



LETTER TO THE EDITOR

## ***Looking back at a decade of science communication in the field of human evolution***

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## ABSTRACT

In the year of 2015, the Group of Studies in Human evolution (GEEvH) completed ten years of existence. Since its foundation, GEEvH's has played an important role in the difficult task of communicating science in Portugal in the field of human evolution. In this paper, an overview of the main activities developed by GEEvH in the last decade as well as upcoming goals, will be provided. This approach will be framed by a short theoretical introduction to Charles Darwin's

theories, highlighting the impact of evolutionary biology views in the Portuguese academic and schools settings. The current situation with regard to the teaching of human evolution in Portuguese schools will also be presented.

*Keywords: Darwin, Evolution, Pedagogy, Outreach, Portugal, Paleoanthropology.*

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## RESUMO

O Grupo de Estudos em Evolução Humana (GEEvH) completou, no passado ano de 2015, dez anos de existência. Desde a sua fundação, o GEEvH tem desenvolvido um conjunto de actividades que se revelaram fulcrais na difícil tarefa de comunicar ciência no domínio da evolução humana. O presente artigo visa sumariar as iniciativas desenvolvidas pelo GEEvH na última década, assim como discutir metas futuras. Esta abordagem será precedida por uma pequena introdução à teoria da evolução de Charles Darwin, destacando o seu impacto histórico no meio académico e escolar português. Neste preâmbulo, será também enfatizada a corrente situação relativa ao ensino da evolução, e da evolução humana, nas escolas portuguesas.

*Palavras-chave: Darwin, Evolução, Pedagogia, Comunicação de ciência, Portugal, Paleoantropologia*

## Introduction

In the year of 2015, GEEvH – Grupo de Estudos em Evolução Humana [Group of Studies in Human Evolution] celebrated its tenth year of existence. In order to fully understand the whole meaning of this special occasion, we have to throwback to the academic year of 2004/2005, when a group of students attended the master's degree in Human Evolution at the University of Coimbra (Portugal). Albeit their distinct undergraduate backgrounds, these students shared a common passion: a desire to better understand the mechanisms that led to the origin and evolution of the human lineage and their primate cousins. As their friendship grew, enlightening discussions about the lack

of visibility of human evolution's subjects in the Portuguese educational system also emerged. To challenge this, an idea was forged and pushed forward: the creation of the first association focused on improving the knowledge of Human Evolution in Portugal, through targeting the general audiences and, more specifically, working with school age children. Hence the Grupo de Estudos em Evolução Humana was born.

Since its foundation, GEEvH's mission has been grounded on three main aims: (1) the scientific and pedagogical promotion of the knowledge in human evolution and of the numerous sciences that contribute to it; (2) the promotion and organization of scientific meetings, conferences, courses, workshops, amongst others; and (3) the fruitful

interaction with other similar scientific institutions to achieve the former two aims.

In the forthcoming pages, an overview of the main activities developed by GEEvH in the last decade will be presented. This retrospective will be preceded by a short theoretical introduction to Charles Darwin's theories and its role in the progression of science, namely in the field of human evolution. The impact that evolutionism had in the Portuguese social and academic milieus will also be discussed. Particular emphasis will be put in the pivotal role that schools have on the teaching of evolution, particularly human evolution.

### **Darwin and evolutionism: a unifying theory of science**

During centuries, the explanation for the origin and diversity of organisms relied on supernatural entities or was attributed to the driving force of elements ([Lewin, 1993](#); [Mayr, 2001, 2004](#); [Wood, 2005](#); [Jurmain et al., 2009](#); [Nickels, 2010](#)). A true revolution happened on the 24<sup>th</sup> of November of 1859 AD, when naturalist Charles Darwin published, in London, *“On the origin of species by means of natural selection or the preservation of favoured races in the struggle for life”* ([Mayr, 2001](#)). In this work, Darwin stated that all organisms are the result of complex evolutionary processes that act upon the living forms selecting those with better traits (i.e., the fittest ones) and ensuring the transference of successful traits to the next generations, in a process he called “natural selection” ([Mayr, 2001](#);

[Kennedy et al., 2004](#); [Mai et al., 2005](#); [Ruse, 2008](#)):

*“Can it, then, be thought improbable, seeing that variations useful to man have undoubtedly occurred, that other variations useful in some way to each being in the great and complex battle of life, should sometimes occur in the course of thousands of generations? If such do occur, can we doubt (remembering that many more individuals are born than can possibly survive) that individuals having any advantage, however slight, over others, would have the best chance of surviving and of procreating their kind? On the other hand, we may feel sure that any variation in the least degree injurious would be rigidly destroyed. This preservation of favourable variations and the rejection of injurious variations, I call Natural Selection.”* (Darwin, 1859 p.80/81).

