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The interdisciplinary dimension of neuroscience. Missionary evaluation

SUMMARY

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Introduction

The Orthodox Church is troubled by contemporary science. It is not only the slow reception of modern culture that makes it uneasy. An important cause is that contemporary research leaves aside ethical and spiritual criteria. The practical application of scientific discoveries in the field of biotechnology provides abundant evidence of this. That said, there is progress today towards an orthodox appreciation of modern culture and contemporary science and towards self-evaluation in the face of current cultural trends. However, this progress cannot have an impact without an authenticating framework. Fortunately, three documents of the Holy and Great Council of the Orthodox Church provide an implicit framework for addressing issues such as the Orthodox attitude towards science, especially towards biology and its related branches, in the light of theological anthropology and traditional ethical and spiritual criteria. A common feature of these documents is that they consider modern culture and scientific research in a missionary perspective.

Given their historical, geographical and cultural circumstances, the Orthodox, who emerged from the Middle Ages much later than Catholics and Protestants, have not been at the forefront of reshaping the Christian mission in the new world. While the new environment came to the attention of the Orthodox in the 19th century through Russian intellectuals, modern scientific culture eluded them until roughly the first decades of the 20th century. Their interests lay elsewhere.

In the 1920s, when several Orthodox Churches adopted the new calendar, most of them decided to keep the old one, having more faith in ancient culture than in modern science. As the calendar schism heralded, today the Orthodox world is divided between those who consider tradition and modernity compatible and those who consider them incompatible. The second instance has degenerated over time into the radical orientations that currently dominate the Orthodox camp, opposed - in the name of traditionalism, biblical literalism and patristic fundamentalism - to all that is Western, modern and scientific. That said, moderate voices are by no means absent, coming from hierarchs, clerics and lay scholars alike. From outlining the contours of a framework, allowing for the cross-fertilisation of theology and science, to translating the traditional doctrine of creation into contemporary scientific language, including ecological, these voices represent the spearhead of today's Orthodoxy, modest in numbers but solid in tradition.

Through them, Orthodoxy engages in the scientific culture of our time both critically and constructively - as it did in past ages. Perhaps the best articulation of these approaches is

Dumitru Stăniloae's statement in the preface to his monumental theological synthesis: 'We have endeavoured to understand the teaching of the Church in the spirit of the Fathers, but to understand it as we believe they would have understood it today. For they would not have ignored our time any more than they ignored theirs." To be widely received in the Orthodox camp, these contributions need an authenticating framework beyond the particular views of a particular Church. This is where the Holy and Great Council of the Orthodox Church (Crete, 18-26 June 2016) comes in. Three of its documents address the Church's mission in the contemporary world and discuss, albeit briefly, issues related to Orthodox engagement in science.

"Mission content is the new creation". The meaning of this phrase is not clarified, but three scriptural references (2 Cor. 5:17; 2 Pet. 3:13; Rev. 21:4-5) suggest that it refers to the renewal of the world in an eschatological perspective. Mission has roots that cannot be reduced to earthly means. This does not mean, however, that mission follows an ethereal model, focused on the future world. The People of God have a foretaste of the new creation in the Eucharistic experience of the liturgy. The liturgy, in turn, constitutes the context of mission. Orthodox mission has no ideological foundation; it is an ecclesial function, anchored in the liturgy as its source and framework. For the Orthodox, indeed, ecclesial means liturgically tested. The mission has ecclesial significance only insofar as it is liturgically tested. Consequently, the expected results of the mission are perceived in the transfigured faces of the saints, the new creation to which the liturgy points. This statement is common to all three documents discussed here, illustrating Orthodoxy's theological anthropology and response to contemporary attacks on human integrity. The prologue concludes by emphasizing that mission involves the effort of all Orthodox to bring hope to our troubled world, "in love, humility and respect for the identity of each person and the cultural particularity of each people."

The second relevant document, the "Encyclical of the Holy and Great Council of the Orthodox Church", elaborates on the above points and provides further information. As with "The Mission", the prologue of the document affirms the task of the Orthodox to bring hope to all people. The fact that we have "our citizenship in heaven" (Philippians 3:20) in no way negates, but rather strengthens our witness in the world. The document returns to the same idea after a few paragraphs, affirming the spirit and purposes of the Orthodox mission. We read there that "the Orthodox faithful are and must be Christ's apostles in the world" and that "the mission must be carried out, not aggressively, but freely, with love and respect for the cultural identity of individuals and peoples". Based on the "Mission", the "Encyclical"

describes the Orthodox mission as an invitation to all people to become the new creation through personal and free participation in eternal life" in the grace of the Holy Trinity within the Church. This understanding of mission conditions the vision of education as a holistic formative enterprise.

Orthodox education seeks to shape the human person in his or her complexity, in relation to God, the human community and the environment. This holistic approach opposes the secularist evaluation of the human world in anthropocentric, individualistic and atheistic terms, and the claim that the Church's spiritual criteria are an impediment to any progress and development. Identifying the Church with conservatism, which is incompatible with the progress of civilisation, is arbitrary and improper.

Throughout history and in accordance with its specific pedagogy, the Church has contributed to the progress of humanity, to its harmonious progress. The Church is therefore not opposed to the development of science and neuroscience. It is opposed to reductionist ideologies which identify progress with an increase in the standard of living or with economic development at the expense of spiritual values. In other words, it combats the idea of one-sided materialistic progress.

In addition, it opposes the greed that undermines both human life and the ecological balance of our world. An integral part of the Church's mission is to counter secularism - and the oversimplification of existence - with a holistic missionary and educational approach.

The last document of interest, "The Message of the Holy and Great Council of the Orthodox Church", continues the line of thought of those previously analyzed. In fact, it begins in a note that echoes the end of the "Encyclical". Specifically, it states that the Church is neither selfish nor lives for its own good. Instead, the Church bears witness to the Gospel of grace and truth, offering the world divine gifts such as love, peace, justice, reconciliation, the power of the Cross and Resurrection, and the expectation of eternal life.

Mission - understood as the re-evangelisation of God's people in modern, secularised societies and the "evangelisation of those who have not yet come to know Christ" - has liturgy as its starting point. There, God's people pray for the whole world and learn to bear witness to the faith to those near and far. A translation of this witness of faith is in terms of the Orthodox message on the current ecological crisis, which has profound spiritual and moral causes. Indeed, its roots are connected with greed, avarice and selfishness, which lead to the misuse of natural resources, the filling of the atmosphere with harmful pollutants and climate change. These roots require the Orthodox to urge society at large to adopt an ascetic mindset as an

antidote to excessive consumption and to cultivate a sense that people are stewards, not owners of creation.

On this note, we understand that the topicality of the way of analysing neuroscience in an interdisciplinary context stems from the status of science in contemporary times, relating theology to science as a natural act, in a competent dialogue between two fundamental dimensions of human knowledge.

In general, the Orthodox Church does not reject scientific findings. It accepts their results, which can have a positive effect and benefit people. Of course, as the Church Fathers teach us, there is no conflict between theology and science because they have different purposes and roles. Science seeks to improve the conditions of human life, because after the fall human beings have put on the "skin clothes" of corruptibility and mortality. Theology, however, leads people to communion with God and ultimately to salvation.

