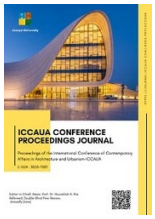

ICCAUA Proceedings Journal
Proceedings of the international conference of contemporary affairs in architecture and urbanism-ICCAUA

Volume 8 (December 2025), Pages 131-137
Journal homepage: https://journal.iccaua.com/

DOI: https://doi.org/10.38027/ICCAUA2025EN0232

Developments of Medieval Romanesque and Byzantine to Modern Architecture through the Gothic: Recourse to the Darwin's Theory

*[1] M.Sc. Oluwanifemi Popoola , [2] Dr. Morisade Adegbie and [3] Assoc. Prof. Dr. Rokhsaneh Rahbarianyazd
[1 & 2] Department of Architecture, Faculty of Environmental Technology, Federal University of Technology, Akure, Nigeria
[3]Department of Architecture, Faculty of Engineering and Natural Sciences, Alanya University, Turkey
E-mail [1]: nifemi.popoola@gmail.com , E-mail [2]: moadegbie@futa.edu.ng , E-mail [3]: rokhsaneh.rahbarianyazd@alanyauniversity.edu.tr

Received: 19 January 2025
Revised: 11 June 2025
Accepted: 18 June 2025
Available online: 5 July 2025

This article has been selected and peer-reviewed for publication in this journal as part of the 8th International Conference of Contemporary Affairs in Architecture and Urbanism, held on 8–9 May 2025 in Alanya, Türkiye.

Abstract

This study appraised the developments from Medieval Byzantine, Romanesque, and Gothic styles to Modern Architecture through a historical deductive research method. It posits that developments in Gothic and Modern Architecture were adapted from the Romanesque by what Darwin implied in the human and animal body, as beneficial selection. In this way, the study observed that major features of the Romanesque are copious in the Gothic and Modern Architecture. However, the study showed that this was further inflected in response to the demands of the era. The study observed that these demands in Gothic and Modern Architecture are a response to climate change and technical improvements in ecclesiastical architecture respectively. Thus, this study attempts to contribute to the discourse relating the human body and the changing demands of eras to architecture.

Keywords: Byzantine; Romanesque; Climate change; musculoskeletal; Gothic Architecture.

1. Introduction

This study is an attempt to analyze the notion relating the Darwin's Theory to the evolution of architectural styles to provide further insight into the relationships between the human body and architecture. The evolution of the styles represents changes in the built forms owing to the different eras in which an architectural style belongs. Fashuyi and Mohammed (2019) observed that the built forms are ever-ambulatory and resilient to stasis. Thus, changes in architectural styles are inevitable. Recent instances of the change to Post Modernism which was a more lavishly decorated and grotesque style from the International Style demonstrated this. Likewise, from the Nouveau Art to Art Deco (Frampton, 2015). Despite that the Darwin's theory is a case made for biological evolution, similar studies relating the flesh - the human body - to stone – Architecture, have been made in earlier studies (see, Li, Zhang & He, 2019; Yunyi 2019; Shaojie & Jiang, 2009). Indeed, Since Vitruvius's Ten Books on Architecture, the topic of body, as a representative of the humanistic tradition of architecture, has continuously promoted the development of architecture (Anthony, 1999). Moreover, Vitruvius, recognized as the first to establish the connection between body and architecture, demonstrated in a square and a circle, the human arm stretch, and the navel at the center, as a guide to perfect proportions. Vitruvius believed that the body is a natural form and suggested that this form should be embodied in Architecture. He believed that the structure of architecture should imitate the structural characteristics of the human body (Chaochao, 2010). This study, citing the Byzantine and Romanesque architecture, is an attempt to contribute to this discourse.

2. Conceptual Framework

The mechanism that Darwin proposed for evolution is natural selection. He theorized that because resources are limited in nature, the fittest organisms with traits that favour survival and reproduction will dominate their peers, causing their traits to increase in frequency over generations. Viewing this against the backdrop of the Vitruvian proposition that sought to establish the connection between body and architecture, it would imply that surviving dominant trends from the Byzantine and Romanesque in the Gothic would exemplify the attributes of Man – the human body, as opposed to inferior or aquatic mammals such as the dolphins which would be expected in the Byzantine and Romanesque.

