Education Mission for Neuroimmune Pharmacology

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It is pleasing to us to offer an article series on education for the field of neuroimmune pharmacology, a field defined as encompassing interdisciplinary studies comprising research into fundamental concepts in pharmacology, immunology, and neuroscience. The field brings together researchers and research activities that target infectious, metabolic, and degenerative nervous system diseases (Ikezu and Gendelman 2008). Such interdisciplinary research serves to dissolve the usual boundaries posed by classic academic departments serving to increase cooperation by bridge building between the disciplines of neurosciences, immunology, and pharmacology. Indeed, members of our own Society on Neuro-Immune Pharmacology (SNIP) hail from a broad range of departments including surgery, internal medicine, pharmacology, pharmaceuticals, neuroscience, cell biology and anatomy, pathology, and microbiology and immunology among others. Collectively, such efforts are intended to improve existing research cultures enabling fresh approaches and team science building to engender novel initiatives for conducting research and educating the next generations of scientists and physicians.

Such an integrative field has emerged as a seminal source of new knowledge that has fostered fresh insights into the neuroimmune axis. In particular, the discipline of neuroimmune pharmacology serves as an incubator for innovative ideas in the roles played by endogenous and exogenous neuroimmunomodulatory agents including abuses of drugs in neuropathologic processes. For the latter, the role of substances of abuse on the immune and nervous systems is a focus for research and educational activities. Prior investigations in the field have led to novel insights into the etiology, prevention, and treatment of infections of the nervous system that include the human immunodeficiency virus (HIV) and a range of neurodegenerative processes such as Alzheimer's disease, Parkinson's disease, and stress-related disorders.

Our SNIP was organized in 1993 to serve as a platform for dissemination and exchange of knowledge in the interdisciplinary neuroimmune pharmacology field. It held its first annual conference as a working group of the College on Problems of Drug Dependence in Toronto, Canada. The Society has since expanded the scope of its conferences to promote engagement of national and international scientists and clinicians. Furthermore, it has been actively engaged in training junior investigators in neuroimmune pharmacology. Its 17th annual conference will be held in April 2011 in Clearwater Beach, Florida focusing on HIV infection of the nervous system and its interplay with substance abuse. In 2006, the Journal of Neuroimmune Pharmacology (JNIP) was established as the official peer-review publication forum of the Society with Dr. Howard Gendelman as Editor-in-Chief. The Editorial Board consists of more than 50 renowned scientists who have joined together to advance research knowledge in cross-disciplinary fields of neuroscience, immunology, and pharmacology. In 2008, a new textbook, *Neuroimmune*

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Pharmacology by T. Ikezu and H. Gendelman (Eds.), was published by Springer Publishers [<http://www.springerlink.com/content/>] and is used in numerous medical institutes around the world.

The relevance of neuroimmune pharmacology as a discipline, and its impact on human health, extends beyond the medical field to include the biological and biomedical sciences and the general public. Thus, it is timely to introduce a special issue of JNIP that focuses on the field from a multidisciplinary educational perspective. Accordingly, this special education issue is divided into two sections. Section 1 covers neuroscience [by Dr. Bryan Yamamoto and colleague (Northrup and Yamamoto 2010)], immunology [by Dr. Thomas J. Rogers (Rogers 2010)], and pharmacology [by Dr. Ing K. Ho and colleagues (Shie et al. 2010)]. These investigators define the basic and fundamental concepts of their respective areas and discuss their integration. It is the aim of the overviews presented in this section to afford the first-time reader a foundational appreciation of the three areas of neuroscience, immunology, and pharmacology as they relate to each other and, in turn, impact the neuropathogenesis for disease. Section 2 presents course syllabi and instructional approaches aimed at different student populations, including pre-medical students, medical students, biological and biomedical graduate students, and continuing medical education professionals. For medical students, Dr. Tsuneya Ikezu and colleague discuss how neuroimmune pharmacology can be taught as a component of a neuroscience course (Freilich and Ikezu 2010). Integrating neuroimmune pharmacology into an immunology course is discussed by Dr. Guy Cabral (Cabral 2010), and inclusion of a neuroimmune aspect into pharmacology is proposed by Dr. Yufen Chen (Chen 2010). Drs. Shilpa Buch and Sulie L. Chang and colleagues propose neuroimmune pharmacology as an elective course for pre-medical students and molecular and cellular bioscience for graduate students, respectively (Buch 2010; Chang and Mao 2010). A proposed course for the CME population is discussed by Dr. Valerie Wojna and colleagues (Brown et al. 2010). In addition, a brief report is presented by Dr. Jason T. Nickla and colleague that addresses “Proper Laboratory Notebook Practices: Protecting Your Intellectual Property” (Nickla and Boehm 2010). This serves to balance the field in perspective with the importance of intellectual property and good note-taking skills. While these courses are taught in a traditional classroom setting, we as scientists recognize that “... students learn from us [scientists] what scholars in our disciplines do. We show the discipline of the mind and evaluate whether our students are catching on... When students feel themselves identifying with us and our disciplines, they come to appreciate the struggle for knowledge; some may even choose to become part of the

intellectual adventure.” [Martin, WA “Being there is what matters” (Martin 1999)]. We also recognize that, in this era of multi-media learning, electronic sources of information play an important role in the learning process. Toward this end, Dr. David McMillan develops a web-based course, which highlights our intention to reach out to an audience beyond classroom boundaries and to take advantage of information technology to globalize the educational perspective in neuroimmune pharmacology.

The diversity of instructional formats in this special issue is presented in recognition that students learn through a variety of processes. Application of an integrative approach that utilizes auditory, visual, and motor skills facilitates assimilation of new knowledge, enhances understanding of the discipline, and reinforces retention of fundamental concepts. Furthermore, it is appreciated that student-learning styles vary according to career stage. Thus, our expert contributors have offered alternative ways of incorporating neuroimmune pharmacology into current didactic disciplines that can be presented to the next generation of scientists. Such an interdisciplinary approach to the field of neuroimmune pharmacology could serve as a catalyst for changing the current template of science and technology curriculum at various levels and could conceivably even affect the daily lives of the general public for future generations.

All together, this special issue of JNIP focused on education has been put together to offer students the opportunity to learn the value of interdisciplinary research, to enable students to understand and possibly implement broad scientific concepts that extend beyond a single discipline, and to allow students to integrate various aspects of neuroscience, immunology, and pharmacology in order to address multifaceted questions in bioscience and biomedical therapies and, as may be appropriate, to challenge existing paradigms.

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