



Do I need to “believe” in the theory of evolution to be a good biomedical engineer?

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Several years ago during a lecture in a graduate biomedical engineering course I made a passing reference to the role of evolution in the development of the vasculature in mammals. To my great surprise, my comment was met with an angry response from a graduate student in my class who ended up leaving the class that day after telling me that he did not “believe” in the theory of evolution. The next day the student came to my office to apologize but did pose the following question: Do I need to “believe” in the theory of evolution to be a good biomedical engineer?

In several editorials in the *BMES Bulletin*^{1,2} Dr. Slack has elegantly addressed the importance of the evolutionary theory to engineers and has described how this theory has come under attack from several well-organized groups. It is commonly believed that these attacks originate mainly from the southern states (the so called “Bible Belt”) and mostly from non-scientists. However, a lack of understanding of the significance of the evolutionary theory is wide-spread across geographic and professional boundaries. The recent court case on the requirement to teach the so called “Intelligent Design theory” to high school students in Dover, Pennsylvania³ and a recent “opinion” from a prominent chemist that questions the significance of the evolutionary theory as the cornerstone of modern biology⁴ are indicative of the wide-spread crusade against the theory of evolution. A recent poll indicates that 51% of Americans reject the theory of evolution⁵ and even a prominent sign at the Grand Canyon National Park now reads: “The landscape seems consciously designed”⁶!

Some of us may feel that the field of biomedical engineering benefits very little from the evolutionary theory because many engineers are able to conduct their daily research and/or development activities without invoking the Darwinian evolutionary theory. From this

line of reasoning, then, it is proposed that we as biomedical engineers do not have to concern ourselves with the crusade against the evolutionary theory. The fallacy of this line of reasoning, however, is manyfold. In a society that owes much, if not all, of its prosperity to advancements in science and technology it is quite irresponsible, and even dangerous, to ignore the calls for replacing a well-established scientific theory (i.e. evolution) in favor of unsubstantiated conjectures such as “Intelligent Design” which even according to its own supporters “does not have any content”⁷. A close reading of the literature from the proponents of ID clearly indicates that it is not only the field of evolutionary biology that they aim to undermine but also many other fields including geology (e.g. questioning evidence of the age of the earth), astronomy (i.e. questioning evidence of the age of the universe), and nuclear physics (e.g. questioning radioactive/carbon dating) to name just a few.

Furthermore, the notion that our daily work as biomedical engineers benefits very little from the field of evolutionary biology is merely an indication of the fact that modern scientists/engineers are in general so narrowly trained and specialized that they can often work in their small niche throughout their careers without the need to invoke or even understand the fundamental theories of their field. For example, most electrical engineers who design impressive pieces of electronic circuitry on a daily basis do this without ever invoking, or even understanding, the theory of quantum mechanics. We can also drive our automobiles without ever having to understand the science of mechanics. Are we then to conclude from the latter examples that quantum and classical mechanics are not the cornerstones of modern electronics and modern automotive engineering? Overall progress in a field of science depends very much on understanding the “big picture” and

being able to relate findings from seemingly unrelated fields of investigation through overarching theories such as evolution, quantum mechanics, etc. It is only through modern theories of evolution and genetics for example that we can understand the relationship between seemingly unrelated experimental observations such as the existence of “DNA exchange” and the rise of “antibiotic resistant germs”. As educators we would be doing our students and the general public a disservice if we were to pretend that scientific discoveries (and technological developments) in different fields of investigation are essentially a group of unrelated experimental observations that are not related to each other through theory. Here I would like to propose that as biomedical engineering educators we need to start a debate on how we can better educate our students, and the public at large, on the significance and importance of the evolutionary theory to biomedical engineering and the future welfare of our society. Many of our students can go through undergraduate and/or graduate training in biomedical engineering without ever hearing the words “evolutionary biology” let alone receiving formal training in the field. I am often amazed that many of our students do not realize that scientific theories are based on systematic analysis of carefully collected and verifiable data and as such what we “believe” is scientifically irrelevant. As a point of departure in this proposed debate, I do not advocate adding yet another series of courses to the already busy biomedical engineering curriculum but rather that we should make sure that the relevance of evolutionary biology to biomedical engineering is better incorporated into our existing educational programs. The solution will come in part from our strength in interdisciplinary training through closer interaction between educators in biomedical engineering and evolutionary biology.