3. Materials and Methods

This study is a qualitative survey of historical medieval architectural features and styles. It examines the succession of the features amongst medieval architectural styles through secondary sources and literature against the backdrop of Darwin's theory. Thus, in the underpinning theory, Darwin is employed in explaining the connect between architecture – the stone – and the flesh – the human body. Given this, the research method is historical deductive. On one hand, the study is deductive because it proves Darwin's theory in the phenomenon examined – the explanation of architectural succession amongst varying styles. On the other hand, it is historical because it relies on literature to obtain historical documents and information on medieval architecture.

4. Results

4.1. Medieval Architecture

The Medieval architecture, which was the art of designing and constructing buildings in the Middle Ages was predominantly sacred and can be divided into the Early Christian, Byzantine, and Romanesque architecture. The most prevalent layout of the Early Christian Architecture is the Latin cross and central plan church. Byzantine remained relatively faithful to the simplicity and balanced proportions of Roman buildings while Romanesque architecture manifested in medieval buildings including residences, civic halls, and commercial structures. This study takes a critical look at the developments in architectural features in Byzantine and Romanesque in the backdrop of the Gothic style.

4.1.1. Byzantine Architecture

Byzantine architecture originates from the Byzantine Empire, which was the predominantly Greek-speaking continuation of the Eastern half of the Roman Empire during the Middle Ages. Its capital city was Constantinople, now known as modern-day Istanbul. Originally Byzantium, it was often referred to as the Eastern Roman Empire. Byzantine architecture retains a sense of balanced classical proportions and favors plain, unadorned exterior surfaces. Nonetheless, the style developed its own unique architectural qualities, distinguished from those of the Romans primarily by complex layouts and an exceptional affinity for domes. Moreover, its interiors are usually adorned with lavish mosaics and murals (figures 1-3). Byzantine column capitals, loosely derived from the capitals of ancient Greece and Rome, were often embellished with intricate reliefs typically featuring abstract or floral designs. The overall Byzantine style of architecture changed little throughout the duration of the Empire (Daniila, Tsakalof, Bairachtari and Chryssoulakis, 2007). Essentially, Byzantine architecture is ecclesiastical. The foremost work of Byzantine architecture is the Hagia Sophia, constructed during the reign of Justinian.

4.1.2. The Hagia Sophia

The Hagia Sophia was designed by Anthemius of Tralles and Isidoros of Miletus. The building is revered for its original contributions to art and regarded as a seminal production owing to its ingenious contrivance and planning (figures 1-5). It consists of an intricate arrangement of solids and voids, hemicycles, and apes covered by domes and semi-domes. This was made possible by a further ingenious leap of invention- the pendentives and squinches (figures 4-5), which helped in covering the square floor bay of the Hagia Sophia with circular domes. The compositional and formal character of the church eventually resulted in a large unbroken area of about 260 feet (80 meters), much of which is covered by domical surfaces. Above the conchs of the two small apses rise two great semi-domes that cover the hemicycles and between these is the vast dome which covers the central square. On the two sides, to the north and south of the dome, it is supported by vaulted aisles in the two stories which bring the exterior form to a square. The entire building is both a product of engineering contraptions and architectural breakthroughs.

Figure 1. Added minarets.

Figure 2. Interior mosaic.

Figure 3. The Dome.

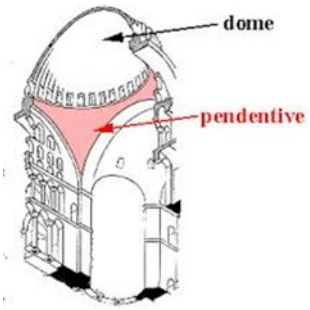

Figure 4. Pendentives.

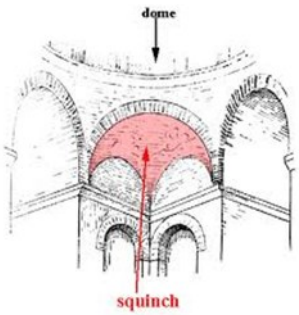

Figure 5. Sqinches.

The Inner Form

The inner form of the Hagia Sophia reveals the synergy of Eastern mysticism and Roman rationalism in a pungent and evocative manner. The use of mosaics became prominent in the interiors and light filtered through sheets of alabaster to softly illuminate the interiors. These mosaics depicted the Virgin Mary, Jesus, saints, and emperors or empresses (figure 2). An array of windows – 40 in number, forms a ring underneath the dome (figure 3). This structural form is possible because the dome rests on pedentives rather than the usual conventional drums, thereby portraying the illusion of windows supporting and carrying the weight of the dome. Structurally, these pendentives are spherical triangles supported by four piers which allow the dome to cover the square bay of the floor below. Sunlight simmers through these windows and is reflected by the gold-colored mosaics on the wall. This action, in a sense, effectively dissolves the solid mass of the walls and invokes a sense of ecstasy and unspeakable delight which permeates the entire interior of the Hagia Sophia.

