

Human Biological Variation in Anatomy Textbooks: The Role of Ancestry

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ABSTRACT Humans vary biologically at different levels: individually, according to sex, age and ancestry. The first three levels are usually competently accounted for in medical curriculum, but this does not seem to be the case with the fourth one. This study focuses on human biological variation due to differences in ancestry and the way it is dealt with in anatomy textbooks. It examines the treatment of human biological variation (ancestry) in current anatomy textbooks written in English, through the content analysis. The results suggest that this type of human variation is either not accounted for or approached only superficially and in an outdated manner. In light of the current debate on the validity of "race" in medical discourse, it is recommended that more adequate and up to date accounts on human variation should be introduced in anatomy textbooks.

INTRODUCTION

The species *Homo sapiens* varies at different levels of biological organization: individually, according to sex, age and ancestry. Whilst the first three levels and their relevance for medical research, practice and education seem to be generally acknowledged, the fourth one is a matter of contention and the subject of heated debates (see, among many others, Braun et al. 2007; Bhopal 2009; Kimmelman 2006; Metroso 2006). Most of these debates focus on the relevance of the race concept and alleged racial differences in susceptibility to disease and response to therapy. The ways in which scientists and clinicians address these issues vary, sometimes dramatically (see, for example, Burchard et al. 2003 vs. Cooper et al.).

The reasons for the differences in attitudes towards race and human variation are many and of both scientific and external nature (Štrkalj 2007, 2008). Research shows that one of the main reasons for the difference in attitudes towards race is to be found in the varying educational backgrounds of the scientists involved (Kaszycka and Štrkalj 2002; Kaszycka et al. 2009;

Lieberman et al. 2004). Furthermore, it would appear that at least some scientists involved in debates on race, especially outside anthropology, exhibit a considerable lack of knowledge of the nature of human biological variation and the microevolutionary processes that underpin it. These include researchers in biomedical disciplines (see, for example, Ellison and de Wet 1997). Even some of the reference works, such as medical dictionaries, seem to display considerable confusion on the subjects of race and ethnicity (Ellison 1999). It could be argued that this apparent lack of competency is largely due to the lack of adequate education on human variation within the ever changing, constantly expanding medical curriculum (Štrkalj and Wilkinson 2006). Consequently, changes in medical education that would address various issues regarding race and ethnicity were proposed (Betancourt et al. 2001; Braun et al. 2007; Kleinman and Benson 2006; Štrkalj and Wilkinson 2006), including a number of different modes of teaching and learning such as lectures, tutorials, practical sessions and workshops.

Anatomy is undoubtedly one of the disciplines in which human variation due to ancestry needs to be dealt with carefully. Moreover, in many medical curricula, it is the first subject in which students get exposed to the complexities of human variation. Some surveys of research and actively teaching anatomists, however, suggest that their approach to human variation

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is far from ideal (see, for example, Morris 2003; Štrkalj and Wilkinson 2006). Therefore, it seems worthwhile to look at the way human variation is related to in anatomy education.

Lieberman et al. (1992: 302) noted: “The two major channels for formal transmission of information to college students are textbooks and teachers.” This study focuses on the former; the aim is to identify whether human variation due to ancestry is accounted for in major human anatomy textbooks and if it is, to evaluate the way in which this is accomplished.

Most of the previous textbook surveys on race and human variation focused on the anthropology texts (Lieberman et al. 1992, 2003, 2005; Littlefield 1982). They demonstrated that, in line with the developments in modern biological anthropology and allied disciplines, there was a significant trend in rejecting the concept of race in favour of more elaborate new approaches such as the clinal. Very few similar studies were carried out in other disciplines. In one of the surveys of anthropology textbooks, biology textbooks were analysed for comparison (Lieberman et al. 1992). It was shown that in the latter, race concept was rejected with lesser frequency than in the former. This suggests that textbooks in other fields might also not be following the latest anthropological developments.

MATERIALS AND METHODS

In this study, the content of selected human anatomy textbooks written in English was analysed (Neuendorf 2002; Krippendorff 2004). Only widely available and prescribed textbooks were included in the analysis, as they are used by a large number of students and in different countries. The availability and usage of textbooks was established through a search of the library catalogues and a survey of prescribed books in several leading universities and medical schools in the English speaking countries. Only the latest available editions were used. The reviewed textbooks were those written for the under-graduate medical students and the students of allied medical disciplines.

A number of exclusion criteria were applied. Atlases, textbooks combining anatomy and other disciplines (e.g. physiology), workbooks, specialised textbooks dealing with only certain regions of the body, laboratory and dissection manuals as well as the textbooks written for the

local markets which have geographically limited distribution, were excluded from the study. These types of anatomy guides are too numerous and in most of the cases difficult to acquire, while their usage is rather limited.

