3	1	1	1
3	2	1	2	1	2	1&2	1	1.5	2	2	1	1	3	2	11	-2	1	1	1

11	2	1	2	2	1	1	40	40	2	2	1	2	3	8	1	5	1	1	2
6	1	2	2	1	1	1	15	20	3	2	1	1	3	4	1	13	0	1	2
3	2	2	2	1	1	1	5	5	3	2	1	1	3	5	16	-1	1	1	1
8	1	1	2	2	1	1	5	30	6	2	1	1	2	8	9	6	1	1	2
9	1	1	2	2	1	1	10	33	6	2	1	1	3	9	9	4	1	1	2
8	2	1	2	2	1	1	15	35	6	2	1	2	2	7	16	-12	0	1	2
2	2	1	2	2	6	6	0.5	6	3	2	1	1	3	8	9	11	1	1	1
1	2	1	2	2	1	1	3	3	1	2	1	1	3	7	1	13	1	1	1
12	2	2	1	2	2	1	20	66	8	2	1	1	3	8	5	8	1	1	1
7	2	1	2	2	1	1	28	28	3	2	1	1	2	7	1	8	1	1	1
7	1	2	2	2	1	1	1	31	3	2	1	1	2	10	1	12	1	1	1
6	2	2	2	1	8	8	10	35	3	2	1	1	3	10	5	11	1	1	1
7	1	1	2	2	1	1	11	12	2	2	1	1	2	7	1	13	0	0	1
7	1	1	2	2	1&2&3	1	12	30	3	2	1	1	3	9	3	4	1	1	2
3	2	1	2	1	2	2	1	1	1	2	1	1	3	8	2	7	0	0	2
6	1	2	1	2	1	1	23	26	2	2	1	2	3	8	1	13	1	1	1
6	1	1	2	2	1	1	20	25	5	2	1	2	2	6	15	1	1	1	1
6	1	2	1	2	1	1	25	25	1	2	1	2	2	8	12	-12	1	1	2
6	1	2	2	2	3&6&7	1&2	2	20	10	2	1	1	3	4	1	11	0	1	2
1	2	1	2	2	1	1	0.5	0.5	1	2	1	1	3	7	7	2	0	1	2
2	2	2	2	2	1	1	0.75	0.75	1	2	1	1	3	8	1	13	1	1	1
6	2	1	2	1	1&3	1	2	25	10	2	1	1	2	4	6	8	1	1	1
5	2	1	2	2	1	1	20	20	1	2	1	1	2	7	14	-3	1	1	2
5	2	2	2	2	1	1	1	20	3	2	1	1	2	9	1	11	1	1	1
8	1	2	1	2	1	1	30	45	2	2	1	2	2	6	1	13	1	1	2
8	2	1	2	2	1	1	26	35	4	2	1	1	2	7	1	13	1	1	2
8	2	2	1	2	1	1	3	30	7	2	1	1	2	5	1	11	1	1	2
8	1	2	1	2	2	1&2	4	34	9	2	1	1	2	8	1	5	1	1	1
7	1	2	1	2	6	1	8	27	6	2	1	1	2	8	12	-3	0	0	1
6	2	1	2	1	1	1	21	27	3	2	1	2	2	7	1	11	1	1	2

2	2	2	1	2	1&2&3	1	4	4	2	2	1	1	4	7	1	8	0	1	2
2	2	2	2	2	1	1	7	7	1	2	1	1	3	7	1	13	1	1	2
5	2	1	2	1	1	1	10	20	2	2	1	1	4	5	16	-13	1	1	1
2	2	1	2	2	1	2	0.75	0.75	1	2	1	1	3	8	1	11	0	0	1
1	2	1	2	1	2	2	0.75	0.75	1	2	1	1	3	8	1	13	1	1	1
1	2	1	2	1	2	2	0.75	0.75	1	2	1	1	3	7	1	11	1	1	1
1	2	2	2	2	3	2	0.75	0.75	1	2	1	1	3	8	1	3	0	1	1
1	2	2	2	2	2	2	0.75	0.75	1	2	1	1	3	7	2	-1	0	1	2
7	1	2	2	1	1	1	2	29	7	2	1	1	2	2	5	5	1	1	1
8	1	2	1	2	1	1	4	35	4	2	1	1	2	6	16	-2	1	1	2
1	2	1	2	2	1	1	1	1	1	2	1	1	3	7	1	10	1	1	2
6	2	2	2	2	7	1	38	38	10	2	1	1	3	7	1	12	1	0	2
2	2	1	2	2	2	2	1.5	1.5	1	2	1	1	3	5	1	13	1	1	2
2	2	2	2	2	2	2	0.25	7	5	2	1	1	3	6	14	9	1	1	2
6	1	1	2	2	2	2	0.25	20	4	2	1	1	3	6	5	2	1	1	2
6	2	2	2	2	2	2	8	22	10	2	1	1	1	7	9	3	1	0	2
1	2	1	2	2	2	2	0.5	1	1	2	1	1	3	8	1	8	1	1	1
2	2	1	2	1	2&7	2	2.5	2.5	1	2	1	1	1	8	14	3	1	1	1
6	1	2	1	2	2	2	20	24	5	2	1	1	3	8	1	5	1	1	1
2	2	1	2	2	2	2	4	5.5	3	2	1	1	3	7	1	9	1	1	2
