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Darwinian Medicine and "Race": a Note on Education*

The relevance of the modern evolutionary theory for medical practice and research has been generally acknowledged. It is, however, still debated whether there is enough benefit to be gained from the evolutionary theory to justify its inclusion in the ever expanding medical curriculum. It is argued in this paper that in addition to the numerous benefits already explicated in other works, the inclusion of the evolutionary theory into the medical education offers yet another potential gain for medicine – it provides the key for the understanding of human biological variation and its relevance within the medical discourse.

Key words:

evolutionary theory, medicine, human variation, "race"

Introduction

Following the family tradition a sixteen year old Charles Darwin enrolled as a medical student at the University of Edinburgh in 1825 (Browne, 1995). Darwin's career in medicine, however, was short lived. Disturbed by some scenes which he witnessed in the operating theaters, he left both Edinburgh and medicine, and was studying in Cambridge to become a pastor already in 1827. Darwin was later, of course, to make a revolution (Ruse, 2009) in biology with his theory of evolution by means of natural selection. This theory made a significant impact not only on biology but also on various other disciplines and even cultural values and society in general (Bowler, 2003).

The early attempts to use Darwinian theory in other sciences usually involved simplifications, often because Darwinism itself was simplified or not com-

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pletely understood. More recent applications, however, are more sophisticated, in line with the modern evolutionary theory. These have already produced many valuable and novel results. The influence of Darwinism is now felt even in social sciences and humanities (Barkow, 2006).

Curiously, one of the last disciplines to endure significant Darwinian input is medicine (Stearns *et al*., 2010). Although attempts at integrating the two fields has a long history and although some remarkable and valuable research was published as early as the nineteenth century (Zampieri, 2009), it was only in 1991 that psychiatrist Randolph Nesse and evolutionary biologist George Williams explicated the principles of what is now know as Darwinian (evolutionary) medicine (Williams and Nesse, 1991; Nesse and Williams, 1994). Darwinian medicine is not devised as a new branch of medicine but rather "consists of the intersections where evolutionary insights bring something new and useful to the medical profession" (Stearns *at al*., 2010, 1691).

Following Williams's and Nesse's seminal work, the integration of evolutionary biology and medicine has taken long strides forwards, especially in the last two decades. In 2009 two events gave a significant impetus to this process: the publication of recommendations commissioned by the American Association of Medical Colleges and the Howard Hughes, Medical institute which suggested the inclusion of competency in evolutionary biology in the premedical education; the Arthur M. Sackler Colloquium of the National Academy of Science, USA entitled "Evolution in Health and Medicine" where the latest research in evolutionary medicine was presented, including further recommendations on the incorporation of evolutionary theory in medical curricula. As argued in a paper from the Sackler Colloquium, there is still a need to show the relevance of evolution to medicine and justify its inclusion in the overcrowded and ever expanding medical curriculum (Nesse *et al*. 2010). Consequently, a detailed proposal of pre-medical and medical competencies and learning outcomes was proposed, together with topics on evolutionary theory to be covered in the medical curriculum.

Darwinian Medicine and "Race"

One of the above mentioned topics on evolutionary medicine relates to "genetic differences among human populations and rates of evolutionary change" (Nesse *et al*., 2010, 1805). This topic provides yet another, somewhat neglected potential benefit of the application of evolutionary theory in medicine – it can help students understand the nature of human biological variation and its relevance to medicine. This seems to be of great importance as one of the most contentious issues in modern medical practice and research is the role of biological variation due to difference in ancestry, which has also, especially in the past, been referred to as "racial". Indeed, most of the controversies concerning this subject revolve around the concept of race – can humans, based on biologically sound criteria, be classified into races and if they can what, if anything, do these groupings tell us about their susceptibility to certain diseases and response to therapy. This is encapsulated by Bamshad and Olson (2003, 79) in the following three questions: "Can genetic in-

formation be used to distinguish human groups having a common heritage and to assign individuals to particular ones? Do such groups correspond well to predefined descriptions now widely used to specify race? And, more practically, does dividing people by familiar racial definitions or by genetic similarities say anything useful about how members of those groups experience disease or respond to drug treatment?"

The answers to the above questions vary dramatically between medical researchers and the issue of human variation seems to be surrounded by numerous disagreements and misunderstandings. Thus, one of the leading medical journals recently published two papers, back to back in the same issue, which expressed diametrically opposing positions on the topic. While in the first article authors state that "race, at the continental level, has not been shown to provide a useful categorization of genetic information about the response to drugs, diagnosis, or causes of disease" (Cooper *et al*., 2003, 1168), the authors of the second paper conclude that "there are racial and ethnic differences in the causes, expression, and prevalence of various diseases" (Burchard *et al*., 2003, 1174).

