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The Science in Psychiatry: Integrating Neuroscience Into Residency Training

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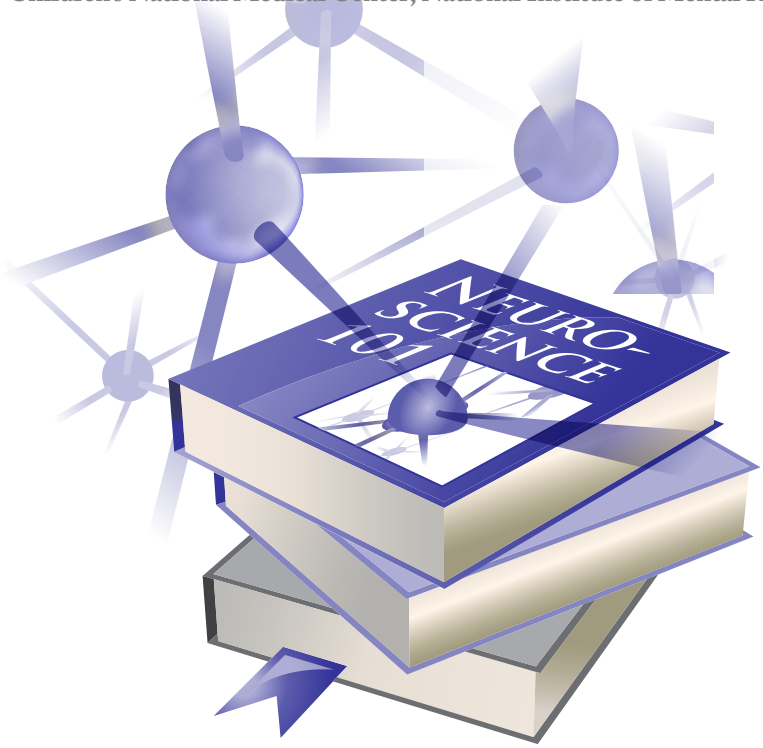

The science of psychiatric practice has received considerable attention recently. As trainees, you may agree that the practice of psychiatry seems a little random at times—too much art and not enough science. In part, this is due to the field being relatively young as well as the significant gaps in the knowledge base. However, there is considerably more science information available than what currently reaches the majority of trainees. In an endeavor to improve access to this information, a neuroscience curriculum is being developed through a collaborative effort among the National Institute of Mental Health, American Psychiatric Association, American Association of Directors of Psychiatric Residency Training, and the Accreditation Council for Graduate Medical Education Review Committee for Psychiatry. The goal of this collaboration is to produce a body of information that translates neuroscience research into clinically relevant information that will guide the way future clinicians think about mental illness. This issue of the Residents' Journal includes interviews with representatives from some of the organizations involved in the collaboration—Alan F. Schatzberg, M.D.; Mayada Akil, M.D.; James J. Hudziak, M.D.; and Victor I. Reus, M.D.—as well as an article on the educational and clinical value of neuroscience in our field.

The Role of the American Psychiatric Association in Integrating Neuroscience Into Psychiatry Training and Practice

The following is an interview with Alan F. Schatzberg, M.D., on the American Psychiatric Association's (APA's) role in the integration of neuroscience into psychiatry training. The interview was conducted by Kayla Pope, M.D., J.D. Dr. Schatzberg is the current President of APA and Chair of the Department of Psychiatry at Stanford University. Dr. Pope is a fifth-year Clinical Research Fellow at Children's National Medical Center, Washington, DC, and at the National Institute of Mental Health (NIMH); she is also the Editor for this issue.

Dr. Pope: As President of APA, what do you see as its role in promoting the integration of neuroscience into psychiatry training?

