Anat Morphol. 2025;1(2):54-57 Received: 2025-06-26 / Accepted: 2025-07-25

On The Triune Brain: A Modern Myth In Neuroscience

Jorge Eduardo Duque Parra[1,*], Jhony Alejandro Díaz Vallejo[1]; Jeferson Gabriel Chaves[1], Jhonatan Duque Colorado[2] & Andrés Morales Peralta[3]

[1] Departamento de Ciencias Básicas para la Salud. Universidad de Caldas, Colombia.
[2] Universidad de La Frontera, Facultad de Medicina, Programa de Doctorado en Ciencias Morfológicas, Temuco, Chile.
[3] Universidad Católica Luis Amigó, Colombia.

Correspondence
Jorge Eduardo Duque Parra
Universidad de Caldas
Calle 65 26-10
Manizales
Colombia
Teléfono: 3003709333

Email: jduqueparra@yahoo.com.mx

DUQUE PARRA JE, DÍAZ VALLEJO JA, CHAVES JG, DUQUE COLORADO J, MORALES PERALTA A. On the triune brain: A modern myth in neuroscience. *Anat. Morph., 1(2)*:54-57, 2025.

ABSTRACT: The purpose of this study was to analyze the validity of the proposed triune brain hypothesis, which appears in various neuroanatomical and neuroscientific literature. To this end, several modern texts published between 2015 and 2025 were randomly and conveniently reviewed to determine whether terms related to this theory were still in use. All texts evaluated revealed the continued use of terminology that supports the outdated popular theory of the triune brain, thus categorizing it as a neuromyth. This is because humans do not possess brain parts from other species, and mammalian species do not increase in complexity linearly, but rather evolve from common ancestors.

KEY WORDS: Triune brain, Evolution, Myth.

INTRODUCTION

Every scientist, even while learning a new path of knowledge, forms concepts based on the knowledge of their predecessors. Pollak K.

The brain, more appropriately, the encephalon, since the brain is only one of its components, the whole being made up of the structures contained within the cranial cavity (Barajas Niño, 1984), including the diencephalon, the cerebellum, and the brainstem, is a biological device necessary for information processing. It naturally lends itself to the study of theories applied to the understanding of itself for decades (Chalk et al., 20182). Among these is the theory of biological evolution, centered on gradual phenotypic and genetic changes in living populations over time, which Paul MacLean (1913–2007) introduced around 1960. He suggested that the human brain, encephalon, houses the genealogical tree of the species, as the result of millions of years of evolution from the reptilian encephalic structure, which is essentially intuitive, to a limbic part marked by emotions, and finally the neocortex, the seat of rationality.

MacLean noted, among other things, that beyond cytoarchitectural differences, there are findings that justify the conclusion that the communication mechanism in the phylogenetically primitive cortex is markedly different from that of the neopallium (MacLean, 1954), terms referring respectively to primitive and newly formed cortex. His hypothesis of the triune brain, presented in his 1990 book, states that the mammalian brain, encephalon, comprises three concentric formations resting on top of each other but intertwined. The deep layer in reptiles is the reptilian brain, encephalon, which involves the basal nuclei (olfactory tubercle, nucleus accumbens, putamen, caudate, and globus pallidus). Then comes a paleomammalian formation or limbic system, and finally a neomammalian formation (Squire, 2009). As some authors have noted, the cerebral cortex contains more archaic parts, meaning those that appeared earliest during species evolution (Anguelergues, 1972).

MacLean himself wrote that in evolution, one could imagine the brain, encephalon, developing like a building to which wings and other superstructures have been added. Moreover, the hierarchy of these three brains, encephalic components, includes the oldest human brain (basically reptilian), the old mammalian brain (marked by the

development of a primitive cortex corresponding to the limbic cortex), and in later stages of evolution, a more complex cortex appears: the neocortex, the hallmark of higher mammals, culminating in the human being. This became the brain, encephalon, of reading, writing, and arithmetic (MacLean, 1973).

MATERIAL AND METHOD

Ten neuroanatomy and neuroscience books, published between 2015 and 2025, were reviewed randomly and for convenience, to check whether the terms archicortex, archibrain, paleocortex, neobrain, and related terms for the cerebellum were still in use.

RESULTS

In 100% of the texts consulted, words linking to the triune brain theory were found. Table 1.

DISCUSSION

An older nucleus responsible for emotions and instinctive behaviors, the so-called reptilian brain, is located within a newer brain, encephalon, capable of motor, cognitive, perceptual, memory-related, chemosensory, behavioral, salutogenic, and predictive processes (Duque Parra & Mendoza, 2025). The main features of this model, known as the triune brain theory, are that newer components literally overlap the older ones as new species emerge, and these newer structures are associated with complex psychological functions we usually reserve for humans or, more generously, for other primates and social mammals.

The mistaken perspectives of this hypothesis rest on the belief that earlier species lacked the more recent external encephalic structures. But just as species did not evolve linearly, neither did neural structures. This view is incorrect, yet the corresponding neuronal perspective remains widely accepted (Cesario et al., 2020), as evidenced by the evaluated texts.