Moreover, there are scientists who are aware of God's presence in nature. Some scientists feel that as research advances, more and more questions arise. They believe that as their knowledge of biology or neuroscience increases, so does their ignorance of religion. There is one huge element which, however much progress contemporary man may make, he can never surpass, and that is the Creator of all. Scientific theories are continually developing and changing. For this reason, the Church, on the one hand, lays down basic theological principles for mankind, but, on the other hand, pursues scientific research calmly, discreetly and without haste, because today's discoveries can eventually be overturned and many of them represent a confirmation of the religious intuitions about man found in the writings of the Holy Fathers.

Thus, the necessity of approaching neuroscience from an interdisciplinary perspective, which we will show in this thesis, arises from the importance of scientific discoveries through experiments that give even greater credibility to theology by validating religious intuitions with revealed foundations.

I. The interdisciplinary dimension of the sciences. Fundamental landmarks

The development of innovative and creative ideas in academia has only happened because of an inter-disciplinary approach. The division into several has also led to the

development of interdisciplinary practice. This has occurred in the sciences, in technological development or the arts, or in the social sciences or the non-material sciences.

Today, academia continues to be organised around departments of mathematics, physics, biology or computer science, engineering schools and professional colleges. However, scientific research tends to take place collectively and collaboratively. Laboratories (e.g. bioinformatics or nanoscience) require teams of researchers with more or less practice-oriented training, methodologies, techniques and technological expertise. Some experiments, discoveries and research are now carried out in multi-disciplinary laboratories, which is why science benefits from the results of these interdisciplinary research laboratories[1] .

The advancement of science, therefore, often takes place across several departments and increasingly with interdisciplinary research objectives at its core. Schools with interdisciplinary programmes within the applied social sciences have become increasingly popular and are composed of historians, sociologists, philosophers, theologians and cultural analysts. A similar relationship is found in American universities between core humanities departments and interdisciplinary humanities research[2] .

This relatively new research method (inter-disciplinary research in science) can be considered an intellectual product of globalisation. Social thinking and the humanities as a result have been transformed in unexpected and unpredictable ways. For example, the renaissance of classical studies in the early twenty-first century has resulted from combining traditional linguistic and historical studies of areas specifically located in the ancient world with archaeology enhanced by new digital imaging techniques and an expansive political geography. These developments have transformed the map of the ancient world by posing questions posed by critical race theory, gender studies or post-colonial theory[3] .

What the humanities have in common is that they show what it means to be human. Similarly, the social sciences have shown normative patterns of psychology, socialisation or governance. These, they have claimed, teach what it means to be rational and rational, cultured and moral, social and political, learned and mundane. Before the Second World War, and more so in the 1970s, the dominant trends in the humanities and social sciences throughout the Anglo-European academy, as well as in universities around the world, which were founded on Anglo-European principles, represented expressions of the culture of

[1] Lisa Lattuca, *Creating Interdisciplinarity: Interdisciplinary Research and Teaching among College and University Faculty*. Vanderbilt University Press, Nashville, 2001
[2] Marjorie Garber, *Academic Instincts*, Princeton University Press, Princeton, N.J., 2001
[3] *Interdisciplinarity: History, Theory, and Practice*, Wayne State University Press, Detroit, 1990

European society and politics, but not of all of Europe, but rather of those belonging to the dominant nations in the European orbit (French, English or German).

New approaches brought about by globalisation, a long-standing process intensified and accelerated dramatically after the Second World War, have contributed substantially to changing the intellectual boundaries of human and social disciplines. Interdisciplinarity, which at first took the form of pluralism, emerged as a result of difficult issues that led to the need to find better tools of interpretation, complex patterns of cultural and human exchange and new perspectives of knowledge. As with any paradigm shift, these new structures of thought brought added value to science[4] .

The use of interdisciplinarity in the humanities and social sciences has confirmed the power of broad representation of the sciences. The natural sciences in particular, complemented by the empirical social sciences, have provided the dominant model for the nature of interdisciplinarity. In some cases, scientific interdisciplinarity has been robust. Computer science, sociology and genomic research, and politics and ethics are good examples. But there are other models of interdisciplinarity that have not added value to science. The Gulbenkian Commission's report on the restructuring of the social sciences, "Open the Social Sciences", rightly points out that the humanities in some formations can actually be much more interdisciplinary than the empirical social sciences[5] .

Jeffrey Sachs rightly insists in an interview with the New York Times Magazine, discussing his commitment to "sustainable development" that interdisciplinarity is the only way to solve the world's problems. The need, he says, is "to focus not on disciplines but on problems and to bring together five main fields in an intense dialogue: earth sciences, environmental science, engineering, public health and social sciences with a heavy dose of economics"[6] .

In conclusion, the inter-disciplinary dimension of the sciences refers to the fact that the sciences do not work in isolation, but are interconnected and interdependent. For example, biology, physics, chemistry, mathematics and other sciences are closely interlinked, and advances in one field can influence and lead to advances in others.

Interdisciplinarity can also be applied in scientific research, which involves collaboration between researchers from different fields to tackle complex problems and

[4] Julie Thompson Klein, *Crossing Boundaries*, University of Virginia Press, Charlottesville, 1996

[5] *Open the Social Sciences Report of the Gulbenkian Commission on the Restructuring of the Social Sciences*, Stanford University Press, Redwood City, California, 1996

[6] Jeffrey Sachs, "Poor Man's Economist: Questions for Jeffrey Sachs" in *New York Times Magazine*, 12 December 2002, p. 45

develop innovative solutions. This type of approach can provide a broader perspective on the research topic and lead to unexpected discoveries and innovations.

Interdisciplinarity is increasingly important in today's world because many of the major issues facing our society, such as climate change, public health and sustainable energy, require an interdisciplinary approach to solve.

While some scientists embrace a vigorous interdisciplinary perspective, other scientists prefer interdisciplinary practice exclusively in the sciences - biology, chemistry, cognitive science and so on. It is therefore important to pay attention to the fact that there are different conceptions, models and practices of the interdisciplinary approach to science.

The word "science" derives from the Latin *scientia* . Historically it has been closely associated with philosophy. At least since the Renaissance, the term has acquired theoretical, organised and experiential knowledge. In the 17th century, a combination of practices, ideas and institutions contributed to what most historians recognize as the emergence of modern science. Galileo Galilei, Rene Descartes, Francis Bacon, Robert Boyle and Isaac Newton (all of whom considered themselves philosophers) wrote texts that later followers called exemplars of the 'new philosophy'. Although there was not universal agreement on exactly what this new philosophy consisted of, some of the most important elements included: 1) the rejection of Aristotelian forms and final causes; 2) the attempt to account for most natural phenomena in terms of efficient causes operating according to the laws of nature; 3) the identification and quantification of objective "primary qualities" such as mass and velocity; 4) the introduction of experimental practices using the controlled operation of events.

The old scientific paradigm comprised two distinct strands, including both a body of knowledge and a coordinated set of instrumental activities that generate technological or engineering solutions. The former continues the legacy of natural philosophy in its aim to understand, explain and predict the world. The latter component has more pragmatic concerns to build tools and solve problems.

In the mid-20th century, scientists launched a vigorous campaign to correctly characterise science and thus distinguish it from illegitimate forms of knowledge or pseudoscience. If the scientific method could be correctly identified, they surmised, then the proper method for generating knowledge could be assured and there would be a better way to eliminate dubious, unscientific or purely ideological claims.

Theology and science, in their dialogue, try to deal with the presence of God in the universe in his real absence. Without a careful clarification of the meaning of this 'presence in absence', the meaning of the dialogue cannot be established. This is why we try to express the

problem of "presence in absence" along the lines of Eastern Orthodox theological apophaticism using the conceptual tools of phenomenological philosophy. The discussion is related to the problem of transcendence in cosmology and its possible theological significance. It is anticipated that all attempts of scientific discourse to "remove" the dichotomy in God's "presence in absence" by pointing to an ultimate reality cannot be fulfilled, but man can theologically overcome the tension by transcendent mediation between the created and the uncreated.