Dr. Schatzberg: As we enter a new age of psychiatry—one that is sure to be influenced by the rapid developments in the neurosciences—it is perhaps an opportune time to address how APA and the neurosciences interact. As President, I have become impressed by the diversity of activities that APA is engaged in, and so many of these interface with the neurosciences. For one, we—as American Psychiatric Publishing, Inc., and the APA itself—are the largest publisher of psychiatric books in the world. Our textbooks on neuropsychiatry, psychopharmacology, mood disorders, schizophrenia, and other topics all feature chapters written by the top neuroscientists and translational researchers in the world. We publish neuroscience books as well, such as a collection of papers by Solomon Snyder of Johns Hopkins University, and others on genetics, brain imaging, etc. I have been fortunate to co-edit two of the textbooks: *Psychopharmacology* and *Mood Disorders*. In addition, we publish *The American Journal of Psychiatry*, which each month presents cutting-edge research in the neurosciences and translational sciences.

Education and training are important missions for APA. Two of APA's journals, *The American Journal of Psychiatry* and *FOCUS*, provide continuing medical education credit for reading specific articles, many of which are on neuroscience. The annual meeting of the APA is the largest psychiatry meeting in the world and often includes many sessions on the neurosciences, as they pertain to our specialty. This year, we have a number of the top neuroscientists in the world giving special lectures: Deisseroth, Volkow, Holsboer, Johnstone, Gur, Benes, Snyder. They will cover such topics as optigenetics, brain imaging, genetics, neuropathology, molecular biology, and pharmacology Incidentally, all of these speakers are psychiatrists as well as superb neuroscientists. In addition, we will have a series of symposia presented by other neuroscientist-psychiatrists, and these will be really informative for our members. For example, Vikaas Sohol will talk on paralbumin interneurons and their significance in schizophrenia; Kerry Ressler will address the interaction of early abuse and genetic risks for psychopathology; and Amit Etkin will talk on functional imaging of implicit emotion regulation. All three are super M.D./Ph.D. neuroscientists, as are many of the former list of speakers. And there are many other sessions on brain stimulation, genetics of the major disorders, innovative pharmacology, etc. In our planning of the annual meeting, we have emphasized the best material from the neurosciences as it pertains to psychiatry. Last, APA participates in the development of a variety of training modules and is finalizing its support for the dissemination of the NIMH neurosciences curriculum being developed.

Dr. Pope: What are some of the ways that APA is involved in promoting neuroscience in psychiatry training and education?

Dr. Schatzberg: The APA is heavily involved in the training and career development of academic psychiatrists, including basic scientists. We give fellowship awards that foster career development for both basic and clinical researchers in the United States and abroad. Some of these are specifically for M.D./Ph.D. psychiatrists. Each year, APA has a Research Fellowship Day at the annual meeting where top academics from around the country provide seminars and feedback to fellows from around the country on their work and their career plans.

Through its various councils and committees, APA has contact around various issues involving neurosciences. Our Council on Research is chaired by Jeffrey Lieberman from Columbia University, and we have a number of key committees and task forces that are neuroscience oriented.

The Association each year recognizes contributions to various aspects of psychiatry research, including the neurosciences, by awarding a series of awards, which includes the Award for Research. These are generally accompanied by a special lecture at the annual meeting or the Institute on Psychiatric Services.

And finally, APA promulgates the Diagnostic and Statistical Manual of Mental Disorders (DSM), and this tome serves as a cornerstone for diagnosis as well as research. DSM is put together by a group of translational and clinical neuroscientists from around the world. The draft of DSM-5 is currently available online (http://www.dsm5.org/Pages/Default.aspx). This work will be used by investigators in psychiatry and clinical psychology for the next decade.

Teaching Neuroscience to Psychiatry Residents: The National Institute of Mental Health Initiative

The following is an interview with Mayada Akil, M.D., on teaching neuroscience to psychiatry residents. The interview was conducted by Kayla Pope, M.D., J.D. Dr. Akil is Special Advisor to the Director at the National Institute of Mental Health (NIMH) and Professor of Psychiatry at Georgetown University. Dr. Pope is a fifth-year Clinical Research Fellow at Children's National Medical Center, Washington, DC, and at the National Institute of Mental Health; she is also the Editor for this issue.