9	1	2	2	1	2	2	5	40	4	2	1	1	2	7	1	5	1	0	1
2	1	2	2	1	2	2	1	6	4	2	1	1	3	4	1	10	1	1	2
5	2	1	2	2	4&5	4	1.5	22	11	2	1	1	3	9	13	2	1	1	1
2	2	1	2	1	2	2	3.5	3.5	1	2	1	1	3	8	9	12	1	1	1
3	1	1	2	1	2	2	4	10	3	2	1	1	2	7	1	13	1	1	1
2	2	2	2	2	2	2	0.75	5	4	2	1	1	2	8	1	11	1	1	2
3	2	1	2	2	2	2	6	10	2	2	1	1	3	8	1	11	1	0	2
2	2	1	2	2	2	2	2.5	3.5	2	2	1	1	3	7	1	13	1	1	2
2	2	1	2	2	3	2	1	2	2	2	1	1	3	6	9	5	1	1	2
4	1	1	2	2	2	2	3.5	15	6	2	1	1	3	8	1	10	0	0	1

2	2	1	2	2	2	2	1	6	3	2	1	1	3	7	1	10	1	1	1
2	2	2	2	1	2	2	2	2	1	2	1	1	3	7	1	13	1	1	2
1	2	2	2	2	2	2	0.75	0.75	1	2	1	1	3	7	1	10	1	1	2
8	2	1	2	2	1	1	12	38	5	2	1	1	2	6	5	7	1	1	2
7	1	2	2	2	1	1	4.5	32	6	2	1	1	2	8	1	5	0	0	1
4	2	1	2	2	2&3	2&3	9	20	5	2	1	1	4	9	5	6	1	0	2
2	2	2	2	2	1&2	1	0.75	3	7	2	1	1	3	5	1	13	1	1	2
2	2	1	2	1	1	1	3	4	2	2	1	1	3	9	10	7	0	1	2
7	1	2	2	1	1	1	6	32	10	2	1	2	2	8	1	13	0	1	2
8	2	1	2	2	1	1	26	32	4	2	1	1	3	8	1	13	0	1	1
8	1	2	1	2	7	7	12	34	10	2	1	1	4	9	1	8	1	1	1
1	2	1	2	2	7	3	0.5	2	3	2	1	1	3	8	1	13	0	1	2
6	1	1	2	1	7	7	22	24	2	2	1	1	4	8	13	-2	0	1	1
4	2	1	2	2	3	3&7	2	2	1	2	1	1	4	8	1	13	1	1	1
6	2	2	2	1	3&7	3&7	25	28	2	2	1	1	4	8	16	-13	1	1	2
6	2	2	1	2	7	7	3	20	10	2	1	1	4	8	9	13	0	0	1
9	1	1	2	2	3&7	3&7	6	41	7	2	1	1	4	9	9	8	0	1	1
2	2	1	2	2	2	2&7	2.5	6.5	3	2	1	1	3	8	1	6	1	1	1
2	2	2	2	2	1	1	3	4	3	2	1	1	3	7	9	5	0	1	2
2	2	2	2	1	3	1	2	2	1	2	1	2	3	2	3	11	0	1	1
2	2	1	2	1	1&4&5&7	1	4	4	1	2	1	1	3	10	16	7	1	1	1
4	2	2	2	1	2	2	8	15	7	2	1	1	3	9	1	12	0	0	2
5	1	1	2	2	7	7	2	23	4	2	1	1	4	8	1	9	0	0	2
2	1	1	2	2	3	3	0.25	3.5	3	2	1	1	3	9	9	10	1	1	1
3	1	2	2	2	3&7	3&7	6	11	3	2	1	1	4	8	5	5	1	1	1
8	1	2	2	2	2	2	10	32	6	2	1	1	3	7	9	6	1	0	1
1	2	2	2	2	2	2	1	1	1	2	1	1	3	6	5	3	0	0	2
1	2	2	2	1	2	2	2	2	1	2	1	1	3	8	1	13	1	0	1
6	2	1	2	2	2	2	10	19	3	2	1	1	3	9	1	13	1	0	2
1	2	2	2	2	3	3	0.5	2	1	2	1	1	3	9	7	5	0	1	1

7	1	1	1	2	1&3&7	1&3&7	6	35	6	2	1	1	4	10	1	13	1	0	1
3	2	1	2	1	6&7	8	0.25	0.5	1	2	1	1	2	8	1	2	1	1	1
4	1	2	1	2	3	3	1.5	13	6	2	1	1	4	9	5	4	0	1	1
2	1	2	2	2	1	1	2	3	3	2	1	1	3	8	13	7	1	1	2
1	2	2	2	2	1	2	2	2	1	2	1	1	3	9	2	13	0	0	2
3	2	1	2	2	2	2	2.5	9	8	2	1	1	2	3	1	12	1	1	2
1	2	2	1	2	2	2	1	1	1	2	1	1	3	8	9	7	0	1	2
2	2	2	2	2	2	2	2.75	2.75	1	2	1	1	3	7	1	13	1	1	1
1	2	2	2	1	2	2	0.75	0.75	1	2	1	1	3	9	1	11	1	1	1
2	2	2	2	2	2	2	1	7	4	2	1	1	2	7	1	13	0	0	2
2	2	1	1	2	2	2	3	4	4	2	1	1	2	8	1	13	1	1	2
2	1	1	2	2	2	2	1.5	2.5	3	2	1	1	3	7	1	4	1	1	2
