

Basic Research and Clinical Application as Ecology Tool

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Ecology has been overlooked for its role in basic and clinical research. This editorial takes a look at how ecology has come to shape the research of a microbiologist and a physiologist. Ecology training is necessary when it comes to having well rounded researchers who can understand the role of ecology in human health and species diversity.

As a classically trained microbiologist who received a Ph.D. and had post-doctoral training at a medical school, it never occurred to me that I would one day need to draw upon my ecology training and knowledge. In my first faculty position at a predominantly undergraduate institution, my task was to establish a research program that could train master thesis students but also offer research opportunities to undergraduate students. As I searched for a project, I realized that my project and soon to be my research passion was right outside my window. On my campus is a wonderful bayou along with several national wildlife refuge areas around the campus. With my "eureka" moment, I began to utilize skills learned while working for the USDA Forestry Service. The skills I learned have carried me as I identify and characterized biofilm forming bacteria in these Northeast Louisiana waterways.

I received my Ph.D. in integrative physiology studying the modulation of vagal control of heart rate via local cardiovascular enkephalins. My post-doctoral training focused on understanding the underlining mechanisms that promote sustained hypertension from renal derived angiotensin II. My graduate and post-doctoral training were both completed at medical schools, thus my research has always focused on biomedical studies. My current research interest combines techniques and attributes of both my graduate and post-doctoral training. Given the fact that pharmacological enkephalins and several antihypertensive agents are derived from natural products; we were logically drawn to explore the antihypertensive potential of extracts from native plant species.

As we look back on our start, we realize how important ecology is not only to researchers but clinicians. Science has published a recent commentary by Beck et al. [1] suggesting that ecology be added to the pre-medical curriculum [1]. Their argument is that between 1980 and 2010 the most prescribed drugs and new small molecule drugs awaiting FDA approval are derived from natural products [2,3]. Even as we think about the pre-medical curriculum, what about ecology for pharmacist? On our campus, we are fortunate to have a School of Pharmacy. We posed the following question: Should a course in ecology be added to the pharmacy curriculum?

The current pharmacy curriculum at the University of Louisiana at Monroe College of Pharmacy has recently undergone a total overhaul. We have adopted an integrative curriculum that includes a systems based approach to teaching the pharmacy curriculum in which the basic sciences are taught with the integration of the clinical sciences. In addition, the pre-pharmacy curriculum has been modified to more closely resemble the number of hours needed at other pharmacy programs and to express subject matter rather than specific courses,

which fosters compliance of students, who are coming from different undergraduate institutions. However, one necessary subject matter that has been overlooked in a large number of pharmacy programs throughout the United States is ecology. Although the current curriculum allows for students to take ecology as an elective, many students complete the program without a single ecology course despite the fact that many drugs and pharmaceutical agents are derived from environmental sources.

Many of the pharmaceutical drugs that our students will dispense over their careers are derived from natural products. There is an emesis interaction between the drugs that are developed and administered and species, such as bacteria and viruses that are commonly found in the environment. It is estimated that more than half of the top 200 prescribed drugs and 75% of the newly developed drugs over the past 30 years are derived from natural sources [4]. Additionally, several of the newly developed and the agents to be developed in the future will be derived from environmental sources. The University of Louisiana at Monroe is home to a great number of quality researchers, who have laboratories that are dedicated to a very diverse quantity of research focus areas. To this end, our basic science faculty are currently undergoing studies that encompass all areas of drug discovery including, pharmacology, drug delivery, drug development, and clinical studies. Currently, a large number of research studies that are focused on drug development use natural products as their primary source of novel agents.

A new area of patient care has developed that includes a team of medical doctors, pharmacist and nurses performing hospital rounds as a collective group. This new medical team approach to patient care aides in the delivery of the most efficient, economical, and comprehensive medical care. Thus, errors in prescriptions, dispensing, and unnecessary cost are minimized by encouraging a direct interaction of the patient's health care providers. Given the fact that clinical pharmacist are being increasingly called upon to support the development of a patient's medical strategy, there is a greater need to have a very well rounded education as it pertains to drugs, infectious agents and disease progression. As previously delineated, the environment plays a pivotal role in drug discovery, disease progression and source of infectious agents. Therefore, one could reasonable conclude that ecology should be added to the current pharmacy curriculum to support a well balanced and rounded pharmacy education.

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In our collaborative effort, we are investigating the role of bacterial biofilms in infections of type II diabetic rats. In an article by Potera, 65% of human infections involve biofilms [5]. Diabetic foot ulcers account for 58% of the infections seen in diabetic-related hospital admissions [6]. In a recent study by James et al 77% of the diabetic foot ulcers analyzed contained a biofilm [7]. Given the importance of biofilms in chronic infections and the fact that biofilms can be 1000-fold more resistant to antibiotics [8], there is a need to look for alternative treatment. We are investigating the role of natural products in controlling hypertension, which can lead to diabetic nephropathy.

Thus, given the interdependence of health outcomes on several environmental factors and the fact that several drug agents are derived from natural products; we propose that ecology be added to the pharmacy curriculum. This will foster in our pharmacy students a more complete understanding of drugs that they are dispensing. In addition they will have a greater understanding of the drug interactions in their patients.

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