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# Transforming Neuroscience Education in Psychiatry

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In considering the articles assembled in this special issue of *Academic Psychiatry* and the motivations for creating it, one must reflect on the current state of the relationship between neuroscience and psychiatry. Psychiatric disorders are inherently brain disorders, and neuroscience is the basic science of psychiatry. Although most psychiatrists entered this profession because of their curiosity about the mind and a fascination with its workings, as well as a desire to alleviate suffering, they did not do so because of an interest in neuroscience per se [1]. Therefore, the interest of psychiatrists in neuroscience is likely to be driven primarily by practical clinical implications.

Neuroscience has seen dramatic advances over the past few decades, some of which are of clear translational relevance. For example, the ability to visualize the healthy and disordered brain in action, to modulate brain systems and behavior, and to model aspects of human diseases in animals hold great promise for understanding and treating psychiatric disorders. Unfortunately, little in current clinical psychiatry reflects insights derived from neuroscience. Our diagnostics and therapeutics have not progressed in substantial ways for the past few decades, nor have morbidity and mortality from mental illness been meaningfully decreased [2]. Any hope of improved understanding of our patients and the development of novel therapeutics is likely to come from basic and translational neuroscience. We argue, therefore, that a coming together of neuroscience and psychiatry is both needed and likely inevitable and that psychiatrists should be trained to become informed consumers of relevant neuroscience literature, because improvements in patients' outcomes will likely stem from advances in neuroscience.

Other commentaries have addressed what form this coming together may take and what may be required to get there [2–8]. By contrast, our focus in this issue of the journal is not to debate whether or when this consilience may happen but, assuming that it must, to compile articles addressing various elements to achieving this integration, including the attitudes of psychiatrists, "model curricula," and the examination of barriers to neuroscience education. In total, this issue should serve as an organizing document that is neither proscriptive nor prescriptive. Rather, we have intended it as the beginning of a national discussion about neuroscience education in psychiatry and as an invitation for experimentation and innovation.

## Integrating Neuroscience into Psychiatry: Are Attitudes a Barrier?

At various points in the recent past, prominent opinion leaders have argued for more integration of neuroscience into the training and practice of clinical psychiatry [2–8]. These arguments have been met by resistance from those who felt that such integration would threaten the humanistic elements psychiatrists deeply value about their profession [9] and that neuroscience has done little to advance clinical care. This integration is further hampered by a lingering dualism dividing mind and brain and by the more practical barriers of how to incorporate a vast body of knowledge, such as neuroscience, into the education of psychiatrists. Hence, one potential barrier for fruitful integration of neuroscience with psychiatry

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may be the attitudes of psychiatrists. Three articles in this edition of the journal directly addressed this potential barrier by surveying trainees [10], chief residents [11], or residency program directors [12] and found that there is actually broad support for neuroscience education and a desire to increase its representation in psychiatric training.

Results from the Stanford Education in Neuroscience Survey of psychiatry residents and fellows suggest an overwhelming agreement that there is a need to bring more neuroscience education to psychiatrists in and out of training [10]. This corresponds with their belief that neuroscience will bring better treatments, help psychiatrists with the psychoeducation of patients and their families, and reduce stigma around mental illness. Indeed, it can be argued that with the proliferation of popular media articles about various aspects of psychiatry and the brain, patients may increasingly come to their psychiatrist asking about their brains. A survey of psychiatry chief residents revealed that most of them (79 %) did not feel that their training program prepared them for translating future neuroscience research findings into clinical practice and that 80 % of them felt the Accreditation Council for Graduate Medical Education (ACGME) should require a specific neuroscience curriculum [11]. Similarly, the American Association of Directors of Psychiatric Residency Training (AADPRT) Task Force on Neuropsychiatry and Neuroscience Education of Psychiatry Residents surveyed psychiatry residency training program directors. The majority of training directors felt that neuropsychiatry and neuroscience were very important to the provision of excellent care, and most were interested in access to portable neuroscience curricula [12]. These results confirm the findings of a previously published survey of residency training directors [13].

Chung and Insel [14] illustrate a number of neuroscience literacy and leadership "stepping stones" currently available to primarily research-oriented psychiatry residents. Although these stepping stones are helpful, Chung and Insel argue that the biggest shift in attitudes and training in psychiatry will occur when the competency requirements themselves change.