It should be mentioned that the concept of “evolution” was not a novelty introduced by Charles Darwin ([Klein, 1999](#); [Ridley, 2004](#); [Wood, 2005](#); [Jurmain et al., 2009](#)). Ancient Greeks such as Anaximander (610 B.C. - 546 B.C.) and Epedocles (495 B.C - 430 B.C.) had already speculated about the origin of life, attributing the world's organic coherence to a gradual process possibly involving the metamorphosis of organisms into others ([Kennedy et al., 2004](#)).

Following the rise of Christianity in the Western World, the ideology that God created all living forms, with unchangeable properties, was generally accepted ([Kennedy, 1985](#); [Kennedy et al., 2004](#); [Wood, 2005](#); [Cela-Conde and Ayala, 2007](#)). This view was

criticised by some Christian theologians, such as the 13<sup>th</sup> century German philosopher Saint Albertus Magnus (1200–1280) and his student, the Italian philosopher Saint Thomas Aquinas (1224–1274), that attributed to earth the ability to produce organisms and stated that the possibility of organisms such as maggots and flies be able to raise from dead meat was not incompatible with Christian faith ([Kennedy et al., 2004](#); [Wood, 2005](#)). Erasmus Darwin (1731-1806), the grandfather of Charles Darwin, also proposed an evolutionary theory in which all organisms derived from one original form, although controlled by divine entities ([Richards, 1987](#); [Lewin and Foley, 2004](#); [Cela-Conde and Ayala, 2007](#); [Ruse, 2008](#)). Almost simultaneously, Jean-Baptiste Antoine de Monet, also known as Chevalier of Lamarck (1744-1829), published “*Philosophie zoologique*”, in 1809 ([Ridley, 2004](#); [Wood, 2005](#)). Having the *scala naturae* as a major reference, Lamarck conceived “evolution” as a linear and dynamic process ([Mayr, 2001](#); [Avelar et al., 2004](#); [Cela-Conde and Ayala, 2007](#)). According to his model, the simplest organisms had a spontaneous origin, reaching high levels of complexity through time ([Mayr, 2001, 2004](#); [Cela-Conde and Ayala, 2007](#)). In this process, it was argued that the environment played an important role in each organism’s change, i.e., all living forms had the ability to adjust to new environmental constraints by adding or removing new organs or functions ([Richards, 1987](#); [Lewin and Foley, 2004](#); [Jurmain et al., 2009](#)). Although Lamarck’s theory was novel, it was still inextricably linked to creationist views, very popular at the time ([Mayr, 2001](#); [Avelar et al., 2004](#)).

In contrast with these first attempts to explain biological diversity, Charles Darwin developed a consistent theory based, not only on the review of important essays such as Charles Lyell’s (1795-1875) “*Principles of Geology*” and Thomas Malthus’s (1766-1834) “*Essay on the Principle of Population*”, but also based on the systematic and accurate observation of the natural phenomena (i.e., artificial selection) and data collection, especially during his journey aboard the Beagle between 1831 and 1836 ([Steffoff, 1996](#); [Klein, 1999](#); [Delson et al., 2000](#); [Avelar et al., 2004](#); [Ruse, 2008](#)).

A similar theory was independently formulated by Alfred Russel Wallace (1823-1913) who shared his thoughts with Darwin thus leading to a joint presentation of the theory of evolution ([Jurmain et al., 2009](#)). Contrary to Lamarck, both Darwin and Wallace regarded evolution as a ramified process from a common ancestry instead of a linear mechanism:

*“(...) in the actual state of nature it is almost impossible, the species being so numerous and the modifications of form and structure so varied, arising probably from the immense number of species which have served as antitype for the existing species, and thus produced a complicated branching of the lines of affinity, as intricate as the twigs of a gnarled oak or the vascular system of the human body”* ([Wallace, 1855](#), p. 189).