Dr. Pope: How did you become interested in integrating neuroscience into psychiatry training?

Dr. Akil: To me, an interest in psychiatry suggests a curiosity about the mind and a fascination by its workings in people with or without mental illness. It follows, therefore, that the training of psychiatrists should incorporate some of the knowledge generated by neuroscientists attempting to understand cognition, emotion, behavioral regulation, and social interactions, all critical aspects of people's lives that are dramatically affected in psychiatric disorders. It also follows that such an understanding should involve the exploration of the mind-brain relationship which is in the realm of neuroscience.

Although neuroscience has much to contribute to the practice of clinical psychiatry, it is often not taught to psychiatrists in training in an effective manner. A handful of prestigious programs have been able to develop a well-thought-out neuroscience curriculum. However, the vast majority of programs have a curriculum that remains largely focused on neurotransmitters and their relevance to psychopharmacology and, more recently, on the genetics of susceptibility to psychiatric disorders. While these are topics that psychiatrists should learn about, this molecular/cellular level of study, if not linked, *through the brain*, to cognition, emotion, behavior, and social interactions, only tends to reinforce the notion of the duality of mind and brain. Consequently, the clinical psychiatrist, in the course of treating a real patient, is likely to ignore the distant and seemingly irrelevant tidbits of neuroscience and, understandably, take the attitude of "let me know when they come up with something useful." The current state of affairs requires urgent attention. By not incorporating concepts and knowledge generated by neuroscience in the training of psychiatrists, we are not only depriving them of valuable conceptual tools but also limiting their ability to access and understand neuroscience discoveries of potential benefits to their patients.

Dr. Pope: Can you give me an example?

Dr. Akil: There are many examples of neuroscience that psychiatrists would find fascinating and useful. One of them is the mirror system in the brain, which has been described at both a cellular and a circuit level. It is a system that mediates a person's ability to infer another person's mental state, affect, and communicative intention. Simulation theory proposes that we can understand the mental states of others by activating the same brain areas that evoke a similar emotion in us. This mirroring activity has been shown to provide a neural basis of empathy and has clear implications for interpersonal relationships, interpersonal therapy, and disorders such as autism in which social interactions are severely impaired.

Dr. Pope: What are the barriers to integrating neuroscience into training?

Dr. Akil: It is difficult from a practical perspective to teach neuroscience to psychiatrists, in part because it is such a vast area of inquiry (the last Society for Neuroscience meeting had over 35,000 attendees!) No one academic institution, however prestigious, has experts that can teach all areas of neuroscience of interest. Moreover, determining the content of a neuroscience curriculum is not a trivial task. What findings are relevant to psychiatry? At what level of detail? How do we give enough methodological information to understand the science without losing sight of critical concepts? How do we find the language that crosses the gap between various fields of neuroscience and the clinic? It is not surprising, therefore, that teaching neuroscience to psychiatrists in training has been challenging.

Dr. Pope: What do you see as the role of NIMH in accomplishing this goal?

Dr. Akil: NIMH is uniquely poised to address this problem. It is the primary federal agency funding research on mental disorders in the United States. It has access to world-renowned neuroscientists working in areas of neuroscience that are of conceptual and practical relevance to clinical psychiatry. NIMH is also highly invested in the training of a generation of psychiatrists that can contribute to discoveries in the field and apply scientific findings in everyday practice. Therefore, NIMH has undertaken an effort to put together a neuroscience curriculum for psychiatrists in training. The first step taken in this direction was to put together a small meeting called Brain Camp. The meeting brought together outstanding psychiatry residents, chosen via a competitive process, and NIMH research fellows with some of the most distinguished and thoughtful neuroscientists in the country. The first Brain Camp took place in the spring of 2009, and the second meeting is planned for March 2010. The goal of these meetings is to identify areas of neuroscience that are of interest/relevance to psychiatrists and the best way to communicate them. These meetings are the beginning of a process to create a neuroscience curriculum that can be shared with psychiatry training programs around the country. The hope is that psychiatrists in training will have access to important knowledge and scientific developments in the neurobiology of psychiatric disorders and treatments for these disorders as they embark on their journey of lifelong learning.

