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LETTER TO THE EDITOR

DNA Double Helix: Seventy Years Since Life's Deep Molecular Secret was Revealed

La Doble Hélice del ADN: Setenta Años desde que se Revelaron los Profundos Secretos Moleculares de la Vida

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To the Editor:

Biological Sciences essentially study living beings, from the molecular level to ecosystems, to understand their structure, function, diversity, origin, evolution, and interrelationships. Among the Biological Sciences, the Morphological Sciences (Cytology, Histology, Embryology and Anatomy) are noteworthy as they study the structures of the human organism —but also animals and plants— in a general and comprehensive way in their macroscopic, microscopic, and developmental aspects (Puig et al., 2004). In Medicine, Morphological Sciences is an interdisciplinary field of knowledge that draws on the contributions of Anatomy, Histology, and Embryology, among other disciplines such as Molecular Biology, Physiology, and Genetics (de Cabalier & Chalub, 2009). Since the end of the 1940s, chemical knowledge of the structure of genetic material —deoxyribonucleic acid (DNA) and ribonucleic acid (RNA)— has been fundamental in obtaining unifying principles of Biology, which have profoundly impacted morphological and biomedical sciences. This Letter to the Editor celebrates the 70th anniversary of the elucidation of the structure of DNA, while at the same time raising some necessary reflections to consider in the Postgenomic Era in which we are living.

The significant advances achieved in the field of Biological Sciences since the late '40s have been applied not only to demonstrate the interrelationships in terms of structure and function between living beings, sometimes so phylogenetically distant from each other, but also to seek unifying criteria in constant general terms for all systems that are considered alive (Bedoya, 1982). The answers regarding the structure and genetic characteristics of the hereditary material were obtained mainly from the critical contributions of E. Chargaff, M. Wilkins and R. Franklin, with which James Watson and Francis Crick in 1953 proposed the famous Double Helix model for the DNA (Watson & Crick, 1953), which based on its properties, made it possible to explain the genetic coding and all the characteristics that hereditary material must have, with the exception some viruses (Bedoya, 1982). From this moment on, a group of specialists have studied the DNA macromolecule, finding an apparent paradox: In this polymer of nucleotides was the underpinning unifying principle of almost all living systems, in which they have universally encoded similarities and differences (Bedoya, 1982). Since that time, we have also seen the flourishing of disciplines such as Molecular Biology and Biotechnology, the beginning of Molecular Genetics and Structural Biology (Mora-Rojas & Vélez-Jiménez, 2023), and the rise of Functional Genomics due to the Human Genome Project (HGP) results (Fig. 1).

The HGP was a large-scale, highly complex, international biological and biomedical research effort (Collins, 2003). The first draft of the sequence was published in 2003 simultaneously by a public and a private organization, but the complete final sequence was published in 2022 (Kumar, 2023). The Genomic Era reached its zenith two decades ago, triggering the Postgenomic Era, characterized by the wide availability of the human genome sequence and complete genomes of reference organisms, a new conceptualization of the gene as part of the expression

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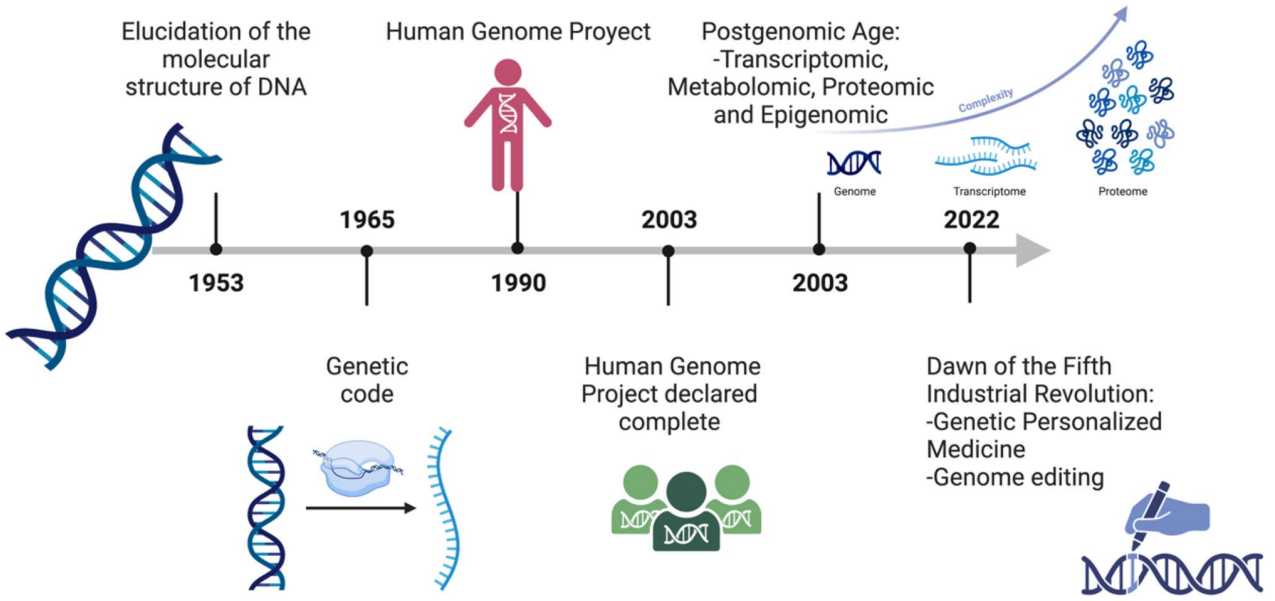

Fig. 1. Some scientific biomedical advances since the discovery of the molecular structure of DNA. Redrawn after Mora-Rojas & Vélez-Jiménez (2023). Created with Biorender.com

of the genome. Currently, it is possible to edit the genome and create synthetic DNA (Ahumada-Ayala et al., 2023), with great potential in health, but also raising profound bioethical debates that need to be kept in mind, for example, regarding manipulation and alteration of the human, animal, and plant genomes.

In conclusion, professionals who work in Morphological Sciences, scientists focused on research in this area, and scholars dedicated to teaching these disciplines should remember that all these scientific-technological advances impact these disciplines and would not have been possible without solving the DNA molecular structure seventy years ago.

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