



Transforming Psychiatry from the Classroom to the Clinic: Lessons from the National Neuroscience Curriculum Initiative

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Abstract

Objective Individual residency programs often struggle to keep pace with scientific advances and new training requirements. Integrating a modern neuroscience perspective into the clinical practice of psychiatry is particularly emblematic of these challenges. The National Neuroscience Curriculum Initiative (NNCI) was established in 2013 to develop a comprehensive set of shared, open-access resources for teaching neuroscience in psychiatry.

Methods The NNCI developed a collaborative, team-based approach with a peer-review process for generating and reviewing content. Teaching resources have included interactive sessions for the classroom paired with a comprehensive facilitator's guide. Brief accessible reviews and short videos have been developed for self-study and teaching in clinical settings. Dissemination efforts have included hands-on training for educators through national workshops. All resources are freely available on the NNCI website. Outcome measures have included the number of educational resources developed, feedback from workshop attendees, the number of US psychiatry residency programs who have adopted NNCI resources, as well as analytics from the NNCI website.

Results To date, the NNCI has developed over 150 teaching sessions, reflecting the work of 129 authors from 49 institutions. The NNCI has run over 50 faculty development workshops in collaboration with numerous national and international organizations. Between March 2015 and June 2019, the website (www.NNCIonline.org) has hosted 48,640 unique users from 161 countries with 500,953 page views. More than 200 psychiatry training programs have reported implementing NNCI teaching materials.

Conclusions This multisite collaborative provides a model for integrating cutting-edge science into medical education and the practice of medicine more broadly.

Keywords Neuroscience · Psychiatry · Residency training · Medical education · Curriculum development

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Residency training directors often find themselves in the position of driving change. Training programs must not only stay up-to-date with the latest scientific advances but also meet an endless cycle of new requirements set by national regulatory bodies. Within this evolving landscape, programs must determine what content should be taught, at what depth, and where and when to fit new material into an already full curriculum. More importantly, who will teach it and how will it be integrated into clinical training sites? For the most recent advances, programs may lack the local expertise necessary to develop a comprehensive curriculum.

The task of integrating neuroscience into the clinical practice of psychiatry is particularly emblematic of these challenges. While most disciplines of medicine are rooted in a biological understanding of illness, the field of psychiatry developed prior to advances in modern neuroscience. What has resulted is an enormous practice gap. Although mental illness

is increasingly understood in terms of genetic, developmental, molecular, cellular, and neural circuitry perspectives, the clinical practice of psychiatry has historically underemphasized this essential perspective [1, 2]. In fact, competency in “clinical neuroscience” was not included in the training expectations for psychiatry until July 2015, when The Psychiatry Milestone Project was officially released [3].

In recognition of the growing importance of neuroscience to psychiatry, the American Association of Directors of Psychiatric Residency Training (AADPRT) established a Task Force on Neuropsychiatry and Neuroscience Education of Psychiatry Residents to conduct a needs assessment for teaching neuroscience in psychiatry. Their 2011–2012 survey found that psychiatry program directors largely agreed that it was important to incorporate neuroscience into psychiatry training; however, a lack of faculty resources and portable curricula was a major barrier [4].

In response, the AADPRT conference committee decided that its 2014 pre-meeting would center on the theme “Neuroscience: Why, What, and How to Teach It.” This NIMH-funded conference (5R13 MH74298 Teaching Scholarly Activity in Psychiatric Training) was held the day preceding AADPRT’s annual meeting. The original goal of the conference (then in its ninth year) was to provide training for psychiatry program directors in research literacy and to aid them in transporting that knowledge to their programs [5, 6].

In May 2013, three of the authors (MA, MT, DR) joined together to plan and co-chair the 2014 AADPRT pre-meeting. As our work progressed, we recognized the need for a comprehensive set of shared resources for teaching neuroscience. Extending our mission beyond a 1-day conference, we formed the National Neuroscience Curriculum Initiative (NNCI). In this paper, we describe the key principles and strategies that have informed this work and report on our outcomes to date.