Neuroscience in the Psychiatry Curriculum: What, Why, and How Much?

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How much neuroscience education should be part of a psychiatry curriculum? Although a simple question on the surface, the answer reveals our implicit values, assumptions, and ideologies about the practice of psychiatry today. In one survey, residency training directors reported neuroscience education as constituting an average of 12% (SD=8.6) of their program's psychiatric curricula (1). Seventy percent of the program directors surveyed observed an increase in their neuroscience education over the previous 5 years, and 86% anticipated an increase over the next 5 years. Interestingly, most residency training directors predicate the importance of neuroscience education on its relevance to future, but not current, clinical practice. The educational value of neuroscience for the future is believed to exceed its clinical value in the present (2). The perception of a low clinical relevance of neuroscience today is implicitly reinforced by the lack of clear guidelines from the Accreditation Council for Graduate Medical Education and American Board of Psychiatry and Neurology on neuroscience content in psychiatry curricula (3, 4).

This perception is slowly changing, thanks to programs such as the first National Institute of Mental Health (NIMH)-sponsored Brain Camp, held April 29–May 2, 2009, at the Cold Spring Harbor Laboratory (Cold Spring Harbor, New York). This meeting, coordinated by NIMH Director Thomas Insel, M.D., began a multidirectional dialogue between basic neuroscientists, translational researchers, and psychiatry residents to help identify areas of neuroscience that are clinically relevant and easy to incorporate into psychiatry training. Several such areas were identified and included neurogenetics, neuropsychopharmacology, cognitive neuroscience, developmental neuroscience, and the neuroscience of social behavior, to name a few. At this meeting, thought leaders presented neuroscience and translational research with high clinical relevance to the practice of psychiatry. From the neurogenetics perspective, we learned the epigenetic mechanism through which susceptibility to psychiatric illness can increase within a single generation. For instance, traumatic experiences during one's lifetime can cause methylation changes at the genomic level, subsequently silencing certain genes while leading to the overexpression of others (5). These epigenetic changes can be passed down from mother to child and are believed to be the biological mechanism of transgenerational trauma transmission (6). From a neuropsychopharmacology perspective, we learned how D-cycloserine, a *N*-methyl-D-aspartic acid partial agonist involved in learning and long-term potentiation, aids individuals with posttraumatic stress disorder (PTSD) in re-learning adaptive responses to traumatic triggers (7). When confronted with such triggers, PTSD patients with successful treatment no longer 1) produce as much glucocorticoid steroid stress hormones (due to suppression of the formerly overactive hypothalamic-pituitary-adrenal axis), 2) show hyperactivation of the amygdala, and 3) respond with characteristic hyperarousal to these triggers. From the perspective of developmental neurobiology, we learned about neurogenesis in the hippocampus in patients treated with selective serotonin reuptake inhibitors, offering a glimpse at one of the mechanisms by which depression and effective treatment of the disorder can change the brain (8). Dr. Insel gave a lecture on the neuroscience of social behavior, comparing differences between the highly sociable prairie vole and its asocial close cousin, the montane vole. Prairie voles pair bond for life and experience high separation anxiety when away from their partners. Contrarily, montane voles are highly promiscuous and experience little distress on separation from their mates (9). The genetic difference between these two closely related vole species lies at the promotor sequences of the oxytocin and vassopressin receptor genes, leading to the species-specific pattern of receptor expression, a potential neurogenetic and neuromolecular mechanism for the evolution of monogamy.

The neuroscience content of the Brain Camp talks was thought-provoking, cutting-edge, accessible, clinically oriented, and potentially easy to integrate into a psychiatry curriculum. The aforementioned topics represent a few of the many areas in which a sound foundation of neuroscience could enhance our understanding of psychiatry and subsequently improve the clinical care we provide to our patients, today and in the future.