## Can Neuroscience-Driven Insights Drive Advances in Clinical Care?

Tremendous, and often surprising, advances have been made in neuroscience which are of direct relevance to psychiatry. For example, in schizophrenia, a large body of work has converged upon an understanding that the disorder is one of perturbed neurodevelopment [15], in which genetic risk factors may overlap highly with some of those for autism [16, 17] and for which a prodromal state can now be defined and investigated [18]. Furthermore, research has demonstrated that schizophrenia is a disorder in which cognitive impairments are substantial, occur early and persist across fluctuations in psychotic symptoms, and best predict long-term outcome [19]. Importantly, deficits in cognition appear to be plastic and may be improvable through novel approaches not related to the dopamine-focused psychopharmacology of the past few decades, which has targeted psychotic, but not cognitive, symptoms [20, 21]. Similarly, a focus on brain circuitry as a basis for understanding psychiatric disorders has led to the rise of more specific circuit-modulating brain stimulation approaches. Transcranial magnetic stimulation to the prefrontal cortex received approval from the Food and Drug Administration in 2008 for treatment-resistant major depression [22], and a variety of deep brain stimulation methods are currently being tried for obsessive-compulsive disorder and treatment-resistant depression [23]. Even the field of psychotherapy, which has developed largely separately from advances in neuroscience, is seeing better outcomes through integration of findings in neurobiology. Eric Kandel argued in a landmark 1979 *New England Journal of Medicine* paper [24] that learning (i.e., experience-dependent plasticity) is central to psychotherapy, and as such, advances in the neurobiology of learning and memory may yield advances in psychotherapy. In a rapidly growing body of work, various investigators have found that administration of D-cycloserine, a partial agonist of the glutamatergic *N*-methyl-D-aspartic acid (NMDA) receptor, improves the effects of exposure therapy [25] by virtue of its enhancement of plasticity and memory formation [26].

With advances in novel clinical interventions derived from neuroscience, such as brain stimulation approaches, Williams et al. [27] examined a developing subspecialty within psychiatry, which they term "interventional psychiatry," by analogy to interventional elements of cardiology, radiology, and neurology. They propose a training model for interventionists that borrows from these other areas of medicine and involves deep learning about neuroimaging approaches for probing dysfunctional neural circuits and both invasive and noninvasive brain stimulation methods. As these methods find increasingly greater success in treating patients with otherwise refractory illnesses, greater impetus may be put toward formal definition and certification of this specialty within psychiatry.

Watson and Michels [28] describe the tension between the notion that neuroscience may be helpful to clinicians in the future and how little it has informed our understanding of psychodynamic psychotherapy so far. They point out that "traditional neuroscience thus far has not so much failed as not even tried." Indeed, as the D-cycloserine work above suggests, the potential is great for fruitful synergy between neuroscience and psychotherapy, thus further emphasizing the importance of neuroscience education even for traditional psychodynamic psychotherapists.

In summary, advances in the neurobiology of mental illnesses and their treatment is already at the point where some novel advances have been made, and many more are poised to unfold in the next decades. With these new diagnostics and

therapeutics will come the challenge of not only proactively incorporating education about them into psychiatric training but even in the consideration of what new subspecialties within psychiatry may look like. Indeed, as Anders and Roberts point out [29], residency programs themselves may need to change entirely in terms of their explicit combination of training across multiple domains not typically part of psychiatric training (e.g., genetics). Inherently, such approaches will further drive the development of neuroscience-related subspecialties within psychiatry, which may then develop their own certification and competency evaluations.

## Persistence of Mind-Brain Dualism: Are There Solutions?

For centuries, Western philosophy has wrestled with the question of the relationship between mind and brain, often explicitly or implicitly holding the view that mind and brain are at some level distinct. This bias pervades both public attitudes about mental illness [30] and those of mental health practitioners themselves [31]. Deeply rooted dualism has pitted a neurobiological approach to the mind and its disorders against a humanistic one [32]. The dichotomy between neurobiology and the humanistic approach, however, is an artificial one, and advances in both psychiatry and neuroscience are hindered by it. The humanistic approach of clinical psychiatrists can be enriched and complemented by the scientific knowledge imparted by areas of neuroscience such as social neuroscience, cognitive neuroscience, and the study of gene-environment interactions. For example, the effects of postnatal experiences on stress response and disease vulnerability and the neurobiology of attachment and pair bonding are some of the areas of neuroscience research that can enrich our understanding of our patients' experiences [33–35].