2	1	1	2	2	2	2	0.5	10	5	2	1	1	3	7	15	7	0	0	1
6	2	1	2	2	3	3&7	9	28	10	2	1	1	3	8	1	8	1	1	1
6	2	1	2	2	3&7	3&7	10	27	5	2	1	1	4	9	9	5	1	1	2
2	1	1	2	2	1	1	3	3	2	2	1	1	3	8	1	13	1	1	2
3	2	1	2	1	2	2&7	5	9	3	2	1	1	3	6	5	1	1	0	2
5	2	1	2	2	3	3&7	4	20	9	2	1	1	4	5	16	-13	0	0	1
2	2	1	2	2	2	2&7	0.5	4	3	2	1	1	3	8	1	9	1	1	2
2	1	2	2	1	1&7	1&7	2	7	5	2	1	1	3	9	1	9	1	1	1
2	2	1	2	2	2&3	3	3.5	4	2	2	1	1	3	9	1	9	0	0	2
7	1	1	2	2	7&8	8	5	24	3	2	1	1	2	8	1	4	1	1	2
6	1	1	2	1	1	1	25	28	2	2	1	2	2	8	1	1	1	1	1
2	1	2	2	2	1	1	5	5	3	2	1	2	3	9	1	13	0	1	2
2	2	2	2	2	1	1	4	6	4	2	1	2	2	8	1	10	1	1	1
8	1	2	1	2	8	8	15	30	4	1	1	2	1	8	7	0	0	0	2
4	2	2	1	2	2	1	10	10	1	2	1	1	2	7	15	-4	0	1	1
6	1	2	2	1	1	1	5	7	2	2	1	1	3	9	9	7	1	1	1
7	1	1	2	2	1	1	26	30	3	2	1	2	2	8	10	9	1	0	1
1	2	2	2	2	1	1	1	1	1	2	1	1	3	8	1	13	0	1	1

5	1	2	2	2	1	1	15	18	2	2	1	1	2	10	3	-1	1	1	1
6	1	1	2	2	1	1	10.5	21	4	2	1	1	2	5	9	11	1	1	2
2	2	2	2	1	8	2	1.5	3	3	2	1	1	3	8	5	9	1	1	2
4	2	2	2	2	2	2	10	16	5	2	1	1	2	8	1	13	0	1	2
4	1	1	2	1	2	2	7	11	4	2	1	1	2	8	11	3	1	1	2
2	2	2	2	2	2	2	0.75	2	3	2	1	1	2	6	9	10	0	0	1
1	2	1	2	2	2	2	0.25	0.25	1	2	1	1	3	8	9	5	1	1	1
4	1	1	2	2	2&7	2&7	10	14	5	2	1	1	3	8	1	13	1	1	2
2	2	2	2	2	2	2	1	4	4	2	1	1	3	6	6	5	0	0	2
6	2	1	2	2	2	2	19	27	5	2	1	1	2	8	5	3	1	1	2
3	2	1	2	2	2	2	5	9	4	2	1	1	3	6	15	1	1	1	1
8	2	2	2	1	2&3	2&3	3	12	4	2	1	1	2	3	9	7	1	1	2
7	2	1	1	2	2	2	15	32	7	2	1	1	2	8	1	13	1	1	2
6	2	1	2	2	2	2	9	23	6	2	1	1	3	7	1	12	1	1	2
7	2	1	2	2	2	2	1	5	2	2	1	1	3	8	13	5	1	1	2
4	2	2	2	1	2	2	7	19	5	2	1	1	2	5	5	10	0	0	1
3	2	1	2	2	2	2	0.5	9	7	2	1	1	2	7	1	8	1	1	1
3	2	1	2	2	2&7	2	3	13	4	2	1	1	2	9	4	-6	1	1	1
4	1	1	2	1	2	2	7	15	7	2	1	1	3	3	13	-3	0	0	2
2	2	1	2	1	1	1	5	7	3	2	1	1	2	8	3	-3	0	1	2
5	1	2	2	1	1	1	2	16	3	2	1	1	3	9	2	11	1	1	2
3	1	2	2	1	2	1&2&3&4&5&7	3	13	5	2	1	1	4	7	9	7	1	1	2
1	1	1	1	1	3	1&3	3	3	1	2	1	1	3	9	1	9	1	1	1
2	2	2	2	2	1	1	0.5	3	3	2	1	1	3	7	16	-7	1	1	1
2	2	1	2	2	2	2	1.5	4	2	2	1	1	3	8	1	9	0	1	1
1	2	1	2	2	1	1	0.25	2	2	2	1	2	3	9	4	-7	1	1	1
2	2	2	1	2	2	1	0.25	3	2	2	1	1	3	8	1	7	1	1	2
1	2	2	2	2	2	2	2.5	3	1	2	1	1	3	9	5	4	1	1	1
7	1	1	2	2	1	1	27	27	3	2	1	2	2	9	4	1	0	0	1

1	2	1	2	2	2	1	0.33	0.5	3	2	1	1	3	8	1	13	1	1	1
2	1	2	2	1	1	1	0.5	6	3	2	1	1	3	8	5	-1	1	0	1
6	1	2	2	1	1	1	6	16	2	2	1	1	2	6	1	10	1	1	1
1	2	2	2	2	1	1	0.25	0.5	1	2	1	1	3	8	2	3	1	1	1