Methods

As a first step, we established a set of learning objectives. While our overarching goal was to help train psychiatrists and other mental health professionals to integrate a modern neuroscience perspective into their clinical work, we recognized the importance of learning objectives at the level of the individual learner focused on knowledge, skills, and attitudes. Our learning objectives included the following: (1) Participants will appreciate the importance of neuroscience to the future of psychiatry and to the way we will approach patient care. (2) Participants will demonstrate an understanding of core concepts in neuroscience, including how complex interactions between environmental stressors and disruptions in neural circuitry may contribute to different psychiatric disorders; and (3) Participants will be able to serve as

ambassadors of neuroscience who can thoughtfully communicate findings from the field to professional and lay audiences.

As we began our initiative, we considered the many barriers that psychiatry programs face in trying to achieve these goals. We considered the challenges of teaching neuroscience effectively, building a comprehensive curriculum, implementing and disseminating resources, and measuring the success of such an undertaking. In response, we developed a set of guiding principles to organize our efforts (see Fig. 1). These included the following: developing an educational framework; building a collaborative, team-based approach; engaging stakeholders and training the trainers; and identifying outcome measures.

Developing an Educational Framework

While our original charge in developing the 2014 AADPRT pre-meeting was to focus on “why, what, and how” to teach neuroscience, we deliberately focused more on *why* and *how*. Drawing from the basic tenets of dissemination research [7], we recognized the need for stakeholder buy-in. To convey the value of incorporating a neuroscience perspective into the practice of psychiatry, we committed to ensuring that all teaching sessions would strive to establish direct clinical relevance. Recognizing the complexity of our field, we also committed to maintaining an integrative approach in which neuroscience was connected to and contextualized within the other rich traditions of our field (including various psychotherapeutic and social psychiatry perspectives). Our hope was to develop teaching resources that would make participants excited about neuroscience and want to learn more.

How we teach is at least as important as the content selected. Literature on how adults learn suggests lectures are relatively ineffective for transmitting knowledge and particularly ineffective at changing skills and behaviors [8, 9]. Therefore, we designed all sessions around active, experiential approaches including paired learning, role play, and construction tasks to aid learning (see Table 1).

Since our central goal was to help improve the teaching of neuroscience across a diverse range of programs, including those with fewer financial resources or local neuroscience experts, we created a comprehensive facilitator’s guide for each classroom session with step-by-step instructions. Additional resources include detailed answer keys for all in-class exercises; additional background readings; and, in many cases, video samples of a skilled instructor delivering that exact session—all freely available on the NNCI website (www.NNCIonline.org). We also hosted a webinar of our Integrated Case Conference series [10].

Over time, we came to appreciate a fundamental limitation to our initial approach. Even with a robust curriculum, classroom teaching is only a small component of training. In

Challenges	Proposed Solution	Details/Process
<ul style="list-style-type: none"> Inherent complexity of the topic, itself Usually taught in a passive, lecture-based format Often presented without direct links to clinical relevance when taught in the classroom Seldom discussed in the context of clinical care 	<p>DEVELOP an educational framework</p>	<ul style="list-style-type: none"> Limit learning objectives to big-picture take home points (and no more than three) Create sessions that are interactive and hands-on with a focus on experiential exercises that are relatively simple and fun Link content to “real-world” clinical scenarios Develop brief resources (videos and articles) that can be implemented in clinical settings without an expert Develop specific rubrics (or frameworks) for teaching that can be replicated to teach a broad range of topics
<ul style="list-style-type: none"> Too much content to cover Rapidly expanding content in the literature Many programs lack content “experts” Programs have limited financial resources and time to develop new curricula 	<p>ESTABLISH a team approach</p>	<ul style="list-style-type: none"> Provide a comprehensive set of free resources (including worksheets, handouts, answer keys, etc.) on an open-access website Solicit submissions from end-users and develop a peer-review process Beta-test resources across diverse settings to ensure exportability Update resources based on end-user feedback Host webinars so programs can take advantage of “experts” at other institutions
<ul style="list-style-type: none"> Limited buy-in given competing training priorities Faculty not familiar with more active teaching approaches Faculty with limited content expertise 	<p>ENGAGE stakeholders & train the trainers</p>	<ul style="list-style-type: none"> Emphasize clinical relevance and importance of training Provide hands on training for medical educators with a particular emphasis on engaging training directors Develop self-study resources that are highly accessible for a clinical audience Provide training for the research community in translating work to a more clinically oriented audience
<ul style="list-style-type: none"> Feedback about educational activities often limited to in-the-moment participant satisfaction Few programs track dissemination efforts Data about the impact on the individual learner often unknown 	<p>MEASURE outcomes</p>	<ul style="list-style-type: none"> Evaluate the quantity and quality of dissemination efforts based upon the number of training workshops provided and participant feedback Evaluate uptake of resources based on web-analytics and self-report from programs Evaluate the impact of published resources based on the Altmetric Attention Score Assess knowledge, skills, and attitudes, as well as application to practice at the level of the individual learner