4.2. The Romanesque Architecture

The Romanesque architecture is a revival of Roman classicism with nuances of the Byzantine style therefore premising on its ideas of axial symmetry and a more relaxed adoption of the classical columns. In fact, in the Romanesque, columns and piers are used interchangeably and alternated in a way that mimics the ancient clarity and mathematical precision of the classical era. This quality of alternation is copious in Romanesque architecture of all types including ecclesiastical and domestic architecture (figures 6 - 7).

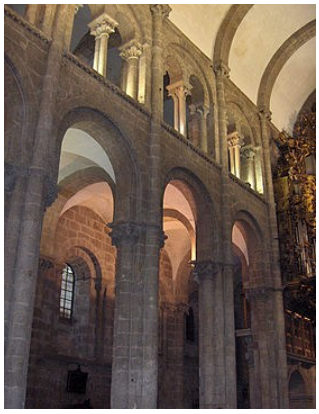

Figure 6. Piers and columns.

Figure 7. Piers and columns.

4.2.1. Forms and Attributes

The Romanesque genre evolved from Byzantine architecture and as such, shares architectural characters which reflect this progenitor. The massive attribute of the style becomes obvious when the building is perceived in terms of thick walls, round arches, buttresses, and sturdy piers (figure 8). Moreover, these qualities lent credence to its Byzantine origin.

Figure 8. Romanesqure residence - lumpy and study.

4.2.2. Structure and Structural Appendages

An important structural attribute of the Romanesque is the vaulting system. The Byzantine architecture used the dome and semi-domes supported on squiches and pendentives as roofs. These were often difficult to construct and may fail owing to technical errors. Instances of these were recorded in the original dome construction by Anthemius in the Hagia Sophia. This domed roof collapsed only after two decades of its construction and had to be reconstructed thereafter (Çakmak, Taylor, and Durukal, 2009). The Romanesque employed a simpler but easier-to-construct method of the roof and the solution to this was found in the vaults. Essentially, the groin vault was mostly used.

4.2.3. Groin Vault

The groin vault consists of two barrel vaults intersecting at right angles (figure 9). In the groin vault, the thrust is released through the arises. As a result, it receives support from the piers that transmit the loads away.

Figure 9. Groin vault.

4.2.4. The Barrel Vault

The barrel vault tunnel or wagon vault, is the simplest form of vault construction. It is an architectural element formed by the extrusion of a single curve along a given distance. The curves are typically circular, lending a semi-cylindrical appearance to the total design. Effectively, the barrel vault is a series of arches placed side by side (figure 10).

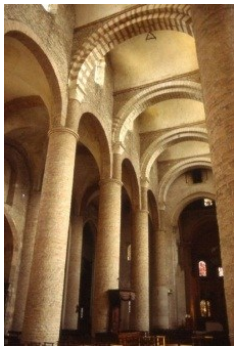

Figure 10. Barrel vault.

4.3. Gothic Architecture

The Gothic architecture is a very slender variant of the Romanesque. It was invented as a style preceding the Romanesque and was vulgarly named Goths by ardent of the Romanesque. These believed in the timeless principles of Roman classical architecture and saw the Romanesque reviving it, but looked down on the Gothic. The style, however, became popular despite the polemics and slanderous intentions of its opposers. It traveled rapidly within Europe as a result of guild activities and the printing press which signaled the invention of billboards.

4.3.1. Characteristics

The dominant structural character of the Gothic style is its slender form particularly when compared with the Romanesque or Byzantine. Because of this, and its emphasis on volume rather than mass, the style has been described as relatively feminine in comparison to the the Romanesque (Figure 11).

Figure 11. Light delicate interior character.