2	1	2	2	2	1	1	2	2	1	2	1	1	3	10	9	5	1	1	1
2	1	2	2	2	1	1	5	5	2	2	1	2	3	8	1	10	1	1	2
2	1	2	2	2	1	1	0.25	3	3	2	1	1	3	8	1	7	1	0	1
3	2	2	2	2	2&6&8	8	0.25	8	4	2	2	1	2	8	1	13	1	1	1
10	1	2	1	2	8	8	5	30	2	2	2	1	2	10	1	13	0	0	1
4	2	2	2	2	8	8	4	16	2	2	2	1	2	8	1	13	1	1	1
9	1	2	1	2	2	2	9	29	2	2	2	1	2	9	3	13	1	1	1
12	1	1	2	2	1	1	13	49	4	1	2	1	1	8	9	4	1	1	2
2	2	1	2	2	3&5	3&5	0.5	7	4	2	2	1	3	9	1	11	1	1	2
8	2	1	2	1	1	1	10	33	6	2	2	1	2	6	3	5	1	1	2
6	2	2	1	2	1	1	10	27	4	2	2	1	2	8	1	13	1	1	2
2	2	2	2	2	8	8	0.25	3	3	2	2	1	2	7	5	8	1	1	2
7	2	2	2	2	1	1	22	24	2	1	2	2	1	10	1	8	1	0	2
3	2	1	2	2	6	1&6	1	9	7	2	2	1	2	8	13	-4	1	1	2
6	2	2	2	2	1	1	12	24	2	2	2	1	2	8	1	10	1	1	2
4	1	2	2	1	5	5	4	12	5	2	2	1	2	2	1	13	1	1	2
8	1	1	1	2	4	4	18	30	6	1	2	2	1	10	6	9	1	1	1
5	1	2	2	2	8	8	15	20	5	2	2	1	2	8	1	13	1	1	2
11	1	1	2	2	2	8	8	40	5	1	2	1	1	5	13	7	1	1	1
11	1	2	1	2	8	8	7	50	4	2	2	1	4	10	9	2	1	0	1
9	2	1	2	2	1	1	3	40	2	2	2	1	2	8	1	10	1	1	2
2	2	2	2	2	4	2	3	7	4	2	2	1	2	5	1	10	1	1	2
4	2	2	2	2	2	2	5	14	6	2	2	1	2	4	11	1	1	1	2
3	2	1	2	2	6&8	6&8	4	14	4	2	2	2	2	10	5	7	0	1	1
5	1	2	2	2	1&2&3&5	1&2	5	10	2	2	2	1	2	9	1	10	1	1	1
5	1	2	2	2	1	1	19	23	4	2	2	2	2	10	1	5	0	0	2

10	1	1	2	2	2	2	8	52	12	2	2	1	2	8	8	-11	1	1	1
10	1	1	2	2	1	1	45	46	2	1	2	2	1	8	1	13	0	1	2
9	2	2	1	2	2	2	32	40	4	1	2	1	1	5	9	7	1	1	2
7	1	2	1	2	1	1	22	22	2	1	2	2	1	4	1	9	1	1	2
7	2	1	2	2	2	2	1.5	27	4	2	2	1	2	8	1	8	1	1	2
9	2	1	2	2	2	2	20	40	4	2	2	1	2	9	9	4	1	1	1
2	2	2	2	2	2	1&2	3	3	3	2	2	1	2	6	1	6	1	1	2
4	1	2	2	2	4	1	6	18	10	2	2	2	2	6	9	4	1	1	2
5	2	2	2	2	2	8	0.25	21	8	2	2	1	2	4	1	13	1	1	2
3	1	2	2	2	1	1	8	10	2	2	2	1	2	9	1	13	1	1	2
5	2	1	2	2	1	1	4	21	4	1	2	1	1	10	16	-13	1	1	2
6	1	1	2	2	2&7	1&2&3	1	3.5	2	2	2	1	2	8	9	2	1	1	1
7	1	1	2	2	1	1	23	27	3	1	2	2	1	10	5	4	1	1	2
12	1	2	2	1	3	8	99	60	2	2	2	1	4	8	1	6	1	1	1
6	1	2	2	1	1	1	2	24	5	1	2	1	1	8	1	13	1	1	2
5	2	2	2	2	1	1	1	20	6	2	2	1	2	9	1	13	1	1	2
6	2	2	2	1	1	1	2	23	6	2	2	2	2	9	1	7	0	0	1
10	2	1	2	1	7	2	7	8	2	2	2	1	4	8	9	13	1	1	1
6	2	2	2	2	1	1	6	26	5	1	2	1	1	6	5	-2	1	1	2
12	1	2	1	2	8	8	99	43	4	2	2	1	4	10	10	4	1	1	2
4	1	1	2	2	4	4	13	15	2	2	2	1	2	10	1	12	1	1	2
6	1	2	2	2	1&3&7	1	12	24	3	2	2	2	2	7	14	2	1	1	2
9	2	2	1	2	1	1	7	42	8	1	2	1	1	9	1	10	0	0	1
4	1	2	2	2	1&3	1	14	15	2	2	2	2	2	4	5	3	1	1	2
12	1	2	2	1	2	2	3	62	3	1	2	1	1	8	1	13	1	1	1
8	2	1	2	2	1	1	3	35	5	1	2	1	1	5	5	7	1	1	2