Fig. 1 Guiding principles of the National Neuroscience Curriculum Initiative (NNCI) developed in response to specific challenges in creating and disseminating resources for teaching neuroscience in psychiatry

addition, residency education is only one aspect of the broader challenge of integrating scientific findings into our field. Clinical teaching faculty and community practitioners may themselves lack mastery of core content—let alone the confidence to teach it. To this end, we designed educational resources for use in clinical settings. Each of our Clinical Neuroscience Conversations sessions begins by asking participants to discuss a case vignette (either from the clinic or via a provided sample). The team then jointly reviews a brief educational resource (a 10-min animated video) focused on a related aspect of neuroscience, and then reflects again on the original case. These self-contained sessions aim to provide short, clinically relevant, and interactive learning experiences without requiring any advance preparation or expertise. These resources are also particularly suitable for self-study.

Building a Collaborative Effort

Faced with limited resources, we realized that it would not be possible for us to develop a comprehensive neuroscience curriculum on our own. Even if we could, how would we keep pace with the rapid advances happening in the field of neuroscience and psychiatry and ensure that the resources we were developing were up to date? For these reasons, we recognized the need for a collaborative model. We envisioned major stakeholders who used our materials (neuroscientists,

psychiatrists, other mental health providers, and trainees) not as passive clients but as investors with the potential to contribute meaningfully to the overall mission.

In lieu of a packaged curriculum, we developed template modules for how to teach neuroscience. Using the teaching approaches described in Table 1, we developed initial, prototype sessions, each centered on a specific pedagogical approach with the idea that these approaches could be a framework for developing additional teaching sessions. For example, the Neuroscience in the Media module provides a specific approach that could be adapted to teach a variety of diagnoses and topics [11].

We encouraged programs to share resources they developed using these models and established a peer-review system for assessing content. Submissions are first evaluated by the co-chairs based on the core tenets of the NNCI mission. For example, original classroom sessions are reviewed based upon their creativity, interactivity, and clinical relevance to psychiatry. Written pieces (scripts for animated videos and clinical commentaries) are reviewed based upon their length (relatively brief), their accessibility (using a narrative style that is engaging and clear), and their focus (aiming for a fairly basic level of complexity with one major teaching point). Each piece is then assigned an editor who works directly with the authors to further refine the resource. Each resource is also sent to a neuroscience expert for a final scientific review.