As a researcher, Charles Darwin coupled an extraordinary group of attributes. He was a persistent and rigorous observer with great theoretical and critical merits ([Mayr, 2001](#);

[Bracinha Vieira, 2009](#)). Furthermore, he was an interdisciplinary thinker that has successfully bridged different disciplines such as geology, botanic, zoology, palaeontology, embryology, ethology and systematics ([Bracinha Vieira, 2009](#)).

Darwin's principles had a major impact on sciences dedicated to the study of human biological and cultural diversity. Darwin was responsible for introducing a new, albeit polemic, view about our place in nature ([Avelar et al., 2004](#)). In *The Descent of Man* he argued that:

*“It is notorious that man is constructed on the same general type or model with other mammals”* ([Darwin, 1871](#), p. 1).

Accordingly, similar selective pressures were responsible for the whole biological diversity as well as for human origins:

*“In the future I see open fields for far more important researches. Psychology will be securely based on the foundation already well laid by Mr. Herbert Spencer, that of the necessary acquirement of each mental power and capacity by gradation. Much light will be thrown on the origin of man and his history”* ([Darwin, 1859](#), p. 414).

Despite Darwin's breakthroughs, his theory was not completely free of criticism ([Dennett, 1995](#); [Steffoff, 1996](#); [Rudolph and Stewart, 1998](#); [Mayr, 2001](#); [Ridley, 2004](#); [Jurmain et al., 2009](#)). It was argued that the evolutionary process was untestable (in contrast with other physicochemical or biological phenomena) ([Caplan, 1985](#); [Mayr, 2001](#)). A lack of knowledge about hereditary rules as well as the apparent gap between

life forms in nature was also pointed out ([Ridley, 2004](#)). Therefore, the theory of evolution was fiercely challenged by Darwin's opponents. It was only after the *rediscovery* of the until then little known work of Gregor Mendel about heredity rules that the mechanisms that control the intergenerational flux of traits, as proposed by Darwin, were clarified ([Steffoff, 1996](#); [Kennedy et al., 2004](#); [Ridley, 2004](#); [Ruse, 2008](#)).

Shortly after its publication, Darwin's theory was misused and /or reinterpreted to validate certain political and ideological agendas. Inspired by Darwin's views, numerous scholars used the theory of evolution by natural selection to justify the moral order of the world or to explain the nature of society<sup>2</sup> ([Salmon and Crawford, 2008](#)). For example, the British philosopher Herbert Spencer (1820-1903) fully supported the use of the evolutionary theory to comprehend human social organization. Spencer perceived evolution as a moral force that drives human society from the primitive to a modern and industrialized state ([Salmon and Crawford, 2008](#): 5). This type of view led to the emergence of “Social Darwinism”, which was then spitefully used in support of imperialism and colonialism policies, the subordination of women and the existence of social classes ([Salmon and Crawford, 2008](#)). The misleading view that both biological and human behavioral traits (e.g. intelligence,

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<sup>2</sup> In a study entitled “*The expression of emotion in man and animals*”, Charles Darwin suggested that the process of evolution by natural selection also applies to the mind of animal and to expressive behavior ([Salmon and Crawford, 2008](#)).

values, morals) are equally ruled by biological factors and controlled by the same mechanisms of inheritance (a phenomenon called biological determinism) also contributed to the rise of eugenics in the late 19<sup>th</sup> century ([Jurmain et al., 2009](#)). The eugenic movement was created by Francis Galton (1822-1911) and aimed at improving the human race through selective breeding ([Salmon and Crawford, 2008](#)). The largest and most dramatic application of this view ended with the elimination of millions of people considered “unfit” (e.g., Jews, homosexuals, mentally handicapped) during the World War II by the German Nazi regime ([Salmon and Crawford, 2008](#)[Jurmain et al., 2009](#)).

Nowadays, it is unquestionable the key role that Darwin’s theories had in the progression of science, namely in our current knowledge about the origin and evolution of the human lineage. In fact, some of the principles depicted in the *Origin of Species* [...] are still relevant today, for instance: the relatedness of all organisms; the enormous variability found within and among species; and the important role that evolution and natural selection plays in the ever changing face of the planet’s physical environment ([Kennedy et al., 2004](#), p. 3).