The focus was therefore on anatomy textbooks with wide distribution in English-speaking countries and (at least some of them), even broader, as they are translated in other languages.

The textbooks were accessed from the libraries of Macquarie University, the University of Sydney and from the authors' private collections. The review was conducted through the search of the books' indexes using a number of key words: general terms relating to human variation (such as “race”, “population” “human variation”, “ancestry” etc.) as well as more specific terms (for example, racial taxa such as “Caucasoid”, “white” etc.). Further reading and analyses of the chapters expected to deal with the subject were also carried out.

The textbooks were examined by the two authors independently and the obtained results showed a perfect agreement (Krippendorff 2009).

RESULTS

A total of 18 textbooks were reviewed (see Appendix). The publication dates of these textbooks range from 1995 to 2010. It was found that only four textbooks (two of which are different versions of the same book – Snell 2007, 2008), dealt with and tried to explain human ancestral variation. However, all of these seem to be rather superficial in content and outdated. Furthermore, all of them rely on the race concept. One of the textbooks (in both of its formats) states: “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 2007: 26, 2008: 36). Another textbook addresses human variation briefly in one of the figures. It presents “principal races of humans”, namely the Mongoloid, Caucasoid, Negroid, people of the Indian subcontinent, Capoid and Australoid (Van De Graaff 2002: 27). This is reminiscent of the classification (and terminology) proposed almost half a century ago by Carleton Coon in his infamous, long since outdated work (Coon 1962),

to which a new “race” (“people of the Indian subcontinent”) has been added. Finally, the third textbook simply notes that “the frequency of variation often differs among human groups, and variations collected in one population may not apply to members of another population” (Moore et al. 2010: 12) These differences are in subsequent paragraphs referred to as “racial”.

It was also recorded that occasional, brief references to human variation due to ancestry were made in some textbooks. It was either to note morphological differences in certain populations or, within a clinical context, to outline differences in susceptibility to certain diseases. Thus, it was noted in one textbook (Moore et al. 2010: 445) that “The spinous processes of the C3-C6 vertebrae are short and usually bifid in white people, especially males, but usually not as commonly in people of African descent or in females...”, while in the other (Tortora and Nielsen 2009: 154) it was highlighted that “... risk factors for developing osteoporosis include... European and Asian ancestry...”

DISCUSSION AND CONCLUSIONS

It may be concluded that human biological variation due to ancestry is either not mentioned or is only superficially accounted for in the analysed anatomy textbooks. Students learning about anatomy, however, need accurate explanation (even if in very basic terms) of the nature of human variation. They should know from the early years of their studies that humans do vary morphologically due to their ancestry, but that the race concept is, as recently argued “both too broad and too narrow” (Feldman et al. 2003: 374), to explain this variation. Students should also be taught that they need to focus on processes that produce the complex patterns of variation rather than fruitless attempts at classifying humans into races.

Teaching medical students about human variation is a considerable challenge, but at the same time a real necessity. There is no doubt that, as argued by Braun et al. (2007: 1426), “improved medical training” on human variation and race “can sharpen diagnostic skills”, especially when dealing with the biologically heterogeneous and culturally diverse populations. The full appreciation of human variation and its relevance within the medical discourse, however, can only be achieved as a result of the constant and coordi-

nated efforts of all those involved in medical education (Anderson 2008; Wilkinson et al. in press). Anatomists and all those involved in teaching anatomy need to be more actively and efficiently involved in this process. This equally applies to the anatomy textbooks, one of the “major channels for formal transmission of information to college students”.

Research shows that significant gains in students’ understandings of human variation can be attained with only a modicum of educational interventions (Hart and Ashmore 2006; Štrkalj and Wilkinson 2005). Textbooks, however, do not seem to be helpful in all disciplines. Previous research shows that, following recent scientific advancements, there have been significant changes in the way in which human ancestral variation is presented in biological anthropology textbooks, particularly in rejecting the concept of race and racial hierarchies (Lieberman et al. 1992, 2005; Littlefield 1982). These changes, however, do not appear to affect other disciplines equally strongly. For example, biology and sport science lag behind (Hallinan 1994; Lieberman et al. 1992) and anatomy, this study suggests, even further. It could be argued that with small changes in anatomy textbooks, which would include relatively brief but more accurate and up to date account on human biological variation, considerable improvements could be achieved in the understanding of this elusive but critically important subject.

Finally, if the parts on human variation are better written, the analysed textbooks could also contribute towards decreasing misunderstandings among biomedical researchers and practitioners at the international level. A number of issues relating to human variation, such as the usage of racial and ethnic categories are context specific and differ significantly between various national and cultural traditions (Aspinall 2007). The language of anatomy is universal and standardised, and could follow international terminological guidelines easily (Aspinall 2007). Furthermore, the analysed textbooks have wide, international usage and therefore have a potential to influence a great number of students across the national and cultural borders. Thus, these textbooks could be a tool in, at least, initiating better communication among experts coming from different cultural backgrounds.