When, in philosophy, it is asserted that God is absent, an argument is usually exercised either to prove that the contrary (i.e., the existence and presence of God) is impossible (Kantian philosophy) or that the notion of God must be questioned (classical phenomenological philosophy)[7] . Theology is against the denial of God because it holds that the living God who is worthy of worship is immanently present in this world. God permeates the world, but He is not in the world. One can reverse this claim by saying that the world is in God through its uncreated energies. This expresses the essence of pantheism[8] .

Orthodox apophaticism affirms ignorance of God if one tries to speak of Him in terms of earthly definitions. But it does not deny God's presence in the world in the form of its tacit absence. God is present in the world, but since this is "presence in absence", any affirmation of this paradoxical situation will lead the human mind to antinomies, so that all sorts of metaphors and allegories can be used to express God's "presence in absence". However, it is important to point out that even in the most influential patristic writers, the methodology of apophaticism, which elucidated the paradox of God's presence and absence in the context of faith, was usually exercised at the level of the relationship between the world and God. What is important here is that, despite the fact that the context of apophatic reasoning presupposes faith in God who cannot be subject to the objectifying tendencies of discursive reason, it is observed that the natural attitude towards the world and towards God is exercised by the theological consciousness, which represents both God and the world beyond itself.

The study of the mind and its biological basis is one of the greatest scientific endeavours of all time. It is the key to a definitive understanding of the very nature of human beings from a scientific perspective. It is considered by many to be one of the 'final frontiers' of great science. However, the complexity of the nervous system and the many

[7] Edmund Husserl, *Ideas. General Introduction to Pure Phenomenology,* Collier Books, London, 1969, p. 58
[8] A. Peacock, *Whom We Live and Move and Have Our Being,* Edited by Ph. Clayton and A. Peacock, William B. Eerdmans Publishing Company, Grand Rapids, MI, 2004, p. 18

methodological barriers that exist in the objective study of its structure and function require extensive collaboration between scientific disciplines.

Collaboration and integration lead to new knowledge, which would not be possible without this integration. This can take many forms: in one form, multidisciplinarity, occurs when disciplines work side by side on separate aspects of a single problem. Interdisciplinarity, on the other hand, occurs when disciplines integrate and collaborate with each other[9] .

Modern neuroscience involves collaboration between molecular and cell biology, developmental biology, genetics, biochemistry, biophysics, pharmacology, electronics, information technology, biomedical engineering, mathematics, statistics, physics, cognitive science, psychology, linguistics and even theology. They converge and intertwine in what is probably the most multid2isciplinary and interdisciplinary of all the sciences.

For example, the membrane of a neuron can be studied separately from chemistry or physics as a complex phase of organic molecules with distinctive electrical properties; abstracting entirely from being part of a living cell and the result of divine creation. This is multidisciplinary research. However, when the structure, properties and functions of the membrane are studied using an approach that combines the contributions of several disciplines working together, we speak of interdisciplinarity.

For example, in a research project described as "the influence of the second messenger system on the molecular conformation of ion channels and its consequence on the integration of input information through dendritic fields of genetically defective neurons in the visual area using electron imaging and micromachined electrodes" we see the intrinsic collaboration of many disciplines from many different fields of knowledge. The outcome of this seemingly important research would not be possible without their integration.

The fascination of many theologians, philosophers and scientists with the workings of the brain and mind made neuroscience a powerful multi- and interdisciplinary field of research and speculation centuries before the very concept of interdisciplinarity was invented. The puzzling nature of neural activity has for hundreds of years spawned and developed all sorts of "explanatory models", which in turn have been strongly influenced by the cultural and scientific paradigms of the time[10] .

Because detailed structural study of the human body could be effectively carried out many centuries before meaningful physiological studies were possible, and because

[9] M. Nissani, "A Working Definition of Interdisciplinarity" in *Journal of Educational Thought,* no. 29, 1995, pp. 119-126

[10] See Thomas S. Kuhn, *The Structure of Scientific Revolutions*, University of Chicago Press, Chicago, 1970.

Renaissance science was fascinated by all things mechanical, it is not surprising that the first models of nervous system function were mechanical[11] . The real philosophical breakthrough was to view the body as a kind of machine, albeit suffused with "vital fluids" that seemed to differentiate it from mere man-made artifacts. This stimulated interdisciplinary collaboration.

II. Neurosciences. Fundamental landmarks

Neuroscience is the scientific study of nervous tissue, nerve activity, organisation, systems and interactions. Neuroscience is paradigmatically interdisciplinary, currently including biophysics, organic biochemistry and biochemistry, molecular biology to evolutionary biology, anatomy and physiology, ethology, neuropsychology, and cognitive and information sciences. Researchers include basic scientists and clinicians. At the end of the 20th century, neuroscience experienced enormous growth. The quantitative information available on the Society for Neuroscience website speaks to this.

Started in 1970 with 500 members, at last count (summer 2004) the Society boasts over 34,000 members worldwide. More than 30,000 registrants attended the 2004 Annual Meeting, where more than 14,000 posters and oral presentations were presented. There are currently over 300 graduate training programmes worldwide in neuroscience. Given its growing academic influence and its obvious link to the eternal philosophical mind-body problem, it was inevitable that philosophers would start to take a serious interest in it.

Systematic interest in academic philosophy could be dated to 1986, the year Patricia Churchland's Neurophilosophy appeared[12] . She boldly proclaimed that "nothing is more obvious than that philosophers of mind could profit from knowing at least something of what there is to know about how the brain works"[13] . Her book presented what was then textbook neuroscience, contextualized by developments in the post-logical empiricist philosophy of science. She laid the groundwork for much of the neurophilosophy and philosophy of neuroscience that followed, especially the branch of neuroscience that philosophers have been concerned with (cognitive neuroscience).

Neuroscience is an interdisciplinary scientific field that studies the nervous system, including the brain and other components of the nervous system, to understand its functioning at the molecular, cellular and systemic levels. The building blocks of neuroscience include:

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[11] Renato Sabbatini, "The Discovery of Bioelectricity" in *Brain & Mind*, no. 6, 1998

[12] Patricia Churchland, *Neurophilosophy: Toward a Unified Science of the Mind-Brain*, The MIT Press, Cambridge, 1989

[13] *Ibid*, p. 4

Neuroanatomy: This refers to the study of the physical structure of the nervous system. Neuroanatomy deals with the identification and description of different regions of the brain, spinal cord and other components of the nervous system.

Neurophysiology: This is the study of the functioning of the nervous system at the cellular and molecular level. Neurophysiology focuses on how neurons transmit electrical and chemical signals and how these signals affect the body's physiological processes.

Neurochemistry: This field explores the chemicals that play an essential role in communication between neurons, such as neurotransmitters. Neurochemistry helps to understand how chemicals influence behaviour and cognitive functions.

Neurogenetics: studies the genes and genetic inheritance of neurological disorders and cognitive traits. Neurogenetics research helps identify genetic factors involved in the development and progression of neurological diseases.

Neuroimaging: This involves using various imaging techniques to visualize the brain and its activity. Imaging technologies such as functional magnetic resonance imaging (fMRI) and computed tomography (CT) provide detailed images of the brain in real time.