Table 1 Description of educational resources available through the NNCI

Module name	Description of teaching approach
Neuroscience lab	These classroom sessions are designed around experiential learning exercises (including playdough construction, collage making, drawing exercises, Pictionary, and card games, as well as interactive online programs). Many sessions also recapitulate a core concept in neuroscience (for example, to learn about reward prediction error, students participate in a taste experiment that is designed to generate positive and negative prediction errors).
Neuroscience in the media	These classroom sessions begin by reviewing popular media pieces (print, audio, or video) as a hook to dive deeper into a contemporary neuroscience topic. Participants then review original scientific articles and role-play how they would discuss this topic with a patient, family member, or other lay person.
Progressive case conference	This module is designed to help participants integrate clinical management planning with key scientific concepts through discussion of an evolving patient case. In these sessions, students are sequentially presented with a series of brief vignettes paired with questions. The session alternates between large group discussion and interactive small group exercises.
Integrative case conference	These sessions integrate the clinical neuroscience underlying a clinical presentation with psychological and social perspectives. Sessions begin with a case presentation and an open discussion followed by a panel of discussants including a neuroscientist.
Translational neuroscience	This module is designed to highlight how advances in neuroscience may transform the future practice of psychiatry. In these sessions, participants review a clinical case and discuss the current standard of care. Afterwards, papers establishing new directions for treatment are briefly reviewed in small groups and the key points and future directions shared with the whole group.
Clinical neuroscience conversations	This module is designed to help participants apply a modern neuroscience perspective to case formulation. Participants formulate and discuss a case. They then watch a short, animated video describing a relevant aspect of neuroscience. Participants then discuss the case again, incorporating this new perspective. Using a similar format, a subset of these sessions (referred to as Talking Pathways to Patients) ask participants to role-play how they would explain the neurobiology to the patient presented in the case.
This “stuff” is really cool	These are a series of brief (7–8 min) talks. Each one is designed to take one core neuroscience concept and make it clear, relevant, and accessible to a clinical or lay audience. Each presenter takes part in an Effective Scientific Communication workshop and then receives extensive one-on-one coaching.
Expert videos	In this video series, neuroscience experts discuss their own area of study and their thoughts on the topics and studies likely to be important to psychiatry in the future.
Biological Psychiatry clinical commentaries	These brief articles (< 1500 words) are the result of a collaboration with the journal <i>Biological Psychiatry</i> . Each piece is intended to capture one core concept in translational neuroscience and bring it to life for a broad audience using a narrative and accessible format. While these articles are ideal for self-study, many have been developed into an interactive exercise (referred to as “What to Say When Patients Ask”). In these sessions, participants discuss a hypothetical patient question. Participants then read the article and discuss how the information presented would inform their response to the original question.
Brief, accessible reviews	These articles each take one concept in modern psychiatry that individuals might not be familiar with (e.g., the default mode network) and explain it in a clear and accessible manner.

Unlike traditional journal reviews whereby authors respond to editorial suggestions, the NNCI team is extensively involved in directly editing content in collaboration with the authors.

To guide our efforts, we developed an advisory committee (led by JE) with eight members from a diverse range of departments based on size, location, and setting, including smaller community-based programs without a strong faculty base in clinical neuroscience. We also included those with expertise across the lifespan (from child psychiatry to neurodegenerative disorders). Members of the advisory committee were also selected based on their interest and experience in developing and implementing neuroscience curricula within their own programs.

The primary role of the advisory committee was to assess the needs of potential stakeholders, to review feedback from

participants, and to review NNCI resources. To achieve these goals, the advisory committee: conducted focus group sessions following the AADPRT pre-meetings (which the NNCI has now co-hosted for the past 6 years); surveyed a group of high-end utilizers of the website; and mapped the NNCI resources available to specific content areas, such as DSM diagnoses, clinical phenomenology, and neuroscience topics, in order to help identify gaps in content areas for future directions. Advisory committee members were often early adopters of NNCI content, testing out new sessions in their own training programs, and providing direct feedback.

As our effort has expanded, we have reconceptualized the advisory committee as an executive council, with each member leading a larger committee or task force focused on a specific initiative. For example, the assessment task force is

charged with developing a bank of multiple choice questions to both guide and assess learning among users, while another committee is looking for ways to bring a more robust neuroscience perspective to the psychiatry curricula taught in medical schools.

Engaging Stakeholders and Training the Trainers

In efforts to engage stakeholders, we conducted training programs at the annual meetings of AADPRT, the Academy of Consultation-Liaison Psychiatry (ACLP), the American College of Neuropsychopharmacology (ACNP), the American Psychiatric Association (APA), the Association for Academic Psychiatry (AAP), and the Society of Biological Psychiatry (SOBP). We have also given talks at the annual meetings of the American Academy of Child and Adolescent Psychiatry (AACAP) and the Association of American Medical Colleges (AAMC) and have presented grand rounds at universities across the USA. Our work has also extended internationally with presentations in Canada, Brazil, the UK (in collaboration with the Royal College of Psychiatry), the Netherlands, Mozambique, and South Africa.