Evolutionism is still the theoretical basis of most fields of research within the natural sciences, including those focusing on human origins. It is an aggregating and merging theory ([Kennedy et al., 2004](#)). In the domain of human evolution, for instance, it links different disciplines, such as paleoanthropology, systematics, comparative

anatomy, primatology, paleoprimateology and genetics, among others. In a more tangible way, evolutionism also has an important role in modern societies since it explains many phenomena that affect our health and environment ([Kennedy et al., 2004](#)). For example, it is pivotal for medicine and epidemiology when studying the co-evolutionary process between hosts and pathogens ([Nesse and Stearns, 2008](#)), as well as in agriculture and natural conservation ([Kennedy et al., 2004](#); [Jenkins, 2009](#)).

### **Evolutionism in Portugal: is there any room for human evolution in our teaching classes?**

Evolutionism as a line of thought made its first appearance in Portugal during the final quarter of the 19<sup>th</sup> century, firstly through newspapers and later reaching the academia ([Almaça, 1993](#)). For example, it was introduced in 1865 at the University of Coimbra by Júlio Augusto Henriques, a botanical researcher ([Pereira, 2001](#); [Fiolhais, 2009](#)). Nevertheless, like in so many other countries, Darwin’s theories were not immediately accepted by most Portuguese academics. Several reasons can be pinpointed: (1) the well-established models of Linneu and Cuvier to classify biological diversity left little space to discuss new theories ([Pereira, 2001](#)); (2) religion and other ideologies were seen as incompatible with the theory of evolution; and (3) the unavailability of a Portuguese translated version of the *Origin of Species* delayed its establishment in Portugal (most of the available translations were in French) ([Almaça, 1993, 1999](#); [Fiolhais, 2009](#)).

According to Pereira (2001), the first Portuguese translation occurred in 1910 but only became available to the general public in 1913. The unavailability of Portuguese translated books has probably impacted the transferring of knowledge to the general public; nevertheless, it does not explain *per se* the delayed acceptance of Darwin's theory in the Portuguese academia. Since the 18<sup>th</sup> century until the 70s of the last century, the Portuguese literary, linguistic and cultural movements were deeply influenced by French ideals of culture and civilization (Laurel, 2007; Machado, 2009). Furthermore, most of the scientific literature available in early 20<sup>th</sup> century was written in French; a language fluently spoken by Portuguese scholars at the time (Laurel, 2007).

Slowly, the acceptance of Darwin's theory in the academia milieu increased in Portugal, which contrasted with other European countries where it had been actively refuted such as France, because of the hegemony of Lamarckism (Almaça, 1999). That acceptance in Portugal was visible in the works of academics such as Jaime Batalha Reis, Júlio Augusto Henriques, Eduardo Burnay, Baltasar Osório (Almaça, 1999), or by the research of Francisco de Arruda Furtado who focused on malacological studies in the Portuguese archipelago of Azores (Pereira, 2001; Constância, 2002; Fiolhais, 2009). The case of Francisco de Arruda Furtado is particularly interesting since he has exchanged correspondence with Darwin during the year of 1881 (Constância, 2002; Fiolhais, 2009). Evolutionism became a major topic of scientific debate (Almaça, 1993, 1999) namely in the field of palaeoanthropology,

archaeology and prehistory through the pioneering studies of Pereira da Costa, Nery Delgado and Carlos Ribeiro, and following the first discoveries of ancient human remains in the Portuguese territory (Pereira, 2001). At the end of the 19<sup>th</sup> century, some Portuguese physicians like Júlio de Matos and Miguel Bombarda were active supporters of evolutionism, namely of its application to the understanding of human natural history (Pereira, 2001; Fiolhais, 2009). Some of these standpoints were also embedded within political agendas such as the anti-clericalism and the republican organizations fighting the monarchic regime. Evolutionism was also welcomed within certain historical, philosophical and political circles, especially through the influence of German naturalist Ernst Haeckel (1834-1919) and British philosopher Herbert Spencer (Almaça, 1999; Fiolhais, 2009). Their philosophies were soon incorporated into the Portuguese literary scenario, especially among poets and writers of the "Geração de 70" (70's Generation) and other contemporaneous thinkers (Fiolhais, 2009). Eugenics also found supporters in Portugal<sup>3</sup>. Aiming to demonstrate the "antiquity" and "racial unity" of the Portuguese, Mendes Corrêa (1888-1960) and Eusébio Tamagnini (1880-1972)<sup>4</sup> - the leading figures of the anthropological schools of Porto and Coimbra, respectively – developed

<sup>3</sup> For additional information with regard to the history of Physical Anthropology in Portugal, see for example: Xavier da Cunha (1982); Areia et al. (1985); Santos (2012b); Cardoso (2006); Cunha (2009); Matos (2012).