In a rather radical departure from its predecessor, the Romanesque, the Gothic style possesses a more developed vaulting system premised on a more advanced technology and the intuitive hunch. This is described as the ribbed vault. This idea induced a breakthrough that allowed the builders a vista of opportunities to play with form in a way that was hitherto impossible with the Romanesque and Byzantine technology. For instance, the introduction of the

ribbed vaults enabled the creation of the triforium which is a shared wall gallery located at a separate level below the clerestory within the thickness of the inner wall that stands above the nave of the church. This paper posits that the advancement in the ribbed vault, the invention of the flying buttresses, triforium, and clerestory windows in Gothic architecture is the product of a natural process of evolution which enabled the Romanesque to metamorphose into the Gothic and led to the Gothic as a superior genre of the Romanesque.

4.3.2. The Ribbed Vault

The ribbed vault is the assemblage of two or three barrel vaults edged with an armature - a piped masonry structure - fused to form a monolithic structure. The advances in the ribbed vaults allowed the construction of the clerestory windows and the triforium.

4.3.3. Flying Buttresses and Window Laces.

The flying buttress is an important feature of Gothic architecture. Its purpose, as with any buttress, is to resist the lateral forces pushing a wall outwards which may arise from stone vaulted ceilings or from wind-loading on roofs by redirecting them to the ground. The defining characteristic of a flying buttress (which made it different from normal buttresses of the Romanesque or Byzantine) is that it is not in contact with the wall, hence therefore lateral forces are transmitted across an intervening space between the wall and the buttress (Figure 12). Apart from this, the breakthrough in ribbed vault technology allows the use of windows in varying shapes and large sizes in Gothic cathedrals. Often, the windows are colored as stained glass and the sills are delicately decorated in carved stones (Fig. 13). These attributes enable the Gothic building to attain the status of grandeur to enhance its aesthetics and complements its beauty.

Figure 12. Laced window.

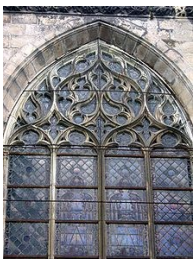

Figure 13. Flying buttresses

4.3.4. Modern Architecture and Climate Change

The Gothic architecture evolved into the different shades of modern architecture, stemming from the International style to Late modern architecture. The Late-modern architecture is a pragmatic and technocratic architecture that draws its inspiration from the highest achievements of modernism (Jencks, 1973). Moreover, the use of indigenous materials has been employed in its construction (Prucnal-Ogunsote, 2001). These materials are environment-friendly and amenable to climate change. Aside from the locally sourced materials, characteristics of the Late-modern are typically in-built courtyards and verandas. Overall, this built-type is resilient to inclement climate situations and has adapted to cope with variations that precipitate as a fall-out of climate change.

5. Discussion

5.1. The Darwin's Theory of Evolution

Darwin's Theory of Evolution is the widely held notion that all life is related and has descended from a common ancestor: the birds and the bananas, the fishes and the flowers - all related". That is, complex creatures evolve from more simplistic ancestors naturally over time. In a nutshell, as random genetic mutations occur within an organism's genetic code, the beneficial mutations are preserved because they aid survival, a process known as natural selection. These beneficial mutations are passed on to the next generation. Over time, beneficial mutations accumulate, and the result is an entirely different organism (not just a variation of the original, but an entirely different creature).

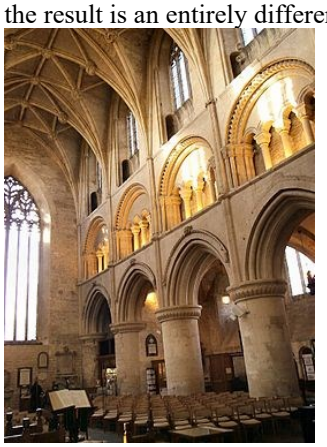

Figure 13. Ribbed vault showing the triforium and the clerestory windows.

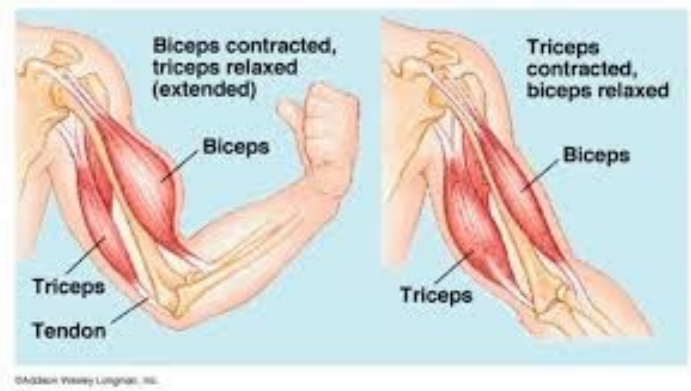

Figure 14. Musculoskeletal comparison of rib vault, and piers.