Neuropharmacology: This field explores the effects of drugs and chemicals on the nervous system. Neuropharmacology helps develop drugs to treat neurological and psychiatric disorders.

Developmental neurobiology: Focuses on how the nervous system develops during embryonic life and childhood. This discipline studies the processes of brain development and the formation of neural connections.

Clinical neurology: is the medical field that deals with the diagnosis and treatment of neurological diseases. Clinical neurologists specialise in treating patients with neurological conditions such as migraines, epilepsy or multiple sclerosis.

Cognitive neuroscience: This discipline focuses on understanding mental processes and human behaviour in the context of brain functioning. Cognitive neuroscience investigates memory, attention, language, thinking and other aspects of cognitive function.

Clinical psychology and psychiatry: These fields intersect with neuroscience through the study of mental and psychiatric disorders that have a neurobiological basis. Clinical psychologists and psychiatrists use knowledge from neuroscience to assess and treat patients with mental disorders.

Neuroscience is an ever-expanding field, and collaboration between the various disciplines in the field helps to develop new knowledge and a deeper understanding of the

nervous system and how it affects human health and behaviour. In our approach we will address only some of the building blocks of neuroscience.

Nanoscience is an emerging new discipline that aims to solve some of the hitherto intractable problems in neuroscience using nanoscientific insights and tools. These state-of-the-art methods are able to address some of the most difficult challenges in neuroscience, such as finding better ways to diagnose, treat and prevent various neurological, neurodevelopmental and neuropsychiatric disorders.

Nanotechnology is arguably one of the best ways currently available to address the core of higher cognitive function. A nanoscale focus on the mechanical interactions of biomolecules is uniquely capable of demonstrating the multiple ways in which neurons communicate and transmit signals, from traditional means of interneuronal and intraneuronal communication to new modes of biomolecular computation. Notable milestones in nanoscience include the development of tools and techniques that allow interactions with small surfaces or individual molecules, such as scanning tunneling microscopy (STM), atomic force microscopy (ATM).

These tools operate in the nanoscale range and have the potential to reveal details of molecular events and subcellular operations within neurons. Nanosciences have also developed a wide variety of nanomaterials - carbon nanotubes, nanoparticles, nanowires and quantum dots, among others - that can be used to probe and stimulate neurons or parts of them. Nanoparticle-based drug delivery systems (or gene therapy delivery systems) with enhanced ability to cross the blood-brain barrier could potentially be used to treat a range of neurological, neurodevelopmental and neuropsychiatric diseases. Nanomaterials, used alone or in hybrid combinations with other materials, could be used to diagnose nervous system disorders, measure neurotransmitter levels or electrical activity in distinct areas of the brain, stimulate distinct areas of the brain, and ultimately construct potential nanoscale prosthetic devices that restore normal patterns of neural activity and cognitive function.

Nanoneuroscience is a science that bridges the gap between neuroscience and nanotechnology, simultaneously addressing the fundamental goals of these two (until recently) separate fields. The quintessential goal of neuroscience is to understand how the nervous system works - how it processes information to determine various actions and mental states - and then to apply this basic knowledge to practical issues, such as the management of nervous system diseases.

III. The relationship of neuroscience to theology. Fundamental aspects

The scientific and religious communities have long been at odds over scientific attempts to explain religious experience. Since the early modern era, a number of scientists interested in religion and spirituality have sought a rigorous understanding of how these types of experiences manifest themselves in the brain and in human behaviour. According to this view, our deepest beliefs and most uplifting experiences can be understood in scientific terms - in particular, in terms of neuroscience which studies "brain anatomy, brain function and brain chemistry"[14] . However, others doubt that science has a legitimate role in exploring the nature of religion or spirituality. In their view, scientists should not attempt to explain the ineffable at all, and they see such efforts as a challenge to the values and experiences they hold most personal and sacred.

Aldous Huxley, one of the most prophetic science fiction authors of his generation, wrote in 1958: "The fact that men and women can, by physical and chemical means, transcend themselves in a truly spiritual way... seems rather shocking. But, after all, the drug or physical exercise is not the cause of the spiritual experience; it is only its occasion."[15] As an experienced explorer of the boundary between chemistry and spirituality, Huxley believed that the "chemical means" of spiritual experience did not invalidate the psychological value of the state itself. In this case, efforts to better understand these means are particularly important to the scientific study of these experiences.

It should be possible to take a scientific approach to religious and spiritual experience without reducing these experiences strictly to chemical reactions. And even if such reductionism were possible, perhaps other disciplines would still provide a valuable grammar for describing and understanding various aspects of religion and spirituality. At the same time, any social, cultural or personal conception of the divine or a higher power ultimately boils down to what is going on inside the brain[16] . The feeling of falling in love, the pain of a broken bone, the beauty of a sunset - these and every other sensation we've ever experienced result from chemical reactions in the brain. Just as humans can't see without eyes or hear

[14] Lionel Tiger; Michael McGuire, *God's Brain*, Prometheus Books, Amherst, 2010, p. 113
[15] Aldous Huxley, "Drugs That Shape Men's Minds" in *Saturday Evening Post* issue on 18 October 1958
[16] Andrew Newberg; Eugene G. d'Aquili, "The Neuropsychology of Religious and Spiritual Experience" in rev. *Journal of Consciousness Studies*, no. 7, year 2000, pp. 251-266

without ears, humans can't experience anything without the ongoing molecular reactions that take place in the brain.

So while neuroscience is not sufficient to fully understand religion and spirituality, it is indeed necessary. This area of study is considered by some to be part of what has been called neuroscience - the link between neuroscience and religious and spiritual inquiry.

In addition, there are certain types of questions that the empirical study may not be able to answer. Neuroscience can help us address questions about the mechanics of the brain, but not about the basic nature of reality or the accuracy of faith. Metaphysical questions of this kind are theological. While some questions may remain mysteries, scientists can at least strive to explain some causal aspects of religion and spirituality from a neuroscientific perspective, focusing on the neurochemical side. For example, does having higher amounts of a certain chemical in the brain predispose people to become religious? How do meditation and prayer exert their beneficial effects at the chemical level? Are religious and spiritual experiences triggered by psychedelic drugs similar to or different from those triggered by meditation?

When it comes to religion and spirituality (and even the brain science behind them), the story is often much more complicated - and interesting - than it first appears. For example, although belief is associated with certain differences in brain structure, it's usually unclear whether these findings indicate causation or just correlation - whether a different type of brain tends to adopt certain types of beliefs, or whether certain types of beliefs change brain structure.

The challenge of understanding the relationship between neuroscience and religion and spirituality stems from the fact that these concepts are classically difficult to define. Some researchers find it impossible[17] , while others have organised conferences to try to reach consensus on working definitions of these concepts[18] . No doubt part of the difficulty in defining these concepts stems from the wide range of components they encompass, including sacred texts, beliefs, community, rituals and practices. In addition, religion and spirituality overlap substantially, but also differ in important respects.

Religion has been described in many different ways[19] . The philosopher and psychologist William James described religion as belief in a god and trying to live according

[17] Andrew McKinnon, "Sociological Definitions, Language Games, and the 'Essence' of Religion" in rev. *Method and Theory in the Study of Religion*, no. 14, year 2002, pp. 61-83

[18] David Larson, Michael E. McCullough; James P. Sawyers, *Scientific Research on Spirituality and Health: A Report Based on the Scientific Progress in Spirituality Conferences*, John M. Templeton Foundation, New York, 1998

[19] Brian Zinnbauer; Brenda Cole; Kenneth I. Pargament, "Religion and Spirituality: Unfuzzying the Fuzzy" in rev. *Journal for the Scientific Study of Religion*, no. 36, issue 4, year 1997, pp. 549-564

to divine commands[20] . Emile Durkheim took a more social approach, defining religion as a moral community based on shared beliefs[21] . More recently, Michael Argyle and Benjamin Beit-Hallahmi have specified that religion includes beliefs about a supernatural entity and common practices and rituals[22] .

