Letters

Microbiology Undergraduate Education

As a hospital clinical microbiologist and, essentially, a “consumer” of microbiology undergraduate education in my interactions with physicians, nurses, nurse practitioners, physicians’ assistants, and other graduates of both two- and four-year allied health sciences teaching institutions, I wish to highly commend Amy Cheng Vollmer for her approaches, as detailed in her ASM 2006 convention presentation that was published in the November 2006 issue of Microbe, p. 516. There is no question that students who take her microbiology courses, or courses from instructors who have similar approaches, will be well grounded in the fundamentals of microbiology and will have healthy attitudes.

However, I am concerned over the fact that, while the type of microbiology course she describes is very adequate for students wishing to pursue a career in research or in industry, students planning careers in the health field need additional training, beyond the basics, that connects microbiology to pharmacology and infectious processes, putting things together in such a manner that they are able to use microbiology laboratory reports to design appropriate patient care plans.

In a typical microbiology undergraduate laboratory course, students do Gram stains to observe gram-negative bacilli and gram-positive cocci, which is important. But, they are not taught that penicillin will not cure gram-negative infections. Additionally, for example, in caring for a patient with possible pneumonia, they need to know that a sputum Gram stain showing moderate or more gram-negative bacilli associated with moderate or more neutrophils whose sputum culture grows Pseudomonas highly suggests that the patient has a life-threatening pneumonia and needs aggressive antibiotic therapy. On the other hand, if the Gram stain shows few or no neutrophils with mixed bacterial flora, if the patient is afebrile with no signs and symptoms of pneumonia, and the sputum culture shows heavy growth of Pseudomonas, the Pseudomonas may be colonizing oral flora and, as long as the patient is stable, the patient may not need to have antibiotics.

Students becoming health care professionals need to have extensive knowledge of proper specimen collection for microbiology. They need to know, for example, that biofilms build up on the inside lumens of Foley urine catheters that have been in place for 4 or 5 days or longer, resulting in false-positive urine cultures with bacteria that are more resistant to antibiotics than those causing urinary tract infection, if the patient actually has a urinary tract infection. They need to know that if a patient has a possible streptococcal throat infection and they only swab the roof of the mouth, rather than the pharynx, a false-negative throat culture is likely.

Health care students need to know what kinds of organisms cause intraabdominal infections, skin infections, kidney infections, inner ear and sinus infections, etc. They need to know which bacteria, if they invade the bloodstream, can cause potentially fatal shock and bleeding complications. They need to know that if a patient has multiple positive blood cultures for a skin flora-type bacteria, an elevated white blood cell count, and a fever, but has no visibly apparent focus of infection, that endocarditis should be considered as a possible diagnosis.

I am not saying that we should train all health science students to become infectious disease physicians, but that they need something beyond the basics in what the pathogen do, how they do it, and how one best manages patients with infections. If there were no room in the curriculum for a full-semester clinical infectious disease course, perhaps a shorter course might suffice. To provide such training, although there are other good texts, my recommendation for a suitable textbook would be Cases in Microbiology and Infectious Diseases by Gilligan et al., whose third edition was published by ASM Press in 2003. The Gilligan text does an excellent job presenting case histories, and then leads the student to discover how what he/she learned in the basic course is clinically relevant and will apply to what they will be doing when they begin caring for patients.

I appreciate and highly commend those institutions who are giving their health care science students the additional clinical infectious disease training.

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The Periplasm and Peter Mitchell

The periplasm is much underappreciated region of the gram-negative bacterial cell. One hopes that the recent publication of The Periplasm [M. Ehrmann (ed.), ASM Press, Washington, D.C., 2007] will change this situation, which is exemplified by the editor in his introduction where he points out that the periplasm scarcely receives a mention in most textbooks. Also not appreciated, and not immediately evident in this new book, is that “periplasm” was, to the best of my knowledge, first discovered and named by Peter Mitchell in 1961 [P. Mitchell, Approaches to the analysis of specific membrane transport, p. 581–603. In T. W. Goodwin and O. Lundberg (ed.), Biological structure and function, vol. 2, Academic Press, New York, 1961].

Perhaps this lack of recognition is a consequence of his fame for formulating the chemiosmotic hypothesis and coining such terms as symport and antiport. Perhaps also Mitchell’s discovery of the periplasm is little known because he published what has turned out to be an important discovery only in a conference proceedings (those
were the days!). Whatever the reason, I hope that his contribution to this field will not be forgotten.