3	1	2	1	2	1	1	9	9	1	2	2	1	2	2	1	13	1	1	2
5	2	1	2	2	2	8	10	5	3	2	2	2	2	10	4	-11	0	0	2
6	2	1	2	2	2&3	2	2	28	10	1	2	1	1	6	5	0	1	1	1
3	1	2	2	2	1	1	12	12	2	2	2	2	2	8	1	10	1	1	2

8	1	1	2	2	8	8	6	34	5	1	2	1	1	8	9	4	1	0	2
3	1	2	2	2	2	2	5	7	2	2	2	1	2	6	1	9	1	1	2
8	2	1	2	2	1	1	0.5	35	4	2	2	1	2	7	9	11	1	0	2
8	2	1	2	2	1	1	10	32	9	2	2	1	2	7	14	-1	1	1	1
5	2	2	2	2	2&3&4	2&3	12	20	3	2	2	1	2	8	12	-2	1	0	2
4	2	1	2	2	2	8	0.75	16	6	2	2	1	2	9	2	11	1	1	2
7	1	1	1	1	5	4	10	15	3	2	2	1	2	6	10	4	1	1	1
10	1	2	1	2	1	1	7	48	4	1	2	1	1	6	1	7	0	0	2
3	2	1	2	2	7	1	6	11	4	2	2	1	2	3	1	9	1	1	1
10	1	2	1	2	4	8	15	33	5	1	2	1	1	8	1	8	1	0	1
5	1	2	2	2	7&8	7&8	10	23	3	2	2	2	2	10	14	-5	1	1	1
8	1	2	1	2	4	8	3	34	2	1	2	1	1	8	9	4	0	0	2
8	2	2	2	1	4&5	4&5&6	18	34	3	1	2	2	1	7	5	-1	1	1	1
6	1	1	2	2	1	1	22	23	3	2	2	2	2	3	14	4	1	1	2
4	1	2	2	1	3	5	2	15	4	2	2	1	2	6	1	13	1	1	1
6	2	1	2	2	1	1	25	25	2	2	2	1	2	8	6	7	1	1	2
5	1	1	2	1	1	1	10	20	4	2	2	2	2	9	5	10	1	1	1
7	2	2	1	2	8	8	2.5	32	6	1	2	1	1	9	16	-7	1	1	1
9	2	1	2	2	2	2	5	38	10	2	2	1	2	8	1	13	1	1	1
3	2	1	2	2	3	1	4	11	5	2	2	1	2	7	1	7	0	1	2
12	1	1	2	2	1	1&2&6	15	15	1	2	2	1	2	7	5	6	1	1	1
12	1	2	1	2	1	1	99	61	3	1	2	2	1	8	1	9	1	1	2
5	2	1	2	1	1&3	1	11	21	4	2	2	2	2	8	5	4	1	1	1
6	2	2	2	2	1	1	12	24	8	2	2	1	2	8	1	12	1	1	2
2	2	1	2	2	8	8	1.5	8	7	2	2	1	2	8	9	12	0	1	2
5	2	2	2	2	1&2	1	2	18	6	2	2	1	2	8	1	13	1	1	2
10	2	2	1	2	2	2	2	50	2	1	2	1	1	8	16	-11	1	1	1
6	2	2	2	2	5	5	10	22	5	1	2	1	1	9	13	1	1	1	1
10	1	1	2	2	2	2	10	50	3	2	2	1	2	8	1	9	0	0	1
5	2	2	2	2	1	1	0.5	20	7	2	2	1	2	7	1	10	0	1	2

3	2	1	2	1	1	1	9	12	3	2	2	1	2	8	1	5	1	1	1
2	2	2	2	2	1	1	2	4	2	2	2	1	2	8	1	4	1	1	1
3	2	1	2	2	5	5	3	11	3	2	2	1	2	8	5	7	1	0	1
7	2	2	1	2	8	8	4	19	5	2	2	1	2	5	14	0	1	1	2
10	2	1	2	2	7	7	35	40	3	2	2	1	4	9	1	7	1	1	1
6	2	2	1	2	2	2	9	21	8	2	2	1	2	7	1	13	1	1	1
8	1	1	2	2	1&8	1	10	25	2	1	2	2	1	8	9	7	1	1	2
4	2	1	2	2	4	4	11	13	3	2	2	1	3	9	13	9	1	1	2
6	1	1	2	2	3	3	12	0.25	1	2	2	2	4	10	1	7	1	1	2
7	1	2	1	2	2	2	25	33	2	2	2	1	2	8	1	13	1	1	1
6	2	2	1	2	1	1	10	26	3	1	2	1	1	6	5	2	1	1	2
7	2	1	2	2	1	1	27	31	2	2	2	1	2	7	1	5	1	1	1
3	2	1	2	2	8	8	2.5	8	8	2	2	1	2	7	1	13	1	1	2
4	2	2	2	1	8	8	8	14	5	2	2	1	2	9	9	5	1	0	2
5	1	2	2	2	8	8	2	21	6	2	2	1	2	8	1	13	1	1	1
3	1	2	2	2	8	8	2	8	5	2	2	1	2	8	4	4	1	1	2
8	1	2	1	2	2	2	1.5	32	10	2	2	1	2	9	9	1	1	1	1
6	1	1	2	2	2	2	10	20	3	2	2	1	2	9	2	6	1	1	2