A religion can be broadly defined as a system of beliefs about supernatural phenomena and practices designed to acknowledge or interact with them. Most common conceptions of religion reflect the worship of divine beings, whether literal entities or representations of abstract forces. These beliefs and practices are often maintained by social organizations, including facilities for worship and formal councils of religious authority.

A growing number of people in the United States identify as spiritual but not religious[23] . In other words, they relate to the more subjective, experiential qualities that religion describes, without following certain customs or belonging to a religious community[24] . Many of these people adopt a belief in a "higher power" or all-encompassing force that unifies humanity, living beings or even the entire universe.

Definitions of spirituality are generally more recent and broader[25] . Frances Vaughan points out the more individual and subjective connotations that spirituality has in relation to religion[26] . Charles Tart extends the concept of spirituality beyond the supernatural to include love, compassion and purpose[27] . Kenneth Pargament offers a definition of spirituality as an often used and comprehensive search for the sacred[28] .

Both religion and spirituality involve beliefs of some kind. For the spiritually inclined, these beliefs may be intuitive rather than formal, as they may be based on subjective feelings, such as a sense of oneness with the world, rather than on particular faith beliefs. For the religious, individual beliefs tend to align with a collective belief system - one that addresses topics such as the existence of a deity, the creation of the world, the relationship between consciousness and matter, and the purpose of existence.

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[20] William James, *The Varieties of Religious Experience*, Harvard University Press, Cambridge, 1902
[21] Emile Durkheim, *The Elementary Forms of the Religious Life*, Free Press, New York, 1912
[22] Benjamin Beit-Hallahmi; Michael Argyle, *The Social Psychology of Religion*, Routledge & Kegan Paul, London, 1975
[23] Brian Zinnbauer; Brenda Cole; Kenneth I. Pargament, *art.cit.*, p. 564
[24] Robert Forman, "Mystical Consciousness, the Innate Capacity, and the Perennial Psychology" In *The Innate Capacity. Mysticism, Psychology, and Philosophy*, Oxford University Press, Oxford, 1998
[25] Brian Zinnbauer; Brenda Cole; Kenneth I. Pargament, *art.cit.*, p. 564
[26] Frances Vaughan, "Spiritual Issues in Psychotherapy" in rev. *Journal of Transpersonal Psychology*, no. 23, year 1991, pp. 105-119
[27] Charles Tart, *Transpersonal Psychologies*, Psychological Processes, El Cerrito, 1983
[28] Kenneth Pargament, "The Psychology of Religion and Spirituality? Yes and No" in rev. *Intern. Journal for the Psychology of Religion*, no. 9, issue 1, year 1999, pp. 3-16

Religion and spirituality also use rituals. Ritual involves separating oneself from the structure of everyday life, entering into an intentional personal practice or group process, and then returning to everyday life[29] . Likewise, people who describe a personal relationship with the divine or the mystical tend to either accept collections of traditions from their religious systems or practice their own ways of gaining these experiences[30] . Religions promote rituals designed to evoke spiritual and related experiences, such as prayer and group ceremonies[31] . Religious and spiritual people also use practices such as meditation, prayer or the use of psychedelic drugs to access altered states of consciousness[32] .

Religious experiences and spiritual experiences are often referred to under the umbrella term religious, spiritual and mystical experiences (RSME)[33] . These experiences usually include positive feelings and may involve a diminished sense of self, a sense of oneness, a sense of sacredness and a deep sense of personal significance[34] . Empirical research has shown that such experiences can be positively transformative in terms of their effects on well-being and altruistic behaviour[35] , and these effects can sometimes last for decades[36] . Recently, a number of academics, from skeptics to believers, have come forward to describe their own experiences of feeling "called" to their current profession[37] .

In Varieties of Religious Experience, William James describes a number of RSMEs through first-person accounts of these experiences[38] . Religious scholars and researchers have used James' classic (and, at the time, groundbreaking) text to further classify the most common types of religious and spiritual experiences. Mystical experiences, for example, involve a sense of connectedness or oneness with all things. Such experiences are often

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[29] Victor Turner, *The Ritual Process: Structure and Antistructure*, Transaction Publishing, London, 41995

[30] Tanya Luhrmann, *When God Talks Back: Understanding the American Evangelical Relationship with God*, Vintage, New York, 2012.

[31] Jonathan Haidt; Jesse Graham, "Beyond Beliefs: Religions Bind Individuals into Moral Communities" in rev. *Personality and Social Psychology Review*, no. 14, issue 1, year 2010, pp. 140-150

[32] Peter C. Hill; Ralph Hood; Bernard Spilka, *The Psychology of Religion, Fourth Edition: An Empirical Approach*, Guilford Press, New York, 2009

[33] Mario Beauregard, "Neuroscience and Spirituality-Findings and Consequences" in rev *Neuroscience, Consciousness and Spirituality*, Springer, Dordrecht, the Netherlands, 2011, pp. 57-73

[34] Nima Ghorbani, Ralph Hood, P. J. Watson, "Dimensions of the Mysticism Scale: Confirming the Three-Factor Structure in the United States and Iran" in rev. *Journal for the Scientific Study of Religion*, no. 40, issue 4, 2001, pp. 691-705

[35] W. A. Richards; R. R.Griffiths; M. W. Johnson, "Mystical-type Experiences Occasioned by Psilocybin Mediate the Attribution of Personal Meaning and Spiritual Significance 14 Months Later" in rev. Journal of Psychopharmacology, no. 22, year 2008, pp. 621-632

[36] Rick Doblin, "Pahnke's 'Good Friday Experiment': A Long Term Follow-Up and Methodological Critique" in rev. *Journal of Transpersonal Psychology*, no. 23, year 1991, pp. 1-28

[37] D. E. Anderson; David Yaden; M. G. Mattar; A. B. Newberg, "Psychoactive Substances and Psychoactive Stimulation: Conceptual and Ethical Considerations" in vol. *The Psychedelic Policy Quagmire: Health, Law, Freedom, and Society*, Praeger, New York, 2015.

[38] William James, *op.cit.,* p. 21

experienced by the subject as being beyond language, time and space[39] . Numinic experiences are encounters with a god or other abstract spiritual entity. Such experiences are often filled with awe, reverence and a sense of awe[40] . Calling experiences are temporary, deeply meaningful states of mind that include a revelation or directive[41] . People who have had a calling experience may see a vision or hear a voice directing them to a particular life path. For example, the New Testament recounts the experience of St. Paul on the road to Damascus, where he reported that he had a vision from God that directed him to change his life[42] .

In general, religion tends to place more emphasis on collective institutions, beliefs and practices, while spirituality depends more on individual belief and experience[43] . From a neuroscience perspective, some of these factors matter more than others. The more subjectively intense aspects of religious and spiritual experiences can be more easily measured because they are easier to detect.

IV. The missionary approach to neuroscience in the contemporary world

With the development of naturalistic thought, the apparent dichotomy between Christianity and the empirical sciences grows rapidly. However, neuroscience and faith are not really at odds. In fact, a deeper examination of the field of neuroscience reveals an amazing harmony between the two. Faith and neuroscience complement each other, because having an active faith allows neural circuits to be strengthened.