Our primary strategy for dissemination has been to engage program directors and other education leaders through faculty development workshops. Workshops are framed as role-play exercises in which participants experience a new way of learning neuroscience as if they were students. They then receive a facilitator's guide with teaching resources and reflect on what it would be like for them, as instructors, to implement the session. Our goal is to give faculty a direct experience of the teaching approach, hopefully enhancing their comfort for implementing the session in their own programs.

For large meetings with over 150 attendees (such as the AADPRT pre-meeting), participants are divided into smaller groups of 20–30 individuals to replicate a more typical classroom experience. Running multiple simultaneous classes has required recruiting a pool of facilitators. In order to underscore (and test) our premise that those without specific expertise in neuroscience can implement NNCI sessions with relatively minimal training, we have asked AADPRT members without a neuroscience background to lead a full day of break-out group sessions after providing them with teaching resources and approximately 2 h of orientation (1 h via video conference and another in person the day before the meeting).

In addition to targeting psychiatric educators with less prior exposure to neuroscience, we were also interested in providing faculty development programs for neuroscientists who may have little training in medical education. Many faculty members are not as familiar with the more active learning techniques employed today. In addition, research-oriented faculty may not know how to best communicate with a clinically oriented audience.

In order to address this issue, we developed a program for teaching effective scientific communication, in the form of brief, engaging talks. In this workshop, participants are taught to focus on one key take-home point and to structure their talk as a narrative story, filled with characters and events (instead of focusing on facts—a more typical approach for a scientific talk). The workshop also highlights approaches for developing effective visual aids and recognizing the performance aspects of giving a presentation. Those interested in honing these skills can apply to receive additional coaching to develop and perform a public talk in this style. Presenters are directed to create materials that are novel and engaging, rather than didactic or comprehensive. We focus on surprise and salience as the key elements of a talk, again drawing on principles of adult learning theory and research on narrative. The resulting product has been a series of 10-min videos we refer to as “This ‘Stuff’ is Really Cool.” Using these same principles, our team has collaborated with *Biological Psychiatry* to develop a series of Clinical Commentaries. These are 1500 word pieces, each focusing on one core concept in psychiatry and neuroscience and presented in a way that is intended to be clear, relevant, and accessible to a clinical audience.

Evaluating Outcomes

Our major outcome measure has focused on dissemination. In order to assess the impact of our efforts, we have tracked the number of training sessions we have hosted. At the end of our workshops, we ask participants to complete a post-survey and comment on what worked well and what could be improved, as well as any other general feedback. Rather than focusing on whether participants “like” a session, our primary measure has been on whether participants are likely to incorporate these teaching approaches into their programs. Using a 5-point Likert scale, participants are asked to rate “how likely” they would be to use the session as part of their curriculum. Immediately after completing the survey, participants are asked to share their thoughts with the group in a 15-min open feedback session.

We then follow-up with participants regarding their implementation efforts. Annual surveys conducted at each subsequent AADPRT pre-meeting have asked participants to note whether they (or someone else from their program) have implemented NNCI teaching resources within their residency training program. We ask participants to voluntarily share with us what program they are from so that we can effectively track dissemination efforts.

Since our goal was to build a library of resources through a collaborative approach, we have also tracked the number of individuals and programs who have contributed to the development of NNCI resources, as well as the total number of educational resources we have developed to date. We have used Google Analytics to assess dissemination efforts of materials

through our online platform. In tracking the broader impact of our work, we have also looked at the Altmetric Attention Score of our publications, which tracks online mentions in social networks, blogs, mainstream news, public policy documents, and Wikipedia, among others (www.altmetric.com).

We are also interested in outcomes at the level of the individual learner. Many of our resources provide inherent opportunities for learner assessment, particularly relevant for the clinical neuroscience milestones in psychiatry [3]. For example, our interactive e-learning programs include built-in assessments related to functional neuroanatomy. Classroom activities (such as case discussions and role-play) can be used to assess learner ability to incorporate neurobiological and genetic information into a comprehensive formulation, as well as the ability to explain this information to patients. As part of our evaluation efforts, we are currently assessing the impact of our resources on gains in knowledge, attitudes, and application to practice among psychiatrists and other mental health providers through a separate NIMH-funded study (R44 MH115546).