<sup>4</sup> Some published works of Eusébio Tamagnini are available at the digital repository of the University of Coimbra: <https://digitalis.uc.pt/pt-pt/content/revista?tid=43564&id=43564>.

numerous studies focusing on the anthropometric characterization of both skeletonized human remains and living individuals ([Santos, 2012b](#)). Their goals consisted in demonstrating that the physical traits of the Portuguese fitted the standards of variation of other European “white” races, contradicting the possible “hybrid” origin of the Portuguese population ([Vale de Almeida, 2002](#); [Santos, 2012b](#)). M. Corrêa and E. Tamagnini also embraced a strong opposition to miscegenation. In the first decades of the 20<sup>th</sup> century, the occurrence of miscegenation in the Portuguese colonies was perceived as dangerous and a source of “racial degeneration” ([Vale de Almeida, 2002](#); [Santos, 2012b](#)). E. Tamagnini was an active supporter of eugenics and a founding member of the Society of Eugenic Studies, which was created in Coimbra in 1937 ([Matos, 2012](#)). Deeply embedded in racial “hygiene” and “in the perfection of race” views, Mendes Corrêa also defended “the segregation of relapsing criminals, for the sterilization of degenerates, and for the regulation of immigration and the banning of marriage for professional beggars” ([Vale de Almeida, 2002](#): 190). Fortunately, the Portuguese eugenic movement did not had the same obscure consequences, as those reported for other European countries, such as Germany (genocide and extermination) and Sweden (sterilization) ([Matos, 2012](#)).

Regarding the teaching of evolution in Portugal, the first textbook that included the theory of evolution by natural selection was published in 1887, under the heading of “Elementos de Zoologia”. The textbook was written by Silva Amado (rector of Liceu

Central de Lisboa) and Pedro Leite (professor of physics, chemistry, and introduction to the natural history at Liceu Central de Lisboa) for teaching zoology in the former 4<sup>th</sup> and 6<sup>th</sup> grades of secondary school ([Cavadas, 2009](#)). A greater emphasis on Darwin’s theory was seen in following publications, namely: “Elementos de Zoologia” published in 1890 by Maximiano Lemos Junior (for teaching physics, chemistry and natural history in the former 4<sup>th</sup> and 5<sup>th</sup> grades of secondary school) and “Lições de Zoologia, 3<sup>rd</sup> volume” published in 1907 by Bernardo Aires (for teaching zoology in the former 6<sup>th</sup> and 7<sup>th</sup> grades of secondary school) ([Cavadas, 2009](#)).

Despite the current acceptance of Darwin’s theory, Portuguese scientists defend that it is not yet satisfactory ([Bracinha Vieira, 2009](#)). One of the major problems is found in the Portuguese official teaching system and curricula. In many countries, teaching evolution is considered a fundamental step in the learning process ([Almaça, 1999](#)). Some authors (e.g., [Jenkins, 2009](#)) argue that natural sciences must be permeable to evolutionary theories since evolution is the key concept to understand the living world. It shows the true interdisciplinary face of science. Furthermore, it grants students with cognitive tools that are much needed to explore and understand their surrounding environments ([Jenkins, 2009](#)). Evolutionism can be portrayed as an aggregator of scientific instruction within the social, human, natural and life sciences ([Smith, 2010a](#); [Yetişir and Kahyaoglu, 2010](#)), allowing educators to differentiate science from other forms of human thought ([National Academy](#)

[of Sciences, 1998](#)). Unfortunately, a gradual decrease in interest regarding this central topic has been affecting the Portuguese school syllabus ([Bracinha Vieira, 2009](#)). For instance, evolution and adaptation are topics not addressed in the official programs of elementary schools ([Campos and Sá-Pinto, 2013](#)), despite the recommendations that support an early exploration of evolutionary biology subjects from kindergarten to high school (e.g., [Fail, 2008](#); [Nadelson et al., 2009](#); [Wagler, 2010](#); [Hermann, 2011](#); [Wagler, 2012](#)). Contrary to previous misconceptions, young children are able to think both concretely and abstractly ([National Research Council, 2007](#)). As an example one can refer the set of pedagogical activities developed by Campos and Sá-Pinto ([2013](#)) in Portuguese elementary schools (K-4). Regardless of the theoretical complexity of the concepts explored (e.g., intra-specific diversity, genealogy and inheritance, systematics), children were able to understand complex evolutionary mechanisms, such as genetic drift and natural selection, as well as to engage into the discussions, applying the acquired knowledge in real case scenarios ([Campos and Sá-Pinto, 2013](#)).