Animals do not increase in complexity linearly but evolve from common ancestors. All vertebrates share the same basic encephalic regions, forebrain, midbrain, and hindbrain, and these regions evolve in form (Cesario et al., 2020). Thus, MacLean's view is unrealistic, since neuronal and anatomical complexity evolved repeatedly within many independent lineages (Oakley & Rivera, 2008). It is not the case that animals like rodents, with supposedly less complex brains, encephala, evolved into other species with slightly more complex brains by simply adding structures to the rodent brain, continuing until humans appeared with their seemingly most complex brains.

This widely cited idea asserts that many animals' behavior is inflexibly controlled by external stimuli, since their brains, encephala, consist only of older structures capable of reflexive responses, while humans and other supposedly higher animals possess modern systems enabling behavioral flexibility (Rosales-Reynoso et al., 2018).

Examples from MacLean's model of encephalic evolution fail to adequately explain how the brain functions, with its scientific justification being heavily influenced by the already outdated framework. The notion that we are

Table 1. Books in which words related to the triune brain theory were found.

English Term	Reference
Archiestriated, archicortex, neocortex	Ascenzi, 2025
Archicortex, paleocortex	Uysal, 2023
Archicerebellum, neocerebellum, neocortex, paleocerebellum, archicortex, paleocortex. The reptilian cortex consists of 3 layers	Kaas, 2020
Archicortex, neopallium	Mtui *et al.,* 2016
Archicerebellum, neocerebellum, archicortex, paleocerebellum	Amthor *et al.,* 2020
Paleocortex, neocortex, archicerebellum, paleocerebellum, neocerebellum, paleo-striatum	Crossman & Neary, 2015
Archicerebellum, paleocerebellum, neocerebellum, archicortical, archicortex, paleocortex, neocortex	Afifi & Bergman, 2020
Archicerebellum, paleocerebellum, neocerebellum	Clark *et al.,* 2018
Archipallium, archicortex, archicerebellum, paleocerebellum, neocerebellum	ten Donkelaar, 2020
Archicortex, neocortex	Grinevich & Dobolyi, 2021

emotionally intelligent if we effectively regulate our supposed inner beast is rooted in this model (Feldman Barrett, 2018). The idea of an ancient animal brain buried deep beneath a newer, more civilized outer layer is widely referenced, bolstered by books that popularized these hypotheses, such as Carl Sagan's (1934–1996). In his 2013 book, Sagan noted that the triune brain model derived from comparative behavioral and neuroanatomical studies, and if the model were correct, we should expect to find evidence of it in humanity's historical quest for self-knowledge. This popularized version played an important role in bringing these ideas to a lay audience.

According to this theory, the three parts of the brain generated instinct, emotion, and intelligence, respectively. But the battle between emotion, instinct, and rationality is nothing more than a modern neuromyth. Even tardigrades outperform us in certain tasks, such as surviving hostile desiccating environments (Boothby et al., 2017) and unknown settings like outer space.

Natural selection did not choose us as a goal; we are simply an interesting type of animal with peculiar adaptations that helped us survive and reproduce in specific environments. Thus, other animals are not inferior to humans; they are exceptionally and efficiently adapted to their own environments. Consequently, our brain, encephalon, is not more evolved than that of a rat or a lizard: it has simply evolved differently (Turney, 2018).

Therefore, humans do not possess a paleobrain, archibrain, or neobrain as suggested by the triune brain hypothesis. It is more appropriate to use stronger language: When MacLean published his magnum opus in 1990, The Triune Brain in Evolution: Role in Paleocerebral Functions, there were already clear signs that the triune encephalon concept was erroneous. Its continued popularity stems more from ideology in science than from objective evidence.

Specifically, MacLean's hypothesis states that the mammalian triune brain, encephalon, comprises three concentric formations resting on one another but intertwined: the deep reptilian brain with the basal nuclei, the paleomammalian formation or limbic system, and the neomammalian formation. MacLean claimed that the human forebrain expands along three basic lines that reflect an ancestral relationship, anatomically and biochemically, with reptiles, primitive mammals, and late mammals, respectively.

He acknowledged that the other two limbic divisions may have counterparts in the reptilian brain, encephalon, but clearly excluded the third division, the neomammalian formation (the neocortex and the thalamic structures primarily connected to it). MacLean further argued that in evolution, the neocortex, together with its connections to the brainstem and neocerebellum, provided progressive capacities for problem solving, learning, detailed memory, and verbal communication in humans (Squire, 2009) (Fig. 1).

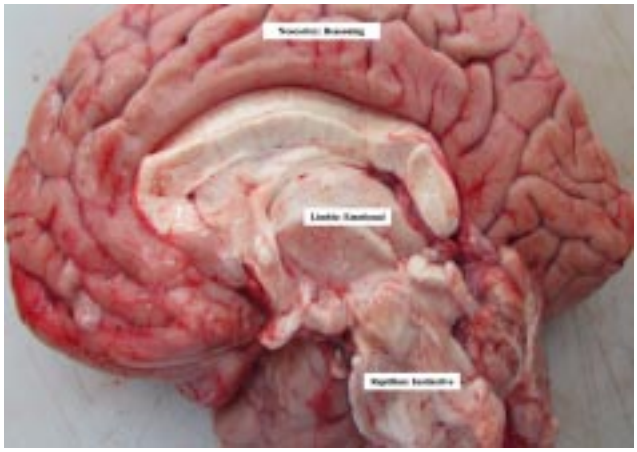

Fig. 1. Misconception of the triune brain–encephalon hypothesis that still persists in textbooks.