Results

Since its inception, the NNCI has compiled over 150 teaching sessions/resources that reflect the work of 129 authors from 49 institutions. While psychiatry residents have been the major target audience for our teaching efforts, they have also been among our greatest contributors. Approximately 64% of our resources have included trainees as authors.

We have also conducted six large-scale, full-day training programs with 160–240 attendees each, for the annual AADPRT pre-meeting. Online feedback was completed by 186 individuals for the 2014 AADPRT pre-meeting and by 157 respondents following the 2015 AADPRT pre-meeting. This feedback was overwhelmingly positive: over 96% of respondents from each year agreed that the educational experience met the stated educational objectives, advanced their knowledge of the subject, and would enhance their ability to train residents. Similar data were not obtained between 2016 and 2019; however, for each of the six conferences, more than 90% of participants indicated that they were likely or very likely to implement at least one of the demonstrated approaches. Over the past 6 years, AADPRT has reported that the pre-meeting workshops have been among the highest rated events of the annual meetings. Written feedback has included numerous comments demonstrating substantial enthusiasm for these efforts.

Since 2014, the NNCI has run over 50 faculty development workshops at the annual meetings of numerous national organizations (including AADPRT) in addition to over 25 grand rounds at various departments in the USA and abroad. More broadly, between March 2015 and June 2019, the website

(www.NNCIonline.org) has hosted 48,640 unique users from 161 countries with 500,953 page views. Most importantly, more than 200 US psychiatry residency and fellowship training programs have reported implementing NNCI teaching materials.

To date, we have published more than 45 Clinical Commentaries in collaboration with *Biological Psychiatry* and, speaking to the demand for such resources, they have been some of the most popular articles on the journal's website (including 3 of the top 30 most downloaded articles for both 2017 and 2018). In addition, the NNCI co-chairs partnered with *JAMA Psychiatry* to create the first ever Educational Review in *JAMA* [12]. This article was published with an accompanying Clinical Challenge directly highlighting the clinical relevance of neuroscience to the practice of psychiatry [13]. The Altmetric Attention Score for this educational review is now over 160, placing it in the top 5% of all research outputs scored by Altmetric.

Discussion

Scientific advances are redefining our understanding of disease and introducing new paradigms of patient care. While medical training programs are expected to play a seminal role in the process of translating the latest research to clinical practice, there are few models available to guide such efforts. Although our focus has been on neuroscience and psychiatry, the process of collaboratively working across institutions is relevant across specialties, as all training programs share the challenge of integrating new advances in science and evidence-based practices into medical education. Teaching modern medicine effectively requires a sense of shared goals and responsibility. We believe that “just as cutting-edge research requires a team-based, collaborative approach, so too does cutting-edge education” [14]. The success of the NNCI underscores: the power of a collaborative, team-based approach to medical education; the value of emphasizing experiential and clinically relevant teaching approaches; and the need to thoughtfully engage with diverse stakeholders as a core component of implementation and dissemination efforts.

As with any effort of this magnitude, there have been challenges. For example, while we anticipated leveraging a collaborative model (similar to an academic journal), we did not anticipate the amount of editing that would be necessary to create the educational resources we envisioned. In retrospect, this is not surprising. Neuroscientists have been trained to write and present their work to a scientific community, in a very different way than we are asking them to do (with a heavy emphasis on storytelling that is not found in traditional scientific journals). Similarly, medical educators often do not have training in adult learning theory and are often more comfortable with formal lectures and PowerPoint presentations. In

addition to providing workshops to help potential contributors develop these skills, each resource has required numerous rounds of peer-review editing before it reaches publication. In many cases, this editing process has been a rate-limiting step in expanding our collection of resources. Despite this limitation, this review process has been critical in ensuring quality control both in terms of developing the type of product we aim to produce and making sure that the science communicated is accurate and clear.