Dr. Yusim is a fourth-year psychiatry resident at New York University School of Medicine and a previous Issue Editor of the Residents' Journal.

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Vermont Center for Children, Youth, and Families Tele-Education Program in Neuroscience and Genomics for Fellows in Child and Adolescent Psychiatry

The following is an interview with James J. Hudziak, M.D., on a tele-education program in neuroscience and genomics designed for fellows in child and adolescent psychiatry. The interview was conducted by Jeremiah Dickerson, M.D. Dr. Hudziak is the Thomas S. Achenbach Chair in Developmental Psychopathology and a Professor of Psychiatry, Medicine, and Pediatrics at the University of Vermont School of Medicine. Dr. Dickerson is a first-year Child and Adolescent Psychiatry Fellow at the University of Vermont School of Medicine.

Dr. Dickerson: Integral to an understanding of childhood psychopathology is an awareness of a child's development across a variety of domains. A psychiatrist's knowledge of developmental neurobiology seems especially important as we, as a field, gain insights surrounding the neurobiological and genetic foundations of mental illness. Training programs differ significantly in their integration of such education into their respective curricula. How has the implementation of your center's tele-education program approached this issue?

Dr. Hudziak: For the past decade, we have been teaching child and adolescent psychiatry fellows at a number of medical schools what we believe are the essential components of developmental neurobiology and genetics. Our pedagogical approach is one that argues the best way to learn neuroscience and genomics is to learn them together. The idea was born when I was serving on an Institute of Medicine committee on the importance of research training during psychiatry residency I. This committee's recommendations, paraphrased, were as follows: "All training programs should offer some minimal training in research literacy and then offer its trainees access to a continuum of research experiences, many of which are not available at the trainees' institution" (1). But it suffices to say that the committee became aware that there were very few programs around the country with access to funded research scientists willing to provide teaching in genomics and neuroscience beyond simple literacy.

Dr. Dickerson: Receiving training under your supervision has allowed me to have access to an exceptional collection of faculty and resources. Can you speak about your center's unique qualities that allow it to address the Institute of Medicine committee's recommendations?

Dr. Hudziak: At the Vermont Center for Children, Youth, and Families (VCCYF), we aimed to try to provide a way for programs to go beyond literacy. Our course was born from the idea that although no single program could provide expert teaching in all areas of psychiatric training, each program may have one or more areas of excellence that it could share with the rest of the educational field. Our proposal was that we could create a virtual research environment that could be delivered live by tele-education, could be downloaded from websites for those groups that could not attend live, and ultimately could be used as a continuing medical education site for those individuals who had gaps in their residency training or had graduated some time ago and wanted to "recharge."

Dr. Dickerson: As the state of the science rapidly advances in terms of psychiatric neuroscience, it can be difficult for trainees to remain abreast of the latest research. How has your group worked to distill a seemingly vast amount of evolving information and provide focused instruction that has clinical utility?

Dr. Hudziak: Members of the VCCYF decided that our strengths best suited us to contribute in two areas: research and teaching in genomics and neuroscience. We constructed and update annually a lecture series aimed at teaching basic principles of developmental neurobiology and genetics. For instance, we have teamed up with our research collaborators and colleagues at McGill's Centre d'Imagerie Cerébralé at the McConnell Brain Imaging Center and present lectures built around the National Institute of Mental Health (NIMH) normative developmental brain research images (2). The work of the collaborative NIMH normal brain development research provides stunning images of both white and gray matter developmental processes from birth to age 18. These lectures, which fall under the heading "The Brain Is Changing, So Is Behavior," allow us a starting point to teach key lessons about the symphony of brain development, the tumultuous period of architectural rearrangement that the human brain undergoes during the ages from birth to 24, and the lessons that the brain does not develop in a vacuum. In other words, genetic factors drive brain development, but environmental factors can put the brain at risk for or protect them from psychopathologic outcomes.

Dr. Dickerson: There seems to be a good deal of new research that supports your last point. How does this new literature help to shape what you teach?