Several explanations are generally highlighted to justify the limited exposure of students to evolutionary biology contents in official schools, namely: (1) naive interpretations of evolutionism; (2) ideological and religious views or simple unawareness; (3) old fashioned textbook based approach; (4) lack of updates concerning the newest discoveries; (5) the frequent changes in curricula content and extent not suitably adjusted to school and

exam schedules, and (6) the optional nature of this topic in biology classes ([Bracinha Vieira, 2009](#); [Smith, 2010a](#)).

Another important factor to note is the apparent cleavage between the scientific institutions and/or universities and the schools and/or the general public. This leads to an inability to convey the most updated information to the latter. If this is problematic in the case of the natural sciences, the difficulties increase in an exponential manner in the case of human evolution. New and ground-breaking fossils are constantly being discovered, challenging previous assumptions and theories. This has a critical impact in the ability of teachers and editors to update school books and other teaching resources. For example, in the year of 2015, a new ancestor candidate of the genus *Homo*, the *Homo naledi* was presented to scientific community. The fossil remains were discovered within the Dinaledi Chamber of the Rising Star cave system (South Africa) and are composed of an extensive collection of 1550 skeletal elements (the larger assemblage discovered in Africa), which represents at least 15 individuals ([Berger et al., 2015](#)). *Homo naledi* fossils present a unique cranial morphology and a mosaic of human-like (e.g. hands and feet) and early hominin (e.g. ribcage, shoulders and pelvis) features ([Berger et al., 2015](#)). Despite the relevance of the discovery, the inexistence of a clear chronology for the remains hampers their placement in the human evolutionary tree, as well as the establishment of more accurate relationships with their close relatives.

In the Portuguese school system, the teaching of human evolution is particularly confined to the first year of the secondary school (7<sup>th</sup> grade) as part of the history curricula. One of the curricula goals consists in identifying the main evolutionary steps from the genus *Australopithecus* to *Homo sapiens sapiens* (Ribeiro et al., 2013/2014). No reference is made to ancient documented genus, such as *Ardipithecus*, *Orrorin* or *Sahelanthropus*, some of which have been identified since 1994 (i.e. *Ardipithecus*) (White et al., 1994).

To overcome this reality, a closer interaction between scientists and public is required to establish and maintain a regular and updated influx of knowledge. Although official schools play an irreplaceable role in Portuguese education, it is important to acknowledge the importance of non-formal and informal<sup>5</sup> environments created by other

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<sup>5</sup> According to the European Commission (2001) the main difference between formal, non-formal and informal education relates to the intentionality of knowledge that is exchanged. In the formal type, provided by official institutions such as schools, colleges and universities, the learning process is programmed and is conducted by an educator (European Commission, 2001; Seequel, 2004). It is structured based on goals, programmatic contents and schedules, and allows the attainment of a certificate (European Commission, 2001). On the other hand, non-formal learning is intentional and provided outside the realm of formal training institutions (European Commission, 2001; Seequel, 2004). Nevertheless, it can be structured since learners may acquire new knowledge either by studying voluntarily or participating in short courses or workshops (European Commission, 2001; Seequel, 2004). Finally, informal learning is mostly non-intentional, self-directed and may

institutions such as the media, science centers and museums, out-of-school programs and community educational initiatives (Honeyman, 1998).

Bell et al. (2009) suggest that schools cannot act alone in the educational process, and depend on the initiatives of the civil society during the challenging task of teaching science. It was these recommendations and a tremendous desire of communicating science to the wider public that led, ten years ago, to the creation of GEEvH.

### **GEEvH main achievements**

Over the last decade, GEEvH's members – always working on a voluntary basis – have developed a set of initiatives that aim, not only to communicate the last scientific discoveries but also to reinforce the interdisciplinarity that underlies knowledge in human evolution. Accordingly, three major areas of action were progressively established:

- 1) The development of scientific and pedagogical activities for children and to the general public;
- 2) The organization and support of scientific meetings;
- 3) The release of two free online publications.

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result from the learner experiences and personal explorations during daily life activities (European Commission, 2001; Seequel, 2004).