A significant element of the Christian lifestyle is the notion that individuals are called to become like God. This concept is emphasized in the Mass, in sermons and throughout Scripture, which presents messages such as "Let this mind be in you which was in Christ Jesus". (Philippians 2:5)

However, when considering this concept, it is hard to understand how Christians can think like Christ. Of course, one can recognize the beauty of having a Christ-like mind, but one may not fully understand how exactly to achieve such an aspiration. This internal conflict between the desire to have a mind like Christ's and the struggle to acquire that mind is where Christian faith and science complement each other. Empirical neuroscientific evidence has

[39] Nima Ghorbani, Ralph Hood, P. J. Watson, *art. cit*.
[40] Peter C. Hill; Ralph Hood; Bernard Spilka, *op,cit.* p. 12
[41] David Yaden, Andrew B. Newberg, "Road to Damascus Moments: Calling Experiences as Prospective Epiphanies" in vol. *Being Called: Scientific, Secular, and Sacred Perspectives*, Praeger, New York, 2015.
[42] Richard Longenecker, *The Road from Damascus: The Impact of Paul's Conversion on His Life, Thought, and Ministry*, Eerdmans, Grand Rapids, 1997.
[43] Kenneth Pargament, *art.cit.,* p. 16

supported the idea that physiological changes are associated with the embrace of faith, thus providing evidence of the transformative power of Christianity through scientific mechanisms that will ultimately lead to human flourishing and the attainment of a Christ-like mind.

The brain, connected by 85-100 billion neurons[44] , is the part of the central nervous system responsible for the development of one's identity, personality, emotions, thoughts and behaviours.[45] Each individual is composed of a unique genetic code ("nature") that is integrated with the environment and the set of experiences ("nurture"). Our environment and experiences shape the expression of our genotypes. Given the malleability of one's genetic makeup and nervous system, a genotype has the potential to manifest itself in a diverse range of phenotypes. Simply put, empirical principles of neuroscience inform us that no two individuals share exactly the same characteristics[46] .

Complementing this neuroscientific observation, the Word of God attests to the beauty and purpose of human uniqueness. In Holy Scripture, it has been proclaimed that God "formed me in my mother's womb" (Ps. 138:13), which demonstrates the complexity with which each human was created by God's handiwork. God created each human being in His own image in a unique and beautiful way. God uses each uniquely shaped personality, genetic code and individual set of gifts to bring good into His Kingdom, as Romans 8:28 states, "And we know that God works all things for good to those who love God, to those who are called according to His will."

Some might argue that the dichotomy between empirical science and Christian faith is too deep to be reconciled[47] . However, when one reconciles the construction of the nervous system according to neuroscience and the human construction according to the Word, there seems to be nothing but harmony. God has interwoven the intricate "wiring" of our nervous system, and the gifts He has given us are established by this beautiful design. For example, one cannot demonstrate the biblical virtue of patience without engaging in parasympathetic activation through the nervous system. The mind was ultimately created to enable people to

[44] Suzana Herculano-Houzel, "The human brain in numbers: a linearly scaled-up primate brain" in rev. *Frontiers in Human Neuroscience*, no. 3, 2009

[45] Jaak Panskepp; Kenneth L. Davis "The brain's emotional foundations of human personality and the Affective Neuroscience Personality Scales" in *Neuroscience and Biobehavioral Reviews,* volume 35, no. 9, 2011, pp. 1946-1958

[46] Mairi Levitt, "Perceptions of nature, nurture and behaviour," in *Life Sciences, Society and Policy*, volume 9, no. 13 (2013).

[47] Sabrina Blank, "Miracle of the Mind: The Transformative Power of Neuroscience and Faith", https://blogs.hope.edu/belltower/bell-tower-volume-1-issue-1/miracle-of-the-mind-the-transformative-power-of-neuroscience-and-faith/ accessed 12.07.2023

achieve more than can be imagined through the power of the nervous system and the Holy Spirit.

There are several negative socio-cultural phenomena that challenge the dialogue between theology and science and the inter-disciplinary perspective of the Church's mission:

- the absence of education of the individual, with a holistic perspective and a healthy temperament (e.g. curricular problems of the public education system);

- succumbing to technological domination (e.g. biological engineering at the expense of ethics; population control at the expense of human values);

- the cultural irrelevance of scholarship: (e.g. training experts instead of cultivating personality and holistic learning);

- disciplinary rivalry (e.g. sciences vs. humanities);

- Ethical confusion: scientific achievements in science and technology (such as organ transplantation, cloning, etc.) go beyond the ethical formulation;

- fragmentation of knowledge (e.g. modern specialist vs. traditional researchers, technocrat vs. administrator) with a distorted view of reality (e.g. compartmentalised mentality, tunnel vision, etc.);

- succumbing to the dehumanising and depersonalising forces of contemporary society (e.g. Marxist, feminist, liberation theologian criticism, etc.).

The challenges of the 21st century must be met through interdisciplinary integration in missiological research[48] .

There are several types of challenges facing Christians in the 21st century that would require cooperative interdisciplinary missional research. The first five are external factors and the last two are internal factors:

- the postmodernist orientation and the tyranny of the "principle of tolerance";

- Pluralist landscape & anti-Christian/anti-establishment sentiment;

- the popularity of the "hard sciences" at the expense of traditional studies, e.g. humanities, theological studies, etc.).

- Promising bio-medical engineering, galloping technological advance and rapid socio-cultural change;

- powerful and pervasive forces, such as the New Age movement, the LGBTQ+ movement, environmental activist groups, orientalization (e.g. the growing popularity of homeopathic medicine and acupuncture), etc.;

[48] Enoch Wan, "The Paradigm & Pressing Issues of Inter-Disciplinary Research Methodology," in *Global Missiology, Research Methodology*, 2005, p. 2.

- the polarization of evangelical scholars: the great divide between liberal vs. conservative harismatic vs. "elect", the debate about "millennial fever", "third wave", (including debates about the "spiritual warfare" mentality, the merits of the "territorial spirits" approach), etc.;

- the power struggle among the intellectual elites of evangelical scholarship, who are polarized by disciplinary differences, denominational division, etc., which would prevent genuine cooperation and collaboration among the best scholars in different disciplines.

Interdisciplinary research in missiology combines and integrates biblical study, theology, anthropology, demography, statistics, etc. to achieve a high degree of coherence or unity in research and for the practice of Christian mission. As Orthodox, we should not be sold out to the latest theory and pragmatic efficiency[49] nor should we engage in unqualified contextualization[50] , such as the many forms of liberation theology (e.g., feminist theology in the West, "minjung theology in Korea," C.S. Song's "third eye theology")

Holy Scripture must be the basis and guide of Christian faith and practice. This is axiomatic for the revealed Christian faith. Interdisciplinarity must be: 1) theologically sustained as pragmatism/experience alone is insufficient, but a sound theology is essential and necessary; 2) analytically consistent i.e. not self-contradictory; but both consistent and coherent; 3) contextually relevant i.e. not out of place, but required to be contextually appropriate and 4) strategic and practical: It is good to have scriptural/theological support with coherent theory and cultural relevance; but be strategically actionable.

How Christian mission should position itself in relation to neuroscience and inter-disciplinary dialogue is fundamental to the context in which it takes place, and Orthodox missionaries play an important role in this.

