What Does it Take to Be a Good Biological Engineer?

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Appeared in the IBE Newsletter, vol 12.2, Summer 2008

The story is recounted in the *Phi Kappa Phi Forum* about a Harvard University conference entitled “Keeping Kids in the Achievement Game” (Malone, 2008). John Merrow, President of Learning Matters, Inc., and a renowned education reporter for PBS and NPR, gave a compelling speech about the importance of quality teachers, holistic education, and the care and nurturing of our inner-city students. No sooner had he finished than a male high school student stood up and asked, “Well, if all this is so important, how come my art got cut, and how come I haven’t had a music program since the fourth grade?”

How come, indeed! Apparently, the No Child Left Behind policy, with its formal standardized testing and rating of successful and unsuccessful schools has caused there to be increased instructional time in reading, writing, math, and science. What suffered was time devoted to arts, foreign languages, and social studies.

Without science and math, reading and writing, our students cannot be expected to survive in the 21st century world. Aren’t they also at a disadvantage without art, history, music, and social and cultural legacies? The world is facing globalization: shouldn’t we prepare the next generation to adapt with languages, global history, and appreciation for foreign contributions?

Emil de Cou, Associate Conductor for the National Symphony Orchestra, has said, “I have yet to meet a teacher who thinks excluding the arts is a good idea. If you just memorize facts and figures, you’re not contributing to society. You’re a maker of widgets. The arts can be a divine spark that grows.” (Express, 2008).

Biological engineering, as some of us like to think, is a very broad integration of science, engineering, and biology. Not only do we expect biological engineering practitioners to be familiar with principles from fundamental physics, chemistry, engineering sciences, mathematics, and biology, but also much more. Biological engineers who truly represent the entire profession, and not just a small segment of it, should also know about ethics, aesthetics, emotional satisfaction, group dynamics, ecology, history, music, art, economics, and law. In other words, they should have some holistic view of the world; some systems concept of the grand scheme of things and how various parts fit together.

We have had several successful IBE meetings with myriad technical papers that reflect the reductionist segmentation of the field. I have gone to many of these presentations and wonder exactly what the speakers were talking about. I wondered why I was there, when I expected perspective and yet got only detail. Perhaps that is the nature of the game, but it makes me yearn for something more complete.

Perhaps that is what we can expect in the future as more and more of our high school students become more and more proficient in math and science, and less and less in cultural diversity. With art and music squeezed out, what chance do we have to maintain a broad view of biological engineering? How can we expect future biological engineers to be adept enough to anticipate reactive maneuvers and unintended consequences characteristic of living things?

Perhaps art and music do not directly contribute to versatility, but they help people to break the chains of constrictive thinking. The box that biological engineers need to operate in should have walls that are far removed from one another. Outside the box thinking should be the norm rather than the exception. If biological engineers cannot do this, then who can?

My Biology for Engineers course reflects this philosophy. It is not a cellular biology course; it is not an ecology course; it is not biomechanics, electrobiology, genetics, or biophysics. It is all of these and more. The reason for this is that just a little exposure to group ecology, beauty, human factors engineering, language, and others goes a long way toward expanding the box. Understanding of genes as only one possible intergenerational information legacy, and of birth as a resetting of a chaotic system to a common starting point gives new perspective on biological details repeated so many times in other courses that one loses a sense of the wonder about the completeness of the biological world. Looking at biology as a source of solutions to be worked with rather than a source of problems to be conquered offers hope that biological engineers can truly add to universal progress rather than to false starts and technological pitfalls.

We want us to be positive contributors. We want us to be appreciative of all the world around us and what it can offer. We need those who come after us to maintain this legacy of hope, vitality, and expression. We need to impart to them familiarity and appreciation for a broad education. We can do this in the home, in school, and in life, but we cannot condone extremism that excludes cultural appreciation.

Very few of us will win the Nobel Prize. I haven't given up hope yet, but there is nothing that I have done thus far to deserve such an honor. And it's not likely that I will ever achieve anything even close. But, as Arlo Guthrie has said, "everyone's good for something." I think it is more likely that the something that someone is good for depends strongly on the education and experiences they have in their formative years. Perhaps the something that we can be good at is to help the next generation to achieve greatness.

References:

Express, 2008, Pr. George's Kids Take Time for Art, *The Washington Post Express,* p12 (18 April).

Malone, H.J., 2008, Educating the Whole Child: Could Community Schools Hold an Answer? *Phi Kappa Phi Forum,* 88(1):16, 25 (Winter/Spring).