Small but well aimed and coordinated steps could induce significant gains in the improvement

of biomedical researchers' and practitioners' understanding of human biological variation. Relevant changes in anatomy textbooks could be one of these steps.

REFERENCES

- Anderson W 2008. Teaching 'race' at medical school: social scientists on the margin. *Soc Stud Sci*, 38: 785-800.
- Aspinall PJ 2007. Approaches to developing an improved cross-national understanding of concepts and terms relating to ethnicity and race. *Int Sociol*, 22: 41-70.
- Betancourt JR, Green AR, Carrillo JE, Ananeh-Firempong IO 2003. Defining cultural competence: A practical framework for addressing racial/ethnic disparities in health and health care. *Public Health Rep*, 118: 293-302.
- Bhopal R 2009. Medicine and public health in a multiethnic world. *J Public Health*, 31: 315-321.
- Braun L, Fausto-Sterling A, Fullwiley D, Hammonds EM, Nelson A, Quivers W, Reverby SM, Shields AE 2007. Racial categories in medical practice: How useful are they? *PLOS Med*, 4(9): 1423-1428; e271. doi:10.1371/journal.pmed.0040271
- Burchard GE, Ziv E, Coyle N, Gomez SL, Tang H, Karter AJ, Mountain JL, Pérez-Stable EJ, Sheppard D, Risch N 2003. The importance of race and ethnic background in biomedical research and clinical practice. *New Engl J Med*, 348: 1170-1175.
- Coon CS 1962. *The Origin of Races*. New York: Alfred M. Knopf.
- Cooper RS, Kaufman JS, Ward R 2003. Race and genomics. *New Engl J Med*, 348: 1166-1170.
- Ellison CTH 1999. Contemporary definitions of 'race' and 'ethnicity' in medical dictionaries. *Ann Hum Biol*, 27: 104-105.
- Ellison CTH, de Wet T 1997. The use of 'racial' categories in contemporary South African health research. *SAMJ S Afr Med J*, 87: 1671-1679.
- Feldman MW, Lewontin RC, King M 2003. A genetic melting-pot. *Nature*, 424: 374.
- Hallinan CJ 1994. The presentation of human biological diversity in sport and exercise textbooks: The example of "race". *J Sport Behav*, 17(1): 3-13.
- Hart D, Ashmore P 2006. Changing students' understanding of race. *Anthropol News*, 47: 10-11.
- Kaszycka KA, Štrkalj G 2002. Anthropologists' attitudes towards the concept of race: The Polish sample. *Curr Anthropol*, 43: 329-335.
- Kaszycka KA, Štrkalj G, Strzalko J 2009. Current views of European anthropologists on race: Influence of educational and ideological background. *Am Anthropol*, 111: 43-56.
- Kimmelman J 2006. The post-Human Genome Project mindset: Race, reliability, and health care. *Clin Genet*, 70: 427-432.
- Kleinman A, Benson P 2006. Anthropology in the clinic: The problem of cultural competency and how to fix it. *PLOS Med*, 3(10): e294. doi:10.1371/journal.pmed.0030294
- Krippendorff K 2004. *Content Analysis: An Introduction to its Methodology*. 2nd Edition. Thousand Oaks, CA: Sage.
- Krippendorff K 2009. Testing the reliability of content analysis data: what is involved and why. In: K Krippendorff, MA Bock (Eds.): *The Content Analysis Reader*. Thousand Oaks, CA: Sage, pp. 350-357.
- Lieberman L, Hampton RE, Littlefield A, Hallead G 1992. Race in biology and anthropology: A study of college texts and professors. *J ResSci Teach*, 29(3): 301-321.
- Lieberman L, Corcoran M, Kirk R, Watterson-O'Neil C 2005. Are physical anthropology textbooks color-blind? *Transforming Anthropol*, 13(2): 92-102.
- Lieberman L, Kaszycka KA, Fuentes AJM, Yablonski L, Kirk RC, Štrkalj G, Wang Q, Sun L 2004. The race concept in five regions: Variations without consensus. *Collegium Antropol* 28: 907-921.
- Lieberman L, Kirk RC, Littlefield A 2003. Perishing paradigm: Race – 1931-99. *Am Anthropol*, 105(1): 110-113.
- Littlefield A, Lieberman L, Reynolds LT 1982. Redefining race: The potential demise of a concept in physical anthropology. *Curr Anthropol*, 23: 641-655.
- Metrosa EV (Ed.) 2006. *Racial and Ethnic Disparities in Health and Health Care*. New York: Nova Science Publishers.
- Moore KL, Dalley AF, Agur AMR 2010. *Clinically Oriented Anatomy*. 6th Edition. Philadelphia: Lippincott Williams & Wilkins.
- Morris AG 2003. Using racial terms in anatomical research. *Plexus*, 2: 9-12.
- Neuendorf, KA 2002. *The Content Analysis Guidebook*. Thousand Oaks, CA: Sage.
- Snell RS 2007. *Clinical Anatomy by Systems*. Philadelphia: Lippincott Williams & Wilkins.
- Snell RS 2008. *Clinical Anatomy by Regions*. 8th Edition. Philadelphia: Lippincott Williams & Wilkins.
- Štrkalj G 2007. The status of the race concept in contemporary biological anthropology: A review. *Anthropologist*, 9: 73-78.
- Štrkalj G 2008. *Beyond Race: A Prolegomenon for the Study of Human Biological Variation*. Saarbrücken: VDM Verlag.
- Štrkalj G, Ramsey S, Wilkinson AT 2004. Anatomists' attitudes towards the concept of race. *SAMJ S Afr Med J*, 94: 90-91.
- Štrkalj G, Wilkinson AT 2005. The influence of a modicum of education on students' attitudes towards the concept of race. In: G Štrkalj, NP Pather, B Kramer (Eds.): *Voyages in Science: Essays by South African Anatomists in Honour of Phillip V. Tobias's Eightieth Birthday*. Pretoria: Content Solutions, pp. 179-186.
- Štrkalj G, Wilkinson AT 2006. "Race" and biomedical research: An educational perspective. *Educ Health*, 19(1): 111-114.
- Tortora GJ, Nielsen MT 2009. *Principles of Human Anatomy*. 11th Edition. Hoboken: Wiley & Sons.
- Van De Graaff KM 2002. *Human Anatomy*. 6th Edition. Boston: McGraw Hill.
- Wilkinson AT, Štrkalj G, Spocter M in press. Should human variation be thought to medical students? In: G Štrkalj (Ed.): *Teaching Human Variation: Issues, Trends and Challenges*. Hauppauge: Nova Science Publishers.