Missionaries should exemplify holiness and guide people to grow in a faith that leads to holiness. As Father Lev Gillet wrote, "Faith is nothing unless it transforms our lives, bears fruit and leads to holiness"[51] . For this reason, many great missionaries of the past took a period of time to cultivate their spiritual life "in the desert" before beginning their active mission. We have the examples of the Apostle Paul who went to the Arabian desert for three years, Cyril and Methodius who spent a considerable period of time in a monastery, Stephen of Perm who lived for more than a decade in a monastery, Kosmas Aitolos who stayed for 19 years on Mount Athos. Saint Seraphim of Sarov says as clearly as possible: "Acquire inner

[49] Enoch Wan, "The Paradigm of 'Relational Realism'" in *EMS Occasional Bulletin*, volume 19 no. 2, 2006, pp. 1-4
[50] Enoch Wan "Relational Theology and Relational Missiology" in *Occasional Bulletin* volume 21, no. 1, 2007, pp. 1-7
[51] *A Monk of the Eastern Church*, SVS Press, Crestwood, 1992, p. 222

peace and thousands of people around you will be saved". Of course, the journey to deep inner peace takes a lifetime, but it should begin before entering the mission field. Unfortunately, too many missionaries do not have this peace. They think that being fruitful simply means getting busy with numerous activities - programs, schedules, meetings; they forget or ignore the most basic responsibility, their own inner peace and spiritual growth toward holiness. "The transformed life of the whole being in Christ is the true characteristic of a missionary"[52] .

When missionaries begin to live a holy life in a pagan society, they begin to teach the first and most basic lesson to the people they go to serve. Without this desire to become saints themselves and then to lead people to holiness, missionaries will be no different from humanitarian workers.

On this journey to holiness, missionaries begin to understand and learn that they act simply as bearers of God's grace, instruments in God's hands. Mother Teresa of Calcutta often uses an apt analogy. She says of her work: "I am a little pencil in God's hands. He thinks. He writes. He does everything - and it's very hard - sometimes I'm a broken pencil. He has to sharpen it a little more. But be an instrument in His hands so He can use you anytime, anywhere"[53] . Missionaries should ask themselves daily, "Am I a bearer of God's grace? Do I realize that my primary responsibility lies here?".

Simeon Yanovsky, a contemporary of St. Gherman of Alaska and a skeptic and agnostic before he met the old saint, spoke of the humble missionary this way, "To my great surprise, the simple uneducated monk Father Gherman ... had a great natural intellect, much common sense, was well read in the writings of the holy fathers, but above all he had the grace of God"[54] .

The purpose of mission is precisely this, to reflect the holiness, goodness, hope that comes through experiencing the life, death and resurrection of Jesus Christ; to act as vessels that carry God's grace to all people.

Another essential aspect of mission is the humble, loving, patient and servant attitude of the missionary. The example of Jesus washing the feet of his disciples remains the primary model for missionaries. They are to serve the people they go to help and identify with them in their struggles and needs. St. Gherman fiercely defended the rights of Alaska Natives against

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[52] Anastasios Yannoulatos, "Orthodoxy and Mission" in *St. Vladimir's Theological Quarterly*, volume 8, no. 3, 1964, p. 147

[53] Dorothy Hunt, *Love A Fruit Always in Season: Daily Meditations from the Words of Mother Teresa of Calcutta*, San Francisco: Ignatius Press, 1987, p. 243.

[54] Michael Oleksa, *Alaskan Missionary Spirituality*, Paulist Press, New York, 1987, p. 49

cruel Russian traders and officials. He became one with the people, so much so that every persecution against them was a persecution against him. He pleaded in a letter to the leader of the Russian-American Company, "I, the humblest servant of the native peoples and their nursemaid, stand before you with bloody tears and write my petition: be a father and protector to us.... wipe away the tears of our helpless orphans, soothe the sorrows of grieving hearts, let us know what joy is like"[55] .

Thus, the first and most basic missionary strategy with regard to neuroscience and inter-disciplinary dialogue is the spiritual development of missionaries - their striving for holiness, their capacity to bear God's grace, their humble attitude of service and their identification with the people.

A second missionary strategy is to approach the missionary task understanding that we are only part of a team. Jesus sent his disciples out two by two, and in the same way we must go, working together for God's grace. The importance of a team has much more to do with us than just giving each other company. A group of missionaries can proclaim the Gospel loudly by the example they set. They teach the first lesson about Christian community through the love, care, respect and compassion shown within their missional community. A positive example is the ministry of Makarios Gloukharev. He went to the Altai Mountains with two other Christians. From the beginning, the three imitated the Apostolic Church, sharing everything with each other as a symbol of their unity and love. They hoped this witness would touch the hearts of the indigenous peoples. Unfortunately, in missionary work there is sometimes the opposite behaviour. Jealousy, competition, misunderstanding and insistence on one's own way are sometimes traits of missionaries/priests. Such behaviour damages the very foundation of the Christian message.

Another benefit of a team is diversity. More parts comprise the body of Christ, and the more parts that are exposed to non-believers, the more likely they are to find a bridge to the Church. Some Orthodox missionaries were not all monks or even men. As well as bishops, priests (single and married) and monks, there were "princesses, diplomats, officers, soldiers, merchants, sailors, emigrants, travellers and prisoners"[56] . Thus, in the missionary work of the priest, he must attract people from as many fields as possible, especially from the scientific field, so that the revealed biblical message can be interwoven with new discoveries in neuroscience, with inter-disciplinary dialogue being essential.

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[55] *Ibid*, p. 310

[56] Anastasios Yannoulatos, "Orthodox Mission - Past, Present, Future." In *Your Will Be Done, Orthodoxy in Mission*, WCC, Geneva, 1989.

The third aspect of Orthodox strategies regarding neuroscience and the promotion of inter-disciplinary dialogue is the proclamation of the Gospel message: "I have become all things to all men, that I might save some by all means" (I Corinthians 9:22).

In this area, the first attitudes missionaries need to cultivate are patience, flexibility and creativity. the mission of St Innocent offers some creative ideas for difficult problems. For example, as bishop, he allowed "pious and informed" laymen to administer the baptismal rite because of the lack of priests (a priest was to complete the baptismal prayer and Christianise the newly initiated at a later date). He also established men and women to act as "readers", persons who conducted weekly worship services in the absence of a priest[57] .

Saints Cyril and Methodius provide another insightful example. They translated the Holy Mass into Slavonic, instead of one of the Byzantine liturgies, and used this Western-rite Mass in their ministry among the people of Moravia. They were sensitive to the fact that the Frankish missionaries had been using this liturgy in Latin for 50 years and therefore wanted to use it as a bridge to the people. Here, we see the greatest Byzantine missionaries not afraid to use a Roman Mass to meet their particular needs and situation. The modern missionary's efforts require such patience, flexibility, creativity and vision.

Another strategy involves catechism itself. In many places, where many people call themselves Orthodox but know little or nothing about the true Orthodox faith, missionaries should stress the importance of learning and practising the faith. We cannot be satisfied with people calling themselves Orthodox just because their grandparents were Orthodox. Sometimes we deceive ourselves, baptizing people without any teaching, just so the Church can say that we have "so many" Orthodox Christians

In our preparatory teaching for baptism, we should be careful not to teach only rules and doctrines. Some priests seem content with people who profess an ideology based on external rules and commands, without ever challenging the faithful to discover the ultimate, intimate relationship with the Holy Trinity.