4	1	1	2	1	4	4	8.5	11	2	2	2	1	2	9	1	11	1	0	1
5	2	2	2	2	2	7	5.5	23	3	2	2	1	2	8	1	13	1	0	2
12	1	2	2	2	1	1	10	51	4	1	2	1	1	8	13	6	0	0	1
7	2	2	1	2	3	8	0.5	30	9	2	2	1	4	8	5	5	0	0	2
9	1	1	2	2	1&2	2	10	29	3	2	2	1	2	9	9	12	1	1	1
6	2	2	1	2	1	1	10	27	2	2	2	1	2	9	1	4	1	1	2
11	1	2	1	2	8	8	5	50	4	1	2	1	1	9	1	10	1	1	2
7	1	2	1	2	1	1	2	25	6	2	2	1	2	7	5	-3	1	1	2
2	2	2	2	1	7	7	2.5	9	5	2	2	1	2	7	1	12	0	1	1
6	2	2	1	2	1	1	14	12	2	1	2	2	1	8	1	5	1	1	2
5	2	2	2	2	3	1	20	20	1	2	2	1	2	3	1	5	1	1	1
6	2	2	1	2	2&7	8	11	20	5	2	2	1	2	6	5	6	1	1	1

10	1	1	2	2	7	7	36	45	5	2	2	1	4	10	1	11	1	0	1
6	1	2	1	2	3&7	3&7	1	25	4	2	2	1	4	9	1	7	1	1	2
6	1	1	2	2	1	1	22	25	2	2	2	2	2	8	9	10	1	1	2
5	2	2	1	2	7	7	8	10	3	2	2	1	4	9	1	13	1	1	1
6	2	2	2	2	2	8	5	26	3	2	2	1	2	7	9	7	1	1	2
7	2	1	1	2	2	2	9	27	3	1	2	1	1	7	13	-5	1	1	1
4	2	2	2	2	1	1	15	15	2	2	2	1	2	8	5	7	1	0	2
6	2	2	2	2	2	1	1.5	26	4	1	2	1	1	3	9	13	1	1	2
4	2	1	2	2	8	8	0.25	15	6	2	2	1	2	8	1	12	1	1	2
6	1	2	2	1	1	1	10	25	2	2	2	2	2	8	13	1	1	1	2
6	2	1	2	2	5&6	5&6	8	22	4	2	2	1	2	8	8	-10	1	1	1
3	1	1	2	2	3&4	2&3&4	5	10	2	2	2	1	3	9	1	3	1	1	2
2	2	2	2	1	4&5	1	2	6	8	2	2	1	2	8	1	13	1	0	1
2	2	2	2	1	4	4	2	2	1	2	2	2	2	8	9	9	1	1	1
8	2	2	2	2	1	1	5	36	10	1	2	2	1	8	10	9	1	1	2
6	2	1	2	2	2	1&2	15	23	3	2	2	1	2	7	2	1	0	1	2
11	1	1	1	2	1	1	5	40	4	2	2	1	2	9	1	11	1	1	1
4	2	2	2	2	1	1	0.5	18	3	2	2	1	2	9	13	7	1	1	2
3	1	1	2	2	1	1	4	13	4	2	2	2	2	8	1	13	1	1	2
6	2	2	1	2	1	1	6	28	1	2	2	1	2	3	3	9	1	1	1
5	1	2	2	2	1	1	14	17	3	2	2	2	3	8	1	13	1	1	1
9	1	2	1	2	1	1	2	38	6	1	2	1	1	7	9	7	1	1	2
11	1	1	2	2	1	2	4	47	7	2	2	1	2	7	9	11	1	0	2
7	1	1	2	2	2	2	14	24	2	1	2	1	1	8	13	-5	0	0	2
12	1	2	1	2	2&8	2&8	12	50	4	1	2	1	1	10	1	13	1	1	2
5	1	2	2	2	7	1	13	16	2	2	2	2	3	7	7	3	1	1	2
3	2	1	2	1	2	2	8	10	2	2	2	1	2	7	1	9	1	1	1
10	2	2	1	2	7	1&2&7	7	47	10	1	2	1	1	5	5	6	1	1	1
8	1	1	1	1	1	1	10	30	6	2	2	1	2	8	9	-5	1	1	2
5	2	2	2	1	7&8	7&8	2	21.5	4	2	2	1	2	9	1	12	1	1	1

4	1	1	1	2	4	4	1	1	1	2	2	1	2	6	1	7	1	1	1
9	2	2	2	1	1	1	37	38	2	1	2	1	1	7	3	11	0	1	2
6	2	2	1	2	3	3	5	28	4	2	2	1	2	8	7	-4	1	1	2
6	2	2	2	2	1	1	10	25	5	1	2	1	1	8	13	1	1	1	2
2	2	1	2	1	1	1	3	3	4	2	2	1	2	10	1	11	1	1	2
11	1	1	2	2	2	1	15	48	5	1	2	1	1	5	1	9	1	1	1
7	2	1	2	2	1	1	8	27	4	1	2	1	1	9	16	-13	1	1	1
10	2	1	2	2	8	8	30	30	2	2	2	2	2	9	1	13	1	1	1
2	2	2	2	1	1	1	3	5	1	2	2	1	2	8	9	7	1	1	1