*The development of scientific and pedagogical activities for children and to the general public*

The GEEvH has developed a set of scientific and pedagogical workshops in the field of human evolution. These activities are part of a project entitled *Brincar com a Grande Árvore da Evolução* [Playing with the Big Tree of Evolution - project VI: CV/PVI 1845] developed and funded within the scope of the Ciência Viva VI national program, a governmental program specifically designed to approach *deliver* Science to the general public ([Assis and Carvalho, 2012](#)). It should be stated that some of these activities were implemented for the first time in 2005 and 2006 during the “Inhabitants and habitats” exhibition that took place at the Municipality of Leiria ([Carvalho, 2006](#)). In fact, it was this event’s success that inspired the creation of the abovementioned project.

Presently, GEEvH offers eight distinct pedagogic workshops that have been mainly presented to children in schools, museums, hospitals, and science exhibitions ([Assis and Campanacho, 2013](#)). Developed on an informal and non-formal bases, their purpose is to disseminate the interdisciplinary concept of human evolution through pedagogical and experimental activities directed to students of different age ranges ([Assis and Carvalho, 2012](#)). The scientific areas covered by the workshops are life origins and biological diversity; human evolution; human osteology and bioarcheology; forensic anthropology; primatology and pre-historic art ([Assis and Carvalho, 2012](#)). All workshops follow a pedagogical model that is divided into two

distinct parts: concise theoretical exposition about a specific subject, followed by games that are both educational and recreational and/or by hands-on activities ([Assis and Carvalho, 2012](#)). In the interactive exercises, the topics previously learned are then applied and, generally, students have shown easy acquisition of the subjects ([Assis and Carvalho, 2012](#)). In addition to the communication of science, these activities also aim to eliminate inadequate preconceived ideas regarding science and scientists, showing that: (1) science is a social enterprise and scientists do not work in a vacuum; (2) science is embedded within the social and political context where individuals live; (3) scientific knowledge is attained by trial and error and can therefore evolve (this is particularly true in the case of human evolution) and that (4) scientists are “normal” human beings and not “crazy doctors” locked in a laboratory ([Bloom, 2006](#)).

In each workshop, the monitors try to follow some of the recommendations proposed by Bloom ([2006](#)), Ingram and Nelson ([2006](#)), and Smith ([2010b](#)) that include: (1) improving language, since one of the main difficulties in communicating science is the specificity of the terminology used. In order to meet a wider public, an adjustment of the discourse to the audience is required; (2) Embracing an informal attitude by, during scientific explanations, researchers being asked to discard an authoritative attitude as if they were the sole owners of truth, and being instead encouraged to cultivate the sense of excitement for new discoveries and to

stimulate critical thought; (3) Embracing creativity since scientists have the responsibility of stimulating others, especially children, to nurture a passion for exploring, explaining, theorizing and testing questions to solve doubts; (4) Be respectful because scientists must accept and respect students beliefs, listening to their questions and doubts and remembering that science does not hold all the answers; (5) Be unbiased, making sure to avoid that their own personal beliefs seep out during the activities, and (6)

Be gentle and patient to allow students to assimilate new knowledge and eventually confronting it with their previous beliefs thus helping them to develop critical thinking skills.

Since the implementation of the *Playing with the Big Tree of Evolution* project, the workshops have been presented to an uncountable number of children and undifferentiated public from several districts of Portugal: Aveiro, Braga, Coimbra, Faro, Guarda, Leiria, Lisbon, and Viseu (Figure 1).



**Figure 1 - A: List of administrative districts of continental Portugal covered by GEEvH's pedagogical activities. B: Images illustrating some of the workshops performed.**

### *The organization and support of scientific meetings*

The GEEvH has also co-organized national and international scientific meetings, mainly with the purpose of allowing the promotion and discussion of scientific works, as well as the creation of new partnerships between researchers and university students,

especially from anthropology and archaeology. Some of these events were also open to the general public, establishing a rare dissemination channel of human evolution concepts for adults in Portugal ([Assis and Campanacho, 2013](#)). Among the events co-organized and/or supported, one can highlight: organization of the Interdisciplinary Studies in Human Evolution

Panel during the 15th International Union of Prehistoric and Protohistoric Sciences, Lisbon, 2006; co-organization of the Workshop in Musculoskeletal Stress Markers (MSM): limitations and achievements in reconstruction of past activity patterns, Coimbra, 2009; co-organization of the Scientific Works Display, Coimbra, 2009-2010; co-organization of the cycles Archaeology and Anthropology...Border Territories, Lisbon, 2010-2014; co-organization of the 1<sup>st</sup> and 2<sup>nd</sup> Bioanthropological Meeting, Coimbra, 2013 and 2015.