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**Gerhard Domagk, The Sulfonamides, and the Nobel Prize**

I very much enjoyed the article on sulfonamides by Bernard Dixon in the November 2006 issue of Microbe ("Sulfa’s True Significance," p. 500), and I do agree with Dr. Dixon that Gerhard Domagk, who discovered the antibacterial effect of sulfonamide, is unjustly forgotten in the history of antibiotics, the greatest triumph of scientific medicine. I take the liberty to add a couple of details regarding the Nobel prize that Domagk was awarded in 1939. At that time the Nobel Prizes were heavily discredited in the eyes of the Nazis, probably because of the choice of Peace prize laureates, and the Nazi government would not see any German as a prize winner. The Nobel committee of that time at the Karolinska Institute with its chairman pathology professor Folke Henschen was subjected to heavy pressure from the Nazi government through its foreign office in Berlin and its embassy in Stockholm not to give the prize to Domagk, but stood up to them, and the prize was announced in October 1939. In his memoirs of 1957 Folke Henschen, who knew Domagk personally, mentions that in the night following the announcement Domagk was arrested by Nazi soldiers in his home in Wuppertal and put in jail. The prison director on his round the next morning got irritated by Domagk’s behavior and on his question Domagk replied “I am professor Domagk of the University of Münster.” “Weshalb sitzen Sie denn hier?” Domagk’s reply: “Ich habe den Nobelpreis bekommen.”

In Scandinavia and many other countries the present distribution of sulfonamides for systemic use is almost nil, mainly because of the scare of blood dyscrasias including aplastic anemia, one of the allergic side effects of sulfonamides, occurring in Sweden at a frequency of 5.3 per million of defined daily doses of sulfonamides, and with a fatality rate of 17% in the affected group. We will probably be forced to come back to sulfonamides, however, as resistance frequencies increase for other antibiotics, and then with knowledge of how to handle side effects.

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**Origin of Emerging and Reemerging Pathogens**

I would like to comment on the excellent article by Mark E. J. Woolhouse entitled “Where Do Emerging Pathogens Come From?—Understanding the Origins of Pathogens will Help us to Combat Emerging Infectious Diseases” (Microbe, November 2006, p. 511–515). The author described that various factors play a role in the emergence and reemergence of pathogens, including the diversity in animal reservoirs, species jumps, factors relating to the host, pathogen, and the wider environment, and last but not least, human activity. This clearly shows that the emergence and reemergence of pathogens is quite a complex process, one we perhaps have only just begun to understand in more detail.

Pathogen emergence and reemergence is a topic of great interest and concern to a variety of parties, including public health professionals, physicians and their patients, biomedical and bioveterinary researchers, governments, and the general public. In the early 1990s, a 19-member committee was formed in the United States to conduct a study on emerging microbial threats to health (J. Lederberg, R. E. Shope, and S. C. Oaks, “Emerging infections: microbial threats to health in the United States,” National Academy Press, 1992). This committee made important recommendations in regard to the recognition (surveillance) and intervention (research and training, vaccine and drug development, vector control, public education, and behavioral changes) of emerging infectious disease threats.

It was noted that infectious agents, like other living organisms, are subject to genetic change and evolution, and that changes in infectious agents and in human populations favor exposure to new pathogens and more efficient transmission. Speciation (i.e., the process of developing a new kind of species) is an event that drives a population or subpopulation out of genetic equilibrium through mutations, genetic drift, natural selection, and gene flow (Starr, Basic Concepts in Biology, 6th ed., Thomson Brooks/Cole, Belmont, Calif., 2006). Individually or collectively, all these factors may contribute to the emergence and reemergence of pathogens. I believe we can only be certain of one thing, which is that new pathogens will emerge, simply because “evolution happens.” The real problem is that we have difficulties in predicting the emergence or reemergence of individual pathogens in time and place, and how it will affect animal and human lives.

I fully agree with Woolhouse that the challenges of emerging and reemerging infectious diseases are significant and require both interdisciplinary and international collaborations in areas such as disease surveillance and intervention, as well as development of diagnostics, treatments, and vaccines. In 2006, I attended a symposium at the 106th General Meeting of the ASM that emphasized the importance for microbiologists and epidemiologists to work more effectively together by sharing information related to infectious disease outbreaks. I also believe that the “one-medicine” philosophy mentioned in Woolhouse’s article is important and should be followed. Finally, there is no doubt that we will need new scientific knowledge, sufficient resources, international surveillance systems, well-developed national and global strategies, and broad political support to combat the challenges that lie ahead of us.

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