Letter to the Editor

Evolution Oroinformatics: A Deep Learning Perspective in Personalised Dental Care

Dear Editor,—Considering the relevance of your Editorial related to efforts to reshape dental healthcare through Artificial Intelligence,[1] we want to reflect on the integration of evolutionary bioinformatics with deep learning in the study of dentistry. The evolving discipline that merges evolutionary bioinformatics with deep learning in the study of dentistry is shedding light on the genetic and evolutionary underpinnings of dental characteristics and disorders.[2] This branch leverages computational tools to explore the genetic evolution behind dental health, which is crucial for personalised treatment and understanding the genetic and evolutionary factors of dental well-being. By marrying evolutionary principles with computational biology, evolutionary bioinformatics redefines dental research.[3] Deep learning algorithms sift through extensive datasets, pinpointing genetic variations that play roles in dental anomalies and features. This enables the crafting of customised treatment strategies based on an individual's genetic makeup. This cross-disciplinary strategy is set to transform dental care with more accurate, person-specific treatment alternatives.

The significance of evolutionary studies in healthcare is increasingly acknowledged, especially following initiatives like the Human Genome Project.[4] This acknowledgement has paved the way for evolutionary medicine, a field bringing together researchers, medical practitioners, ethicists, and anthropologists. Investigating the evolution of Homo sapiens through fossils and genomic research offers critical insights. Anthropology enriches evolutionary medicine by showing how shifts to agricultural societies have impacted our health, diets, and disease susceptibility. These shifts have brought about longer lifespans and changed dietary habits, leading to a prevalence of chronic conditions.[5] The mismatch between our modern lifestyle and evolutionary history affects our health fundamentally. Comparative analyses among diverse human populations and non-human primates reveal the genetic basis for dental adaptations, helping clinicians personalise disease prevention and treatment to an individual's genetic risks. Evolutionary medicine is indispensable for addressing challenges born from evolutionary impacts on humans and pathogens, particularly with the rise of infectious diseases driven by urbanisation, deforestation, and wildlife trade. Evolutionary bioinformatics zeroes in on the genetic and historical aspects of dental evolution. Shift from foraging to farming diets has remodelled our teeth and jaw structures, increasing the prevalence of dental diseases like caries and periodontal conditions.[6,7]

Researchers can pinpoint genetic variations linked to dental features and their evolution through genetic studies. This examination is key for understanding genetic sequences and evolutionary ties between species, assisting in identifying genes responsible for tooth formation, structure, and diseases across different species.[1,8,9] Comparative genomics, another crucial aspect of evolutionary bioinformatics, entails comparing species' genomic sequences to spot conserved regions vital for tooth development and divergent ones indicating species-specific adaptations or evolutionary shifts.

Deep learning models,[10,11] specifically convolutional neural networks (CNNs), are extensively utilised in dentistry. They analyse dental imagery, diagnose conditions, predict treatment results, decode gene expression patterns, and simulate evolutionary dynamics under varied scenarios. They can spot genetic markers tied to dental conditions, forecasting an individual's disease susceptibility. These models, analysing large genetic and clinical datasets, predict dental disease onset and progression, considering genetic, lifestyle, and environmental factors.[1,8,12] Insights from deep learning help in devising personalised dental care, encompassing preventive measures and live management suggestions based on a patient's genetic backdrop. Fusing evolutionary bioinformatics with deep learning opens new avenues in crafting dental materials and methods that align with an individual's genetic particulars. Integrating genetic data into dental material and procedure design mimics natural evolutionary processes, enhancing the likelihood of success while minimising adverse reactions. Understanding genetics in tooth development can usher in more effective regenerative treatments. At the same time, the inclusion of wearable technology and apps in dental care offers continuous oral health monitoring, allowing for personalised oral hygiene advice. The blend of evolutionary bioinformatics and deep learning in dental research revolutionises our insight into oral health's genetic and evolutionary determinants. It spearheads a move towards precision dentistry, where treatments are meticulously tailored to a patient's genetic profile, lifestyle, and health needs, heralding a new era of personalised, effective dental care.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author contributions

The author contributed to the conception, analysis, interpretation of data, and drafting of the manuscript.

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Pradeep Kumar Yadalam
Raghavendra Vamsi Anegundi
Department of Periodontics, Saveetha Dental College, Saveetha Institute of Medical and Technology Sciences (SIMATS), Saveetha University, Chennai, Tamil Nadu, India

Carlos-M. Ardila*
Colombia. Biomedical Stomatology Research Group, Universidad de Antioquia, Medellín, Colombia

**Corresponding author:* Colombia. Biomedical Stomatology Research Group, Universidad de Antioquia, Calle 70 No. 52-21, Medellín, Colombia.
E-mail address: martin.ardila@udea.edu.com (C.-M. Ardila).

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