5.2 The Evolution theory and natural Evolution of Romanesque to Gothic

The theory of evolution as postulated by Darwin implies that the features of the Gothic are finally realized as the products of a slow but sure mutation of the Romanesque. The mutation itself – a change in natural form until eventually, the fittest survive. In architecture, this would mean that many attempts at creating a new form of

architecture would have experimented until finally the most mature and reliable form is realized. This is because according to Darwin, random genetic mutations occur within an organism's genetic code, and the beneficial mutations are preserved because they aid survival - a process known as 'natural selection' (Ruse, 2009). Moreover, from Darwin, it could also be inferred that the simpler version is the Romanesque because he also pointed out that complex creatures evolve from more simplistic ancestors. The Gothic, therefore, is the product of several attempts and experiments with forms using the Romanesque as the underlying template. The fact that the Gothic was eventually able to stand as a style, a unique genre, and have its own particular identity was similarly implied by Darwin when he concluded that: 'over time, beneficial mutations accumulate and the result is an entirely different organism not just a variation of the original, but an entirely different creature. In this case, it is an entirely new architectural style – the Gothic.

5.3 Darwin's Theory of Evolution and the Ribbed Vault

The structure of the ribbed vault consisting of armature, the spherical surfaces, piers, and columns, possesses an uncanny resemblance to the human muscular system (Figures 13 - 14). In a sense, the muscular system and its alliance with the skeleton provide support for the body. Some have described the ribbed vault and column arrangement of the Gothic as the skeleton of the Gothic cathedrals (Ren & Qian, 2014). In this way, it is possible to see the Gothic structural logic as a structural maturity because of its structural similarity with the musculo-skeletal system of man - man being the most developed genre in the evolutionary line, possesses the most mature and developed musculo-skeletal system. Thus, the Gothic is superior, particularly when it is compared with the Romanesque.

Figure 15. Romanesque form compared with the Musculo-skeletal form of a lower animal.

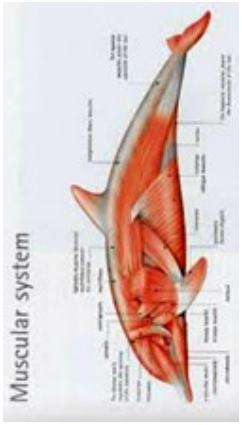

Figure 16. The dolphin's musculoskeletal form compared with the Romanesque architecture.

Reflecting on the vaulting mechanism in this way is transcendental rather than phenomenological but it helps to realize that the structural logic of Gothic architecture is the apotheosis of structural rationality at least in its era in as much as the human specie, generically described as homo sapiens is the most developed genre of the animal world (Ren & Qian, op. cit). However, this idea may be seen as a phenomenon that exists in physical manifestation by visualizing the Triceps bones as the armature of the vaulting, while the curved-shaped muscles (Figure 14) represent the spherical vault surfaces.

The Romanesque architecture on the other hand is sturdy, thick, lumpy, and evokes a sense of mass rather than volume. Biologically, the support system resembles a mass of muscles with less developed bony skeletons and this is particularly peculiar to the less developed lower mammals such as the Dolphin (Figure 16). Premised on the fact that the homo sapiens are more developed species of mammals compared to Dolphins (Pekkarinen and Anttonen, 1988; Moret, Pereira, Monteiro and Galeão, 2012). It is plausible to state that the structural support mechanism of the Gothic is superior to the Romanesque.

5.4 Theory of Evolution and the Flying Buttresses

In either case of Romanesque and Gothic buildings, a system of support is needed to transmit the dead loads from the vaulted roofs away from the building. This is necessary because the weight of the vault and the wind loadings on the vaults induce lateral thrusts on the walls that carry it. This structural challenge was solved using the vertical buttresses enclosed within massive walls in the Romanesque. The buttresses and wall, though they act independently but complement each other. In the Gothic, this principle was radically advanced to a structural system of flying buttresses which provides similar support but relieves the walls of the load-bearing function to adopt a more aesthetic function of enclosing large stained windows. Critics and theorists have observed that this development is superior to the Romanesque version because of the following observations:

1. It is a much lighter and cheaper structure (Walsh, 2005).
2. The flying buttress relieves the load-bearing walls with a much smaller area of contact, therefore much larger voids can be built into those walls, such as for windows, that would otherwise be impossible.
3. This development permits slender walls and laced windows which further lent credence to the feministic nature of the Gothic.
4. The possibility of two flying buttresses acting in moiety to bear the wind and dead load is possible.
5. It represents a technological breakthrough (Nicholas and Christian, 2009).