**APPENDIX: A LIST OF THE ANATOMY
TEXTBOOKS ANALYSED**

- Drake RL, Vogl WA, Mitchell AWM 2010. *Gray's Anatomy for Students*. 2nd Edition. Philadelphia: Churchill Livingstone/Elsevier.
- Eizenberg N, Briggs C, Adams C, Ahern G 2007. *General Anatomy: Principles and Applications*. 2nd Edition. North Ryde: McGraw-Hill.
- Ellis H 2006. *Clinical Anatomy: Applied Anatomy for Students and Junior Doctors*. 11th Edition. Oxford: Blackwell Science
- Faiz O, Moffat DB 2006. *Anatomy at a Glance*. 2nd Edition. Malden: Blackwell.
- Gosling JA, Harris PF, Humpherson JR, Whitmore I, Willan PLT 2008. *Human Anatomy: Color Atlas and Textbook*. 5th Edition. London: Mosby/Elsevier.
- Larsen WJ 2002. *Anatomy: Development, Functions, Clinical Correlations*. Philadelphia: Saunders/Elsevier.
- Lumley JSP, Craven JL, Aitken JT 1995. *Essential Anatomy*. Philadelphia: Churchill Livingstone/Elsevier.
- Marieb EN, Mallatt J, Wilhelm PB 2008. *Human Anatomy*. 5th Edition. San Francisco: Pearson/Benjamin Cummings.
- Martini FH, Timmons MJ, Tallitsch RB 2009. *Human Anatomy*. 6th Edition. San Francisco: Pearson Benjamin Cummings.
- McKinley MP, O'Loughlin VD 2008. *Human Anatomy*. 2nd Edition. Boston: McGraw Hill.
- Moore KL, Dalley AF, Agur AMR 2010. *Clinically Oriented Anatomy*. 6th Edition. Philadelphia: Lippincott Williams & Wilkins.
- Saladin KS, McFarland RK 2008. *Human Anatomy*. Boston: McGraw Hill.
- Sinnatamby CS 2006. *Last's Anatomy: Regional and Applied*. 11th Edition. Edinburgh: Elsevier/Churchill Livingstone.
- Snell RS 2008. *Clinical Anatomy by Regions*. 8th Edition. Philadelphia: Lippincott Williams & Wilkins.
- Snell RS 2007. *Clinical Anatomy by Systems*. Philadelphia: Lippincott Williams & Wilkins.
- Srebnik HH, Wilson GM 2002. *Concepts in Anatomy*. Boston and London: Kluwer Academic.
- Tortora GJ, Nielsen MT 2009. *Principles of Human Anatomy*. 11th Edition. Hoboken: Wiley & Sons.
- Van De Graaff KM 2002. *Human Anatomy*. 6th Edition. Boston: McGraw Hill.