Dr. Hudziak: It is this last point that led to us developing our program as one that combines neurodevelopment and genomics. We feel the best way to understand developmental neurobiology is through a genetic lens. Our work on monozygotic twin pairs discordant for a trait (attention deficit hyperactivity disorder) (3, 4) has provided us with structural and functional evidence of the role that environmental factors play in moderating brain development and behavioral outcome. In the genetics/genomics section of the course, we teach lessons from base pairs to pro-

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teins. We review chromosomal disorders, the processes around copy number variation and their possible role in autism and other developmental disorders, single and oligogenetic candidate genes studies, linkage, whole-genome association studies, and epigenetic studies. We combine these lessons with animal and human research, on both negative outcomes and positive pathways. For instance, we teach from the epigenetic literature the role of methylation of specific genes in outcomes such as suicide (5) and we counter balance those lessons with the role that environmental mediation, such as playing music, plays in brain development (6). We teach each of these lessons through a pedagogy that argues that all behavior and wellness are affected by genetic and environmental influences (and their possible interplay) that have their effects on the brain, which leads directly to changes in proteomic function and ultimately behavior.

Dr. Dickerson: We are certainly learning more about the etiology and development of childhood emotional and behavioral problems. These studies speak to the importance of a child psychiatrist being particularly mindful of risk and protective factors as they relate to both mental *health* and mental *illness*.

Dr. Hudziak: We have built our lecture series on the premise that it is the job of the child and adolescent psychiatrist to not only protect the brain but to play a role in health promotion and illness prevention by identifying neurodevelopmental and genetic environmental risk factors (to be avoided) and environmental protective factors (to be embraced).

Dr. Dickerson: Using technology and interactive audiovisual technology to offer dedicated neuroscience and genomics training seems like an ideal partnership. How successful has the tele-educational program been? What does the future hold for this particular program?

Dr. Hudziak: We initially tested the utility of our teaching program with our sister program at Dartmouth School of Medicine. Over the past decade, it has grown to provide a series of 8-10 tele-educational lectures to fellowships across the country and in Canada. Our long-term goal is to partner with the great centers around the country to create an online tele-educational program for all trainees to assure that every future clinician, and possibly the next wave of research scientists, has equal access to the best teaching available in neuroscience and genomics.

The Vermont Center for Children, Youth, and Families tele-education program was designed and implemented in an effort to provide interactive neuroscience and genomics didactic sessions to child and adolescent psychiatry trainees using state-of-the-art tele-communications technology. Attendee's from throughout the United States participate in the lecture series, which is taught by University of Vermont child and adolescent psychiatrists. The program is a collective teaching effort among several departmental faculty psychiatrists, including James J. Hudziak, M.D., Robert R. Althoff, M.D., Ph.D., Allison Y. Hall, M.D., John G. Koutras, M.D., and David C. Rettew, M.D. Dr. Dickerson will be participating in the educational program as a second-year child and adolescent psychiatry fellow.

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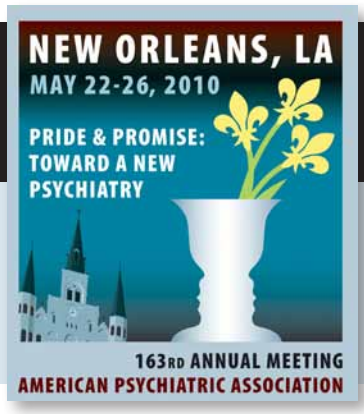

Writing for the "Blue Journal":
The Residents And Fellows Edition of
The American Journal of Psychiatry

Date: **Monday, May 24, 2010**
Time: **9:00 AM to 10:30 AM**
Location: **RM 346/347 in the Morial Convention Center**

Neuroscience and Psychiatry: The ACGME Perspective

The following is an interview with Victor I. Reus, M.D., on neuroscience and psychiatry. The interview was conducted by Carla Marienfeld, M.D. Dr. Reus is Professor of Psychiatry at the University of California, San Francisco, and is the current Chair of the Psychiatry Residency Review Committee for the Accreditation Council for Graduate Medical Education (ACGME). Dr. Marienfeld is a third-year Psychiatry Resident at Yale University School of Medicine. Dr. Marienfeld's longstanding interest in residency education allowed her to develop a curriculum within her program devoted to global mental health and to serve as the American Psychiatric Association nominee to the ACGME Residency Review Committee for Psychiatry.