A final aspect of missional strategies with regard to neuroscience and inter-disciplinary dialogue is contextualization, the idea of "becoming all things to all men, that by all means [we] might save some" (I Corinthians 9:23). From St. Paul we see how he preached to the Jews as a Jew, but presented the Gospel in a different way among the Gentiles. For example, among the Athenian philosophers and idolaters, St. Paul mentioned nothing about the Jewish past and the fulfilled prophecies of the Messiah Jesus[58] . Instead, he addressed the Greeks on

[57] *Ibid*

[58] Clare K. Rothschild, *Paul in Athens: The Popular Religious Context of Acts 17*, Mohr Siebeck, Tübingen, 2014

their level. He did not condemn them for their gross idolatry, but chose to find good in their worship: "Men of Athens, I perceive that in all things you are very religious; for, passing by and considering the objects of your worship, I even found an altar with this inscription, To the unknown God. Whom therefore ye worship without knowing, him I proclaim unto you" (Acts 17:22,23)[59] .

Starting from this introduction, he went on to talk about topics relevant to the Greek mind. He even quoted Greek philosophers and pagan poets to support his apologetics for the faith. In this way, St. Paul contextualized the Gospel and minimized the chances that his Gentile audience would reject his message simply because of a cultural or religious bias. Thus, our sensitivity to proclaim the Gospel with creativity, flexibility, boldness, contextualization and truth, creating an intimate and transformative relationship between the listener and God, are essential characteristics of an appropriate approach to mission.

Conclusions

Science is about understanding the nature and mechanisms of the world. Modern science tells us that nature is a continuum from the physical to the chemical to the biological world. Disciplines such as physics, chemistry, biology, mathematics, etc. emerged as the knowledge base expanded and it was necessary to focus on a subfield for research purposes.

With easy access to knowledge through computers/internet, contemporary man can avoid retaining too much information or too many facts. However, we still need vertical depth in a discipline or even a subfield within a discipline to do research. In this context the interdisciplinary approach to science is essential.

The interdisciplinary dimension of the sciences refers to the fact that many areas of scientific research are not limited to a single field of knowledge, but intersect and collaborate with other fields to address complex problems and gain a more comprehensive understanding of natural or social phenomena. This is increasingly important in the scientific world and in current research.

Many of today's problems, such as climate change, chronic diseases or artificial intelligence, cannot be tackled effectively from a single perspective alone. They require multiple approaches and expertise from several fields to find appropriate solutions.

[59] Pr. Luke A. Veronis, "Traditional methods for mission and evangelism", in *International Conference on Mission and Evangelism*, Brookline, 1995

Interaction between different disciplines can bring new and innovative perspectives to problems, leading to the development of better technologies and solutions. Combining expertise in a variety of fields can generate synergies that can accelerate scientific progress.

Interdisciplinarity allows researchers to approach problems in a more holistic way, taking into account multiple aspects and influences. This can lead to more complete understandings and more informed decision-making.

The world is changing fast, and new issues and challenges often don't fit strictly into one area. The interdisciplinary approach allows for greater adaptability to changes in society and the environment.

Many of the world's biggest problems, such as poverty, hunger or pandemics, are complex and multifactorial. By researchers from different fields working together, more effective and sustainable solutions can be found.

The interdisciplinary dimension of neuroscience has been shown throughout the paper by the fact that neuroscience is an interdisciplinary field of science concerned with the study of the nervous system, including the brain and central nervous system, and how they influence behaviour, thought, emotion and other aspects of human experience. This field draws on knowledge from several disciplines, such as neurology, psychology, molecular biology, biochemistry, physics and mathematics.

Neuroscience is a broad, interdisciplinary field that involves research and study of the nervous system and its associated cognitive and behavioural processes. The building blocks of neuroscience include:

Neuroanatomy dealing with the study of the structure of the nervous system, including the brain and spinal cord. Researchers look at the anatomical organisation of different regions of the brain and the connections between them.

Neurophysiology which involves investigating the functioning of the nervous system, including neuronal activity. It looks at how neurons transmit electrical and chemical signals and how these signals influence behaviour and cognitive function.

Molecular and cellular neurobiology focusing on the biological and genetic processes underlying the functioning of neurons. Researchers study the genes, proteins and neurotransmitters involved in the functioning of the nervous system.

Neuropharmacology which explores the effects of chemicals (drugs, medicines) on the nervous system and how these substances can be used to treat or influence neurological and psychological conditions.

Cognitive neuroscience which deals with the study of cognitive processes such as attention, memory, thinking and decision-making, and how these are represented and regulated in the brain.

Behavioral neuroscience involving the observation and analysis of human and animal behavior in the context of neural activity and nervous system functioning.

These elements form the interdisciplinary basis of neuroscience, and researchers and neuroscientists often work collaboratively to gain a deeper understanding of the nervous system and its influences on behaviour and cognitive function.

Neurotheology is an interdisciplinary field of research that seeks to explore the connections between neuroscience and religion. It aims to investigate how the brain and neurological processes can influence religious experience, religious beliefs and religious-related behaviours. This area of study raises profound questions about the religious nature of humanity and how this can be explained or understood from a scientific perspective.

Neurotheology focuses on how the human brain perceives and experiences religious phenomena, such as prayer, meditation, religious ecstasy, and a sense of connection with divinity or transcendence. Researchers are trying to identify the areas of the brain involved in these experiences and understand the neurological mechanisms involved.

Neurotheology explores how the human brain processes and internalises religious beliefs and dogmas. This may include studying the cognitive and emotional processes that underlie religious beliefs and spiritual convictions.

This field investigates the impact of religious belief on individual mental health and well-being. Research has highlighted both the potential benefits of religion in terms of stress management and social support, and the possible risks associated with religious fundamentalism and excessive religious guilt.

Neuroscience also addresses how religious believers and leaders interpret neuroscience findings and integrate them into their teachings and beliefs.

Because neurotheology grapples with sensitive issues related to religion and science, it raises important ethical and philosophical questions about religious freedom, ethical responsibility in neurotheological research, and the dialogue between faith and reason.

Neurotheology remains a relatively new and controversial field, and research in this area is still developing. Some scientists and theologians are engaging with the discipline to explore the complex interactions between faith and science and to bring a deeper understanding of human religious experiences from a scientific perspective.

Neuroscience, the field that studies the nervous system, has had a significant impact on society in recent decades. For one thing, neuroscience research has led to a better understanding of how the brain and nervous system work, leading to the development of more effective treatments for neurological and mental illnesses. For example, neuroscience research has led to the discovery of drugs that can help treat anxiety disorders, depression, schizophrenia and other mental illnesses.

Second, neuroscience is having a strong impact on the development of artificial intelligence and robots by creating models of artificial neural networks that mimic the functioning of the human brain. These technologies can be used in a variety of fields such as medical research, machine learning, autonomous robots and more.

In addition, neuroscience has also been used in education, allowing for a better understanding of learning and memory processes, as well as better development of teaching methods. For example, neuroscience research can help to develop more effective and personalised learning methods for individual learners.

Finally, neuroscience also has an impact on ethics and morality. As neuroscience research continues to advance, more and more questions arise about how it could be used to influence human behaviour. For example, there is discussion about the possibility of using neuroscience to create technologies that allow mind control or even manipulation of human behaviour.

In conclusion, the social impact of neuroscience is vast and continues to grow as research in this field advances. It can be beneficial for the development of medicine, artificial intelligence and education, but also ethically and morally challenging and the interdisciplinary dimension of neuroscience that I have shown throughout this thesis is fundamental.

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