GEEvH (Group for the Studies in Human Evolution) and CIAS (Research Centre in Anthropology and Health) jointly organized biennially, since 2008, the “Portuguese Meeting of Paleopathology” [Jornadas Portuguesas de Paleopatologia]. The 5<sup>th</sup> edition will take place in November 2016 at the Department of Life Sciences, University of Coimbra – the host institution since the first edition.

This meeting aims at providing an interdisciplinary perspective on the reconstruction of health and disease patterns in past human populations. The majority of presentations report paleopathological studies done in Portugal or made by Portuguese researchers and the increasing presence of several participants from other countries (Brazil, Colombia, Italy, Lebanon, México, Poland, Spain and Venezuela) contributes to the internationalization of the *Jornadas*.

Keynote speakers are always invited to share their knowledge on topics such as radiology,

history of medicine, mummy studies, history, forensic anthropology, paleoanthropology, zoopaleopathology. A prize is awarded to the best communication presented by students - whose interests and academic backgrounds are diversified and include areas such as anthropology, archaeology, biology, history, law and medicine. The program-abstract books of the four editions are available online at *Estudo Geral* (<https://estudogeral.sib.uc.pt/>) and a summary of each meeting is published on *Paleopathology Newsletter*<sup>6</sup> from the Paleopathology Association (<https://paleopathology-association.wildapricot.org/>).

#### *The release of two free online publications*

In 2012, GEEvH reached another memorable milestone. The first issue of [Cadernos do GEEvH](#) was released. This journal was launched with the main objective of filling a gap: the inexistence of an open-access peer-reviewed Portuguese journal focusing on the broad scope of human evolution. Cadernos do GEEvH offers other benefits as well. It allows publishing in three different languages (Portuguese, English and Castilian) and welcomes grey literature. The latter is composed of technical reports, dissertations, databases and other kinds of information that are usually not easily accessible since they are often refused for publication in conventional journals. At Cadernos do GEEvH, we believe that such papers are also worthy of publication as long as authors followed good practices regarding their

<sup>6</sup> Santos ([2008](#), [2011](#), [2012a](#), [2015](#)).

scientific research. We try to make sure of that as much as possible through a process of blind peer-review.

The papers published in Cadernos do GEEvH are a good illustration of the very broad topic that is human evolution. So far, we had contributions from paleoanthropology, forensic anthropology, paleopathology, primatology, archaeology, geoarchaeology, archeogenetics, paleoparasitology and we look forward for submissions coming from other research fields. Furthermore, in 2014, a new online publication – [Show Us Your Research! \(SUJR!\)](#) – was created by GEEvH in collaboration with NAP (Group of Archaeology and Paleoecology, University of Algarve). SUJR! main goal consists in publishing social and biological anthropology and archaeological works aimed for the general public, to construct a new channel of communication between the researchers and the wider public. We welcome works about any anthropological and archaeological topic, such as: past and current research projects, methodologies, artefacts, theories, pathological conditions, anatomical features (e.g. non-metric traits), an archaeological site, and outreach activities, etc. Broadcast of SUJR! works is made through social media, such as facebook, mailing-lists, webpages and blogs (*Powered by Osteons* by Dr Kristina Killgrove USA, *These Bones of Mine* by David Menear UK, and *Ritual is power: An Exploration of Ceremonial Architecture at Huaricanga* by Dr Matthew Piscitell USA). Ten SUJR! works have been issued from Portugal, UK, Canada, Spain and Denmark academics.

## Future Prospects

Although a lot has been accomplished in the last ten years, much still needs to be done to fulfil the objectives that were at the root of the creation of GEEvH and that continue to be extremely current nowadays. For that to take place, the association must increase the number of its associates since further endeavors are forcibly dependent on both human and financial resources. Regrettably, GEEvH has not been very successful regarding this aspect. The amount of members has been rather stable in the last few years and this has been an impediment to our involvement in additional activities. Therefore, there is room for improvement in that department.

If we are successful at enlarging the revenue coming from membership fees and are able to recruit additional volunteers to participate in our activities, GEEvH will be able to further strengthen its position in the Portuguese scientific panorama. For example, one of our longstanding desires is to be able to directly support scientific research by funding short-term individual research grants.

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