It could be argued that many of the abovementioned misunderstandings are at least partly attributed to the lack of education on the subject (e.g., Anderson, 2008; Štrkalj and Wilkinson, 2006; Wilkinson *et al*., 2010). Current medical curricula and textbooks seem to provide little help. Indeed, some recent research suggests that human variation is often not accounted for or is discussed in an outdated manner. This was clearly revealed in a survey of eighteen frequently used anatomy textbooks, written in English (Štrkalj and Solyali, 2010). Only four of these textbooks discuss human variation and do that in a cursory and obsolete manner, while relying on the concept of race. One of textbooks, for example, provides the following simplistic descriptions and explanations: "Racial differences may be seen in the colour of the skin, hair, and eyes, and in the shape and size of the eyes, nose, and lips. Africans and Scandinavians tend to be tall, as a result of long legs, whereas Asians tend to be short, with short legs. The heads of central Europeans and Asians also tend to be round and broad" (Snell 2008, 36).

It has been argued (Braun *et al*. 2007, 1426) that "improved medical training" on human variation and race "can sharpen diagnostic skills". Accordingly, some Medical Schools have already introduced teaching on the topic in their curricula (Anderson, 2008). It could be argued that the main focus in this training should be on the understanding of microevolutionary processes which have produced modern human biodiversity.

The species *Homo sapiens* has resulted from a long and complex process of evolution. According to a model of the evolution of modern humans (Tattersall, 2009), now strongly supported by archaeological, anatomical and genetic data species, our species evolved from a rather small African population which started to disperse to other parts of the world in the relatively recent period between 70.000 and 125,00 years ago. Subsequent to this dispersal, the descendants of this . population were to adapt, through the process of natural selection, to life in different environments, diversifying genetically and morphologically as a result. The process of

diversification was further mediated (heightened or lessened) through other evolutionary forces, such as genetic drift, where allele frequencies are changed due to chance alone. As a result, modern humans show considerable biological heterogeneity as a result of their geographic ancestry. This diversity is exceptionally complex, the complexity being further exacerbated by constant migrations of different groups of people which resulted in increased gene flow between different populations.

Dividing into races, however, though perhaps intuitively appealing (Yoon, 2009), does not seem to be applicable to the species *Homo sapiens*. "Human races" into which anthropologists traditionally used to classify humans (Brace, 2005), are not natural biological groups but artificial divisions made according to certain (usually arbitrarily) chosen character or set of characters (Štrkalj, 2006). It also has to be born in mind that if one analyses any two or more of these morphological traits, they often have different patterns of distributions between different human groups (discordant distribution). Furthermore, the incidence of many traits often change gradually across different geographical regions (clinal distribution) making the boundaries between different population fuzzy, rather than well defined.

It is important, however, that some of the traits in which humans vary might be of clinical importance (see Wilkinson *et al*., 2010). For example, differences in skin pigmentation: people of lighter complexion having stronger predilection for developing skin cancer in the areas of high ultraviolet radiation then people of darker complexion. Understanding the pattern of distribution of skin pigmentation, its nature and origin is crucial in understanding possible clinical implications.

Conclusions

Insights into the relevant elements of the evolutionary theory, therefore, would make students understand that they need to focus on mechanisms behind the complex patterns of biological variation rather than fruitless attempts at classifying humans into races. Students will, therefore, be able to recognise that while humans do vary biologically due to their ancestry, the race concept is, as recently noted, "both too broad and too narrow" (Feldman *et al*., 2003, 374) to explain this variation and its medical implications.

The evolutionary theory provides many benefits to medical education – understanding human biological variation is undoubtedly one of them. It would, of course, be too optimistic to expect that teaching evolution to medical students could resolve all the issues relating to human variation in medicine. However, the inclusion of the evolutionary biology into the medical curriculum might be a decisive step in the right direction.

Theodosius Dobzhansky (1973, 125) once noted that "Nothing in biology makes sense except in the light of evolution". One might add that quite a few things in medicine make sense in the light of evolution. Charles Darwin's greatest contribution to medicine is, indeed, his theory of evolution.

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Дарвинистичка медицина и "раса": напомена о образовању

Кључне речи:

еволуциона теорија, медицине, људска варијабилност, "раса"

Важност модерне еволуционе теорије за медицинску праксу и истраживања је данас готово опште прихваћена. Још увек се, међутим, расправља да ли еволуциона теорија доноси довољно добитка да би оправдала евентуално укључење у стално растући медицински програм. У неколико недавно објављених радова представља се детаљна структура образовног програма у којем би се релевантни делови еволуционе теорије предавали студентима медицине и сродних дисципина, као и објашњење како еволуциона теорија доприноси развијању клиничких компетенција. У овом раду се представља још једна, до сада углавном занемарена, потенцијална добит од увођења еволуционе биологије у медицински образовни програм – знање о еволуционим процесима обезбеђује кључ за разумевање људске биолошке варијабилности и њеног значаја у оквиру медицинског дискурса. Биолошка варијабилност се испољава на више нивоа – индивидуалном, полном, старосном и популационом. Сви ови нивои варијабилности су од значаја за људско тело и његово функционисање, у здрављу и болести. Различити ставови према проблемима везаним за варијабилност према популационој припадности и њеном значају за медицину су у последње време изазвали доста котроверзи. Управо ова, популациона варијабилност, се мозе потпуно разјаснити само у светлу модерне еволуционе теорије. Познавање принципа еволуције насе врсте је први корак у одбацивању застарелих приступа, базираних на појму расе, и корак ка разумевању популационе вариабилности у медицини у свој њеној комплексности.