Given the intensive time required to oversee and implement these efforts, funding from the NIMH (R13 MH74298, R25 MH101076-02S1, and R25 MH086466-07S1) has been critical. The NIMH has supported our full-time program/production manager and has provided funding to support 10–20% effort of the co-chairs and head of the advisory committee. Without this support, this effort would not have been possible. Now, with this funding coming to an end, we are exploring the possibility of offsetting some of our production costs by offering continuing medical education (CME) credits for clinicians. We have also received additional small grants from both SOBP and ACNP. In addition, we have been fortunate to work within institutions that value this mission and that have supported our efforts with protected time and salary support. We have not received (nor solicited) any funding from industry.

We would be remiss if we did not acknowledge the important impact of top-down regulations on driving some of the success of this effort. Our first AADPRT pre-meeting coincided with the pending launch of the milestones and the first time that clinical neuroscience was included as a training expectation within psychiatry. Although many programs expressed interest in incorporating more neuroscience into their training programs [4], they may not have been as motivated to implement change without this mandate.

One critique of our work has been our relatively limited focus on exactly “what” programs should be teaching in psychiatry. We have been reluctant to endorse a specific neuroscience curriculum for several reasons. First, we know that given the diversity of our programs, one size will not fit all. In addition, we envision the need for flexibility to adapt as our field evolves. Furthermore, we want participants to approach neuroscience as lifelong learners given the advances that are likely to emerge over the span of their careers.

To aid those programs interested in incorporating NNCI resources into a more comprehensive curriculum, or those who are just beginning to develop a neuroscience curriculum, we have offered individual consultations. Our consultation process walks participants through a SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) and assists programs in setting neuroscience training goals that are customized to their own needs and resources. Through this process,

participants are provided a list of NNCI resources organized by topic, along with examples of how other programs have incorporated NNCI materials into a 4-year neuroscience curriculum for psychiatry residents.

While the response to our work has been overwhelmingly positive, feedback we have received may be somewhat biased by participants with a pre-existing interest in neuroscience education in psychiatry. The large number of attendees who chose to attend our workshops (particularly the AADPRT pre-meeting) suggests that there is indeed a strong interest in this content. However, since one of our major goals is dissemination, capitalizing on early adopters (and those with more interest in the content) is an intentional implementation strategy [6].

At the same time, there have been some concerns that our focus on teaching neuroscience in psychiatry is in some way “reductionistic and simplistic” and emphasizes a neuroscience perspective over psychotherapeutic approaches [15]. These comments make it clear to us that a strong mind-brain dualism still exists within our field. While we support teaching neuroscience, we are in no way implying that this is in lieu of psychotherapeutic or psychosocial approaches. We envision neuroscience as a mechanism for bringing together these various perspectives. For example, psychosocial experiences can directly impact the brain through epigenetic changes [16]. These changes, in turn, can affect how individuals interact with their environment. In addition, we know that when psychotherapy works, it is through its ability to modulate and change brain activity [17]. We maintain that “the diseases that we treat are diseases of the brain” [14, 15].

We also continue to face questions about the added value of a neuroscience perspective to clinical care. While an understanding of neuroscience is not currently necessary to diagnose and treat most patients, we believe that advances in neuroscience are poised to redefine the way we classify psychiatric illnesses [18]. These advances are also likely to propel the field towards new therapeutic approaches. The expansion in research techniques, such as the ability to turn on and off neurocircuits—and associated memories—in live animals through optogenetics, is just one example of the dramatic advances happening in neuroscience that virtually no one would have imagined 30 years ago [19]. As educators, we need to provide trainees with the skills for a career in psychiatry in a world that will be very different from that of today.

At the same time, we believe that neuroscience is also relevant to clinical practice *now* [20]. Providing patients with a better understanding of the underlying pathophysiology of their illnesses, as well as how we can use this information to inform treatment choices, can be a critical part of patient engagement. A neuroscience perspective may also help families and other providers to have more empathy for those patients suffering from chronic-recurrent mental illnesses.

As we continue to develop our collection of educational materials, we have increased our focus on the critical role of assessment: both as a core component of an effective curriculum and as an opportunity to engage with a broader community of practicing psychiatrists via CME experiences. We hope to expand our outreach efforts to include medical students and other mental health providers. Working with patient and family groups, we also hope to assess whether these types of resources may help shift the conversation about mental health away from the stigma that patients often experience and towards a more thoughtful dialogue about the nature of brain diseases.

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