9	2	1	2	2	1&2	1	8	40	8	1	2	1	1	8	1	11	1	1	2
6	2	1	2	1	1	1	24	28	2	2	2	2	2	10	9	13	1	0	2
12	1	2	1	1	1	1	99	30	2	1	2	1	1	8	1	6	1	1	1
12	1	2	1	1	1	1	99	53	1	1	2	2	1	8	8	-6	1	1	1
8	2	2	1	2	1	1	8	34	4	1	2	1	1	9	13	-1	1	1	2
10	1	1	2	2	1	1	17	35	2	1	2	2	1	10	1	8	0	0	1
8	2	2	1	2	2	2	16	36	20	2	2	1	2	4	1	13	1	1	1
5	2	2	2	2	1	1	21	23	1	2	2	1	2	10	1	12	1	1	1
5	2	2	2	1	2	2	4	20	5	2	2	1	2	8	5	3	1	1	1
8	2	2	1	1	3	3	4.5	36	6	2	2	1	2	8	1	13	1	1	1
3	2	2	1	2	1	1	1	10	3	2	2	1	2	9	1	9	1	1	2
12	1	2	1	2	1	1	99	20	3	1	2	2	1	10	5	4	1	1	2
8	2	1	2	2	1	1	15	35	2	1	2	1	1	8	9	6	1	1	1
6	1	1	2	2	1&3	1	20	25	3	2	2	1	3	6	13	8	1	1	2
3	2	2	1	2	8	8	1.5	8	5	2	2	1	2	7	1	9	1	1	1
6	1	2	2	1	1&2&3&4&5&6	3&4&5&6	3	21	7	2	2	1	2	6	13	2	1	1	1
3	2	2	2	2	5&8	8	12	13	3	2	2	1	3	10	5	5	1	1	1
6	2	2	1	2	1	1	10	16	3	2	2	2	2	6	13	7	1	1	1
8	2	1	2	2	1	1	7	34	5	1	2	2	1	8	9	8	0	0	1
9	2	2	1	2	3	3	6	35	12	2	2	1	4	10	16	-6	0	0	2

2	2	2	2	2	8	8	2	4	3	2	2	1	2	7	2	9	1	1	2
6	1	2	1	2	8	8	18	18	1	2	2	2	2	7	14	-1	1	1	2
4	2	1	2	2	2	2	13	13	1	2	2	1	2	7	5	7	1	1	2
3	2	2	2	2	1	8	4	8	5	2	2	1	2	7	1	10	1	1	2
7	2	2	2	2	3	7	8	5	4	2	2	1	4	7	9	9	1	1	1
6	2	1	2	1	2	2	9	13	2	2	2	1	2	6	9	12	1	1	1
5	2	2	2	2	1	1	9	20	3	2	2	1	2	9	1	11	1	1	1
12	1	1	2	2	1	1	53	53	1	1	2	1	1	6	1	11	1	1	1
5	2	1	2	1	2	2	10	20	3	2	2	1	2	7	13	7	1	0	1
5	2	2	2	2	2	2	1	20	10	2	2	1	2	5	1	13	1	1	1
7	2	2	1	2	4	4	1	26	10	1	2	1	1	7	1	13	1	1	2
7	2	2	2	1	8	1&4&8	99	30	3	2	2	1	2	2	5	0	0	1	1
6	2	1	2	2	4	4	6	26	3	1	2	1	1	9	12	-1	1	1	2
7	2	2	1	1	1	8	0.5	30	6	1	2	1	1	10	1	13	1	1	1
6	1	2	1	2	8	8	6	15	4	2	2	2	2	8	1	9	1	0	2
8	1	2	1	2	1	1	30	31	2	2	2	2	2	7	1	8	1	1	2
2	2	2	1	2	8	8	2.75	2.75	1	2	2	1	2	7	5	7	0	0	2
8	1	1	2	1	2	2	1	14	4	2	2	1	2	4	13	7	0	0	2
11	1	2	2	2	3	3	99	46	6	2	2	1	4	7	9	5	1	1	2
7	1	1	2	1	1	1	25	25	3	2	2	2	4	9	13	-3	1	1	2
5	1	2	1	2	3	3&4&5&6	14	14	4	2	2	3	2	8	1	11	1	1	1
4	2	2	2	1	6	6	1	12	2	2	2	1	2	9	12	-3	1	1	1
4	2	2	2	2	2	2&3	8	15	8	2	2	1	2	8	1	13	1	1	1
8	2	1	2	1	8	8	17	20	5	1	2	3	1	8	16	-13	1	1	1
6	2	2	2	2	4&5	5&6	1	17	10	2	2	1	2	9	13	5	1	1	2
9	2	2	1	2	2	2	13	35	30	1	2	1	1	9	10	2	1	1	2
7	1	2	1	2	1	1	27	29	3	2	2	2	2	9	5	7	1	1	2
8	2	2	1	2	1	1	1	12	7	1	2	1	1	7	10	9	1	0	2
2	2	1	2	1	3&7	1&2	3	4	3	2	2	1	2	4	1	11	1	1	1
2	2	2	2	2	1	1&2	0.5	7	10	2	2	1	2	5	10	4	1	1	2

3	1	2	2	2	1	1	0.75	8	9	2	2	1	2	9	1	13	1	1	2
4	1	1	1	2	3	6	5	15	7	2	2	1	2	7	12	-6	1	1	2
