Convergent Evolution

Convergent evolution is the development of similar biological characteristics in two or more separate lineages that do not share a common ancestor. The similar characteristics appear to have evolved independently as a response to similar environmental factors. Examples include the similarities in form and function of the placental flying squirrel and ground hog with the marsupial flying phalanger and wombat, which evolved on separate continents.

Within the past 15 years, geologists, ecologists, and civil engineers, three separate lineages, began to evolve similar curricula, particularly at the graduate level. This, I believe, is in response to environmental pressure to perform interdisciplinary research and to acquire external funding for this type of research. As a result, civil engineering faculty are performing more basic research, which formerly was the domain of earth scientists and ecologists. To do this type of research, civil engineering faculty are offering fewer courses in engineering design and construction of public works structures and are offering more courses that compliment those in similar earth science disciplines in terms of the use and application of concepts and principles that are held in common.

Ancestors and Lineages

Traditionally, geologists at all levels of study were educated as physical scientists to observe, identify, describe, experiment, and analyze the Earth to form and test concepts explaining natural phenomena. The common degree obtained by practicing geologists was the Master of Science. The amount of college course work was minimal and a significant amount of training occurred on the job, especially with large oil companies, the major source of employment. In the past 20 years, this historical relation changed as employment with oil companies declined and employment with geotechnical and geoenvironmental firms grew. At these smaller companies, new hires are expected to immediately contribute to the bottom line and require little additional training.

Ecologists also are trained as scientists. Practicing ecologists generally acquire a Master’s of Science degree usually majoring in biology and taking courses at the graduate level in organismal biology, population sampling, and statistics. Job opportunities for ecologists, like geologists, have increased markedly as a result of federal and state regulations addressing the impact of human activities on the quality of Earth’s environments. Because of these mandates, ecologists are hired by consulting firms to work on multidisciplinary projects with geologists and engineers.

Undergraduate civil engineers receive a traditional engineering education where scientific and mathematical principles are applied to practical problems dealing with the design and construction of public works projects such as sewer line excavation, surface water structures, dam construction, mining, slope stability, etc. In the past 20 years many civil engineering departments have added coursework in environmental engineering to address the need for construction of environmental projects such as wetlands, rivers, and beaches. The highest degree sought by most practicing engineers is the bachelor’s degree, as that degree and on-the-job experience are needed to acquire a Professional Engineering license.

Why Convergent Evolution Now?

For generations, geologists, ecologists, and civil engineers have taken divergent paths. Why are aspects of these formerly separate disciplines coalescing now? Part of the answer is the mandate by academic funding agencies for us to perform more interdisciplinary research. Another part of the answer is supply and demand economics aimed at capturing more student credit hours to prop up waning departmental budgets. This internal “butts-in-chairs” funding competition among departments on the same campus often focuses on the perceived attraction of the “E” word. The word “Environmental” is believed by faculty in many departments to possess phoneme-like properties that will stem the downward spiral of enrollments in science and engineering, whereas it is hoped by willing and anxious students to help provide employment.

Can We All Survive in the Same Niche?

By “All” I mean the faculty, all the departments, and all the students. I doubt all our departments can survive competing for the same students interested in the application of science to human environmental problems. Science is perceived by the vast majority of students to be the path of most resistance. As a result, geology, ecology, and civil engineering departments are largely competing for the same group of predisposed students. Rather than compete with civil engineers, who have a well-established licensing structure, and ecologists, who have well-defined tasks within most regulatory guidelines, all the civil engineering departments need to emphasize the skills that make their students unique.

Contrary to this, in the past decade many geology departments have developed courses that do not develop or reinforce the geologic skills that our students will rely on during their professional careers to make them unique. Students today are savvier than we were several decades ago. Today, students are openly concerned about job prospects and know something about them, or the lack of them. If you were like me, you, too, were blissfully naïve about job opportunities as an undergraduate.

So, while we are trying to help our budgets with larger enrollments, are we penalizing our undergraduate students? I suspect we are. However, my opinion in this matter needs to be discounted because I do not work outside the hallowed halls. To get a reasonable answer to this question, we need to listen to the opinions of our alumni, faculty, and students as a group and not just a few. This gives the public a voice that can inform our undergraduate students what types of jobs are available for them after they invest tens of thousands of dollars in their education and苦读5 years in our department. Other departments do this well and benefit from it. Undergraduate students think about career opportunities. Without oil companies, we seem to be too inexperienced in industrial applications of our unique skills to make the curricular changes to assist our own students.

What Are the Consequences?

The character to the left is a combination of the cartoon characterizations of all three disciplines. Just as a mule is an infertile hybrid between a donkey and a horse, an Ecogeoengineer is an unemployed hybrid because he/she does not possess enough specific skills to compete for a job. To mo, our undergraduate curriculum should strive to keep up with advances in technology, especially computer technology and software development, while emphasizing the skills that make geologists unique and our services needed by society. If we do this, students will come. If we don’t…