Griffith [36] describes a curriculum that teaches "normal brain anatomy and the social, cognitive, and existential neuroscience of a normal person at the start, with the neuroscience of psychopathology taught subsequently as a departure from normality." This unique curriculum teaches neuroscience in a humanistic context that adopts both the phenomenological and the empirical and utilizes both in a complementary fashion. Etkin and Cuthbert [37] further illustrate how a reformulation of psychiatry-relevant neuroscience away from categorical diagnoses and toward a dimensional understanding of perturbed brain function in psychopathology may actually increase, rather than decrease, the patient-centered orientation of clinicians.

## What Neuroscience Should Be Taught, and How?

Neuroscience is a vast body of knowledge and the question of what to teach and how to teach it is not a trivial one. Fung et al. [10] found that areas of neuroscience like neuroimaging and neural circuits, genetics and epigenetics, and specific topics like emotional regulation, the neurobiology of attachment, and attention/cognition are of particular interest to psychiatrists. In their editorial, Coverdale et al. [38] conducted a comprehensive search of published papers to identify model curricula for neuroscience education in psychiatry and found very little specific content on which to rely. Indeed, they found only six such examples, of which four were published for the first time in this issue of *Academic Psychiatry.*

One of the most comprehensive of these curricula is the description by Ross and Rohrbaugh [39] of their overhauled residency training program at Yale. They describe their approach as "based on adult learning principles and an integrative, patient-centered approach." They emphasize an integrated education that includes biological, psychological, and social perspectives in the context of clinical cases. Gopalan et al. [40], likewise, describe a "longitudinal interdisciplinary curriculum" that spans 4 years of psychiatry training, focusing in the first 2 years on basic neuroscience such as genetics, neuroanatomy, neuronal structure, and neurotransmission and emphasizing clinical correlates in the last 2 years. Griffith [36], as described above, focused on integration of a neuroscience curriculum within the context humanistic psychiatry.

An additional challenge to the teaching of neuroscience is that our very understanding of the neurobiology of mental illness is undergoing a shift away from the traditional, clinically employed diagnostic categories. Neuroimaging studies have found significant similarities between phenotypically related disorders [41–44], and clinical studies have found higher rates of comorbidity between disorders than expected by chance [45]. Genetic work has identified common risk alleles across disorders that differ widely in terms of their clinical presentation [46]. Basic neuroscience research in humans and animal experiments have delineated a set of neural systems that map directly onto specific behaviors and, when perturbed, are thought to result in particular impairments, such as deficits in attention, perception, or emotional regulation that cross traditional diagnostic boundaries. The National Institute of Mental Health (NIMH), the world's largest funder of research on neuroscience and psychiatry, has proposed a reformulation of mental illness for research purposes in terms of dimensional impairments within these neural systems [47]. Etkin and Cuthbert [37] draw on this reformulation to present a novel approach at teaching transdiagnostic neuroscience to residents. They illustrate how doing so may both better capture the neurobiological nature of these impairments and simultaneously encourage the clinician to be more attuned to the patient's specific complaints and areas of difficulty and, in that way, to listen to the whole person.

## Conclusion

As illustrated in this issue, a number of creative and talented educators in academic psychiatry departments are currently teaching neuroscience and coordinating courses or curricula using a variety of organizing principles and pedagogical approaches. We hope that these represent only the beginning of experimentation and innovation in this domain and that by our assembling these examples in this issue, their efforts can be modeled or disseminated more widely.

What is remarkable about these efforts is that they all acknowledge the strengths of existing elements within clinical psychiatry and aim to be inclusive and not dualistic. They also enjoy a broad base of support both within psychiatry and neuroscience. Expansion and implementation of these new ideas, including at training programs without a strong representation of neuroscience research among their faculty, will require the development of new teaching resources, the engagement of new sources of funding, as well as the involvement of regulatory agencies governing graduate medical education. At present, these advances in neuroscience education are a matter of passion for those involved; we hope that in 5 to 10 years they will become a matter of course.

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