7	2	1	2	2	1	1	27	29	2	2	2	2	2	8	1	13	1	1	2
7	2	1	2	2	5	5	0.25	30	10	2	2	1	2	7	1	5	1	1	1
4	2	2	2	1	8	8	5	17	7	2	2	1	2	7	9	2	1	1	1
7	2	2	1	2	2	2	13	29	3	2	2	1	2	8	1	10	0	1	1
12	1	1	1	2	1	1	99	64	4	1	2	1	1	8	1	13	1	1	1
3	1	1	2	2	5&6	6	4	7	3	2	2	1	2	7	6	2	0	0	1
8	2	2	1	2	1&2	1&2	21	36	40	1	2	3	1	8	9	9	1	1	1
11	2	2	2	2	1	1	99	50	4	2	2	1	4	10	9	7	1	1	1
8	1	2	2	1	1	8	4	33	2	2	2	1	2	8	9	4	1	1	2
3	2	1	2	2	3&6&7	1&2	9	9	3	2	2	1	3	3	1	12	1	1	2
5	1	1	2	2	1	1	16	18	3	2	2	2	2	8	1	10	1	1	2
8	2	2	1	2	2	2	10	30	6	1	2	1	1	6	9	13	1	1	2
7	2	2	1	2	1	1	29	29	2	1	2	1	1	7	1	12	1	1	1
5	2	1	1	1	1&2&7	2	3	17	6	2	2	1	2	7	1	11	1	1	1
6	2	1	2	2	1	1	4.5	25	6	2	2	1	2	8	1	13	1	1	2
12	1	2	1	2	2&4	1&2	12	55	6	1	2	1	1	8	1	13	0	0	1
5	2	1	2	2	6	6	9	22	3	2	2	1	2	9	1	9	1	1	2
7	2	1	2	2	2	2	3.75	12	7	2	2	1	2	8	1	13	1	1	2
8	1	2	2	2	1	1	4	35	4	1	2	1	1	7	12	-5	0	0	1
9	2	2	2	1	2	2	1	41	8	1	2	1	1	8	13	2	1	1	1
7	1	1	2	2	1	1	9	25	2	2	2	2	2	6	16	-13	1	1	2
8	2	1	2	2	8	1&2&7&8	2	30	16	2	2	1	2	8	1	10	1	1	2
3	2	2	2	2	2	1	7	10	2	2	2	1	2	6	1	7	1	1	2
12	1	2	1	2	2	2	99	54	3	2	2	2	1	8	9	13	1	1	1
6	2	2	1	2	2	8	3	11	3	2	2	1	2	5	5	0	1	1	1
6	2	1	2	2	4	8	11	26	5	2	2	1	2	8	5	8	1	1	2
6	2	2	1	1	7	7	30	30	1	2	2	1	4	9	13	3	1	0	2
5	1	1	2	2	8	8	10	12	10	2	2	1	3	8	13	8	0	0	2

9	1	2	1	2	1	8	11	40	2	1	2	1	1	10	13	-2	0	1	1
8	2	1	2	2	8	8	7	34	8	2	2	1	3	8	1	9	1	0	2
4	1	1	2	2	8	8	9	14	6	2	2	1	2	6	9	6	1	0	1
7	2	2	1	2	1&2	1	11	29	6	1	2	1	1	7	1	5	1	1	2
3	2	1	1	2	2&7	8	8	13	3	2	2	1	2	8	1	13	1	1	2
8	2	2	1	1	1	1	1.5	35	4	2	2	1	2	9	1	13	1	1	1
7	1	1	2	2	1	1	5	30	5	1	2	2	1	7	1	10	0	1	2
8	1	1	2	2	4	4	15	33	5	2	2	1	2	8	6	-4	1	0	2
12	2	1	2	2	2	2	33	60	6	1	2	1	1	8	14	-1	0	0	1
6	1	2	2	1	2	2	5	15	4	2	2	1	2	6	9	3	1	1	2
10	1	2	2	1	8	8	99	39	6	2	2	1	2	8	9	3	1	1	2
4	2	1	2	2	6	6	3.5	17	3	2	2	1	2	8	1	12	1	1	2
4	2	2	2	2	3	8	10	15	3	2	2	1	2	8	9	7	1	1	1
6	2	1	2	2	1	1	20	28	2	1	2	1	1	7	1	13	1	1	2
11	1	2	2	1	4	4	5	46	3	1	2	1	1	8	1	7	0	1	2
7	2	2	1	2	1	1	0.5	25	4	1	2	1	1	10	1	13	0	0	1
9	2	1	2	2	3	3	1.5	41	4	2	2	1	2	9	5	6	1	1	1
7	2	1	2	2	4	8	4	30	10	2	2	1	2	5	1	13	1	1	2
6	2	1	2	2	3	1	8	25	7	2	2	2	2	1	5	7	1	1	1
2	2	2	2	2	2&3&5	2	1.5	2.5	3	2	2	1	2	7	9	6	1	1	2
4	2	2	2	2	2&5&7&8	8	0.5	13	8	2	2	1	2	9	1	3	1	1	1
6	1	1	2	1	8	8	4	26	13	2	2	1	2	8	2	11	1	1	2
9	1	2	1	2	4	4	4	40	8	1	2	1	1	10	1	13	1	1	2