Dr. Marienfeld: How do we determine what knowledge residents need from psychiatry training?

Dr. Reus: The formulation of program requirements in psychiatry has—like in other medical and surgical specialties—been guided by the movement toward competency-based standards and increasingly away from a fixed specification of the content and duration of the didactic or clinical experience. Expectations regarding the level of knowledge to be acquired in basic and clinical neuroscience are subsumed in the medical knowledge section of the program requirements and, like other content areas, described in a relatively generic fashion, i.e., "residents must demonstrate knowledge of the established and evolving biomedical, clinical, epidemiological, and socio-behavioral sciences, as well as application of this knowledge to patient care," with more specific reference given to the biologic and genetic factors influencing development over the life cycle, the etiologies of major psychiatric disorders, the biologic factors affecting prevention, incidence, prevalence, and the long-term course and treatment of these disorders, and the diagnosis and treatment of neurologic disorders commonly encountered in psychiatric practice.

Dr. Marienfeld: Why should we consider increased neuroscience training in residency education?

Dr. Reus: As is evident, there is no specific delineation yet of what basic understanding of neuroscience is required for a resident to be able to translate such knowledge into clinical utility. The pace of neuroscience research has led many to argue that the clinical and research interests of neurology and psychiatry are increasingly converging and can best be served by an integrated educational experience (1–4). Roffman et al. (5) surveyed psychiatry residency training directors in the United States and Canada and found that the amount of neuroscience in residency curricula had significantly increased from 2001 to 2006 and that further increases in each specific neuroscience content area were expected. More recently, Reynolds et al. (6) argued that the future of psychiatry lies in clinical neuroscience and that advances in the assessment, treatment, and prevention of psychiatric disorders are most likely to arise from studies of etiology and pathophysiology based in clinical and translational neuroscience.

Dr. Marienfeld: While there is increasing neuroscience education, is there still a gap between what residents are taught and what they should know?

Dr. Reus: The level of technologic sophistication and knowledge required to fully analyze and critique neuroscience-based investigations published in the leading psychiatric journals has paralleled the exponential growth in neuroscience knowledge and led to an increasing experiential and intellectual separation between psychiatric researchers and clinicians in their formulations of what the specialty is and what its scope of practice should be. A move to more specifically articulate medical knowledge requirements in neuroscience is probably overdue, given the likely future discoveries of etiologic mechanisms of mental disorders and subsequently altered approaches to their prevention and treatment. However, adaptation to such requirements will be difficult to achieve in many clinically-based or more rural residencies, and resistance is likely to come from those practitioners whose orientation or expertise is given less emphasis in the modified curriculum.

Dr. Marienfeld: How do we provide residents with the right balance of training for the future of psychiatry, which will likely require a neuroscientific knowledge base, while still respecting the demands and interests of current programs?

Dr. Reus: Development of internet-based lectures and reading lists can address some of the issues of faculty resources, but the availability of knowledgeable local faculty who are adept at translational science and can serve as role models is essential. A greater difficulty is the lack of consensus in the field as to what the operational definitions of the core competencies should be. To accommodate a more rigorous grounding in neuroscience as part of its educational mission, psychiatry may have to reconceptualize its view of what level of skill can be attained in various modalities of clinical intervention by completion of the general residency experience. Like internal medicine, psychiatry may need to incorporate postresidency fellowship training as a standard pathway to attaining specific credentialing in such heretofore standard competencies as psychotherapy, social psychiatry, and psychopharmacology as well as in the more traditional subspecialties.

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