6. Within the purview of the Darwinian theory of evolution, it becomes obvious that the flying buttresses are a beneficiary mutation of the Romanesque vertical buttresses and that by the processes of natural selection (according to this theory), the flying buttresses were adopted as a superior genre over the Romanesque vertical buttresses.

6. Conclusion

The Byzantine and Romanesque architecture was characterized by large monumental bodies of sturdy structures. In the Byzantine, this large body of structures is relished with beautiful mosaics and a more flexible play with classical columns. In the Romanesque, the sturdy walls are recessed to produce a set of blind arcades which enclose the nave in the Romanesque churches. Emphasis of the Gothic cathedrals, however, is volume rather than mass contrary to notions of the Byzantine and Romanesque. In the Gothic, the structural compositions are resolved to make the walls amenable to additional fixtures and triforiums. The study opines that these slender additions lend credence to the feminine qualities of the Gothic, that the Gothic architecture evolved from the Byzantine and Romanesque, and that the structural form of the Gothic is an advanced genre of the Romanesque. The study further showed that the Late-modern architecture evolved from the International style in response to climate change. Lastly, the study explained this natural order of evolution, took recourse to Darwin and in this way, the study concludes that the Gothic is superior to the Romanesque and that its structural components are more developed.

Conflict of Interests

The Author(s) declare(s) that there is no conflict of interest.

References

Breese, L. (1988). Early Normandy and the emergence of Norman Romanesque architecture. *Journal of Medieval History, 14*(3), 203–216.

Çakmak, A. Ş., Durukal, R. M., & Erdik, T. E. (2009). The structural configuration of the first dome of Justinian's Hagia Sophia: An investigation based on structural and literary analysis. *Soil Dynamics and Earthquake Engineering, 29*(4), 693–698.

Chaochao, C. (2010). The projection of body in classical architecture. *Huazhong Architecture, 28*(1), 145–148.

Daniila, S., Tsakalof, A., Bairachtari, K., & Chryssoulakis, Y. (2007). The Byzantine wall paintings from the Protaton Church on Mount Athos, Greece: Tradition and science. *Journal of Archaeological Science, 34*(12), 1971–1984.

Fashuyi, S. O., & Mohammed, T. A. (2019). User lifestyle and the thermal performance of the compound house: An appraisal. *Buildings, 9*(155), 1–15.

Frampton, K. (1982). *Modern architecture: A critical history*. London: Thames and Hudson.

Jencks, C. (1973). *Modern movements in architecture*. Garden City, NY: Anchor Press.

Moret, M. A., Pereira, H. B. B., Monteiro, S. L., & Galeão, A. C. (2012). Evolution of species from Darwin's theory: A simple model. *Physica A: Statistical Mechanics and its Applications, 391*(8), 2803–2806.

Nicholas, R., & Christian, I. (2009). Philosophy of architecture. In A. Meijers (Ed.), *Philosophy of technology and engineering sciences* (pp. 1199–1256). Elsevier.

Pekkarinen, A., & Anttonen, H. (1988). The effect of working height on the loading of the musculoskeletal system in workplace kitchens. *Applied Ergonomics, 19*(4), 306–308.

Prucnal-Ogunsote, T. (2001). Classification of Nigerian architecture. *Arches Journal, 1*(6), 77–79.

Ren, Z., & Qian, L. (2014). Finite element modelling in the musculoskeletal system: Generic overview. In Z. Ren & L. Qian (Eds.), *Computational modelling of biomechanics and biotribology in the musculoskeletal system* (pp. 12–38). Woodhead Publishing.

Ruse, M. (2009). Charles Darwin on human evolution. *Journal of Economic Behavior & Organization, 71*(1), 10–19.

Shaojie, S., & Jiang, L. (2009). Glimpse of modern and contemporary architecture from the viewpoint of "body". *Architectural Journal, 1*, 27–29.

Walsh, M. (2005). A Gothic masterpiece in the Levant: Saint Nicholas Cathedral, Famagusta, North Cyprus. *Journal of Cultural Heritage, 6*(1), 1–6.

Wang, Y. (2019). The care of "heart": The study of architectural space from the perspective of "medical body". *Beauty & Times, 3*, 21–22.