Due to methodological shortcomings and a degree of conservatism that entrenched mistaken assumptions in the literature, certain dogmas were established and reproduced in articles and textbooks. One such dogma is that the cerebral cortex represents the pinnacle of brain evolution (Lent et al., 2012). However, the reception of the triune brain idea among neuroscientists has been unfavorable. As new data accumulated, it became evident that the older, simpler ideas about encephalic evolution and function, on which the triune brain rests, are fundamentally wrong. Unfortunately, neuroscientists largely ignored or overlooked this. Still, MacLean continued promoting it, targeting mainly non-neuroscientists (Reiner, 1990).

MacLean's pioneering concept of the triune brain, encephalon, emerged in 1949 with his publication Psychosomatic Disease and the Visceral Brain, followed in 1952 by Some Psychiatric Implications of Physiological Studies on the Fronto-Temporal Portion of the Limbic-Visceral System (Ploog, 2003). Modern neuroscience research shows that the triune brain theory does not accurately explain how the brain works in everyday life or during stress responses.

Emotion and cognition are interdependent and work together. The limbic system is not a purely emotional center, nor are there purely emotional circuits in the brain. Likewise, the cerebral cortex is not a purely cognitive center, nor are there purely cognitive circuits (Steffen et al., 2022).

CONCLUSION

The popular theory of the triune brain, encephalon, is a neuromyth that has unfortunately remained implicit in neuroanatomy and neuroscience books. Humans do not possess parts of the brain, encephalon, from other species, and mammalian species do not increase in complexity linearly but evolve from common ancestors.

REFERENCES

Anguelergues R. El cerebro y sus incógnitas. Barcelona, Editorial Bruguera S.A, 1972.

Barajas Niño E. Curso de etimologías griegas. Bogotá, Universidad Nacional de Colombia, 1984.

Boothby TC, Tapia H, Brozena AH, Piszkiewicz S, Smith AE, Giovannini I, Rebecchi L, et al. Tardigrades Use Intrinsically disordered proteins to survive desiccation. Mol Cell. 2017; 65(6):975-84.e5. https://doi.org/10.1016/j.molcel.2017.02.018

Cesario J, Johnson DJ, Eisthen HL. Your brain is not an onion with a tiny reptile inside. Curr Dir Psychol Sci. 2020; 29(3): 255-60. https://doi.org/10.31234/osf.io/x83dq

Chalk M, Marre O, Tkaˇcik G. Toward a unified theory of efficient, predictive, and sparse coding. Proc Natl Acad Sci. USA. 2018; 115: 186-91. https://doi.org/10.1073/pnas.1711114115

Duque Parra JE, Mendoza J. Predictive coding in the brain: It's not just about afferents and efferents. The brain is at work. Anat Morphol., 2025; 1(1):18-22.

Feldman Barrett L. Cómo se construyen las emociones. Ediciones Paidós, 2018.

Lent R, Azevedo FAC,Andrade-Moraes CH, Pinto AVO. How many neurons do you have? Some dogmas of quantitative neuroscience under revisión. Eur J Neurosci. 2012; 35:1–9. https://doi.org/10.1111/j.1460-9568.2011.07923.x

Maclean PD. The limbic system and its hippocampal formation; studies in animals and their possible application to man. J Neurosurg. 1954; 11(1):29-44. https://doi.org/10.3171/jns.1954.11.1.0029

MacLean PD. Triune concept of the brain and behaviour. University of Toronto Press 1973.

Oakley T H, Rivera A S. Genomics and the evolutionary origins of nervous system complexity. Curr Opin Genet Dev. 2008; 18: 479-92. https://doi.org/10.1016/j.gde.2008.12.002

Ploog DW. The place of the triune brain in psychiatry. Physiol Behav. 2003; 79(3):487-93. https://doi.org/10.1016/s0031-9384(03)00154-9

Reiner A. An explanation on behavior. Science. 1990; 250:303-5.

Rosales-Reynoso MA, Juárez-Vázquez CI, Barros-Núñez P. Evolución y genómica del cerebro humano. Neurología. 2018; 33 (4): 254-65. https://doi.org/10.1016/j.nrl.2015.06.002

Sagan C. Los dragones del Edén. Editorial Planeta, 2013.

Squire LR (Ed). Enciclopedia of neuroscience. Elsevier Science & Technology, 2009.

Steffen PR, Hedges D, Matheson R. The brain Is adaptive not triune: How the brain responds to threat, challenge, and change. Front Psychiatry. 2022; 13:802606. https://doi.org/10.3389/fpsyt.2022.802606

Turney J. La biblia de .la neurociencia. Octopus Publishing Group Ltd, 2018.