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Promoting Biomedical Engineering and the Society at the High School Level

Alejandra Garza, BMES membership marketing manager

BMES is devoted to championing the biomedical engineering (BME) field and the society whenever the opportunity presents itself. This spring, BMES accepted an invitation to encourage young high school students toward the BME field.

Montgomery County Public Schools, Montgomery County Business Roundtable for Education, and Montgomery College in Germantown, Maryland worked together to host the Professional Development Conference for Students on Wednesday, March 22, 2006.

Nearly 500 students enrolled in the Montgomery Public Schools Academies of Finance, Information Technology, Law, and Hospitality and Tourism participated. The conference held twenty interactive workshops to engage the students and enlighten them on the latest innovations and job opportunities in their chosen field. The conference also arranged a networking breakfast, a keynote address, and practice interviews.

Dr. Peter G. Katona, Executive Director and CEO of the Whitaker Foundation, and Barbara Dunlavey, Executive Director of Biomedical Engineering Society illustrated the tremendous growth of the biomedical engineering field and showcased some of the out of the ordinary projects biomedical engineers (BMEs) develop in their presentation for the workshop session, "The Future of Medicine."

The presentation, which was repeated twice, was lead by Dr. Katona who first introduced himself, and then asked the group "how many really know what BME is; how many have some idea?" Most students seemed reluctant to answer his initial questions, but once Dr. Katona offered examples of biomedical engineering's involvement in imaging, modeling, devices, and other advancements in medicine, students became animated and raised some interesting questions. One student was especially interested in learning whether there are roles for BMEs in professional sports, and was eager to

learn that BMEs can work in developing aiding devices for bone and joint injuries. Another student was interested in finding out more on the role BMEs play in healing diseases when Dr. Katona mentioned a new way that insulin can be administered.

Barbara Dunlavey and Dr. Katona pointed out the different industries in which BMEs work, the wide range of projects BMEs innovate, what the curriculum of a BME program is like, and offered advice on choosing a university and a career field.

It was obvious that the students who participated in "The Future of Medicine" session with BMES were well on their way to become talented engineers. Many of them had an idea of what opportunities to undertake in order ensure a successful academic career. Students departed that afternoon with a better understanding of the field of biomedical engineering and will likely link the field to the Biomedical Engineering Society for years to come. ■

Roderic I. Pettigrew , MD, PhD

Receives BMES Honorary Fellow Designation



Dr. Roderic Pettigrew, Director of NIH's National Institute for Biomedical Imaging and Bioengineering was presented BMES' Honorary Fellow membership and commemorative plaque on Wednesday, January 25, 2006 at the NIBIB's Advisory Council Meeting by Dr. Frank C-P Yin, who serves on the Council.

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And yes, we do need to UNDERSTAND the theory of evolution in order to be good biomedical engineers. Otherwise, we will be operating as technicians, however competent, and not engineers and scientists; we would be chemists without the atomic theory-alchemists!

- ¹ Slack, S.M. (2004) Evolution revisited. BMES Bulletin, 28(4):1.
- ² Slack, S.M. (2002) Non-overlapping magesteria. BMES Bulletin, 26(3):1.
- ³ Mervis, J. (2006) Judge Jones defines science – And why Intelligent Design isn't. Science, 311:34.
- ⁴ Skell, P.S. (2005) Why do we invoke Darwin? Scientist, 19(16):10.
- ⁵ Collins, G. (2005) An evolutionist's evolution. The New York Times, November 7, 2005.
- ⁶ Longino, J.T. (2005) Revisiting the Grand Canyon. Science, 310:619.
- ⁷ Dennett, D.C. (2005) Show me the science. <http://www.edge.org/documents/archive/edge166.html>. Last visited August 2005.