INTEGRATION OF TRAINING AND PRACTICE IN NEUROLOGY AND PSYCHIATRY: OPPORTUNITIES, CHALLENGES, AND KNOWING THE BOUNDARIES

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Introduction

The concept of interdisciplinary interaction in clinical neuroscience has been a central tenet for decades. I believe the reviews and the suggestions for the future will come sooner and more easily in the areas of research and education than they will in clinical practice and even in clinical training. Psychiatry and Neurology have expanded their research and practice, specialized in different directions, and have had their directions molded by both the value of interdisciplinary study and the motivation of money-- for both research and reimbursement for clinical services. Perhaps the most difficult area for collaboration and integration is clinical practice. Neurology and psychiatry have differentiated along lines that have in many ways pushed parts of them further apart than ever--even as we note the many ways that neuroscience research have brought brain and behavior together to a common substrate. From the perspective of psychiatry many have weighed in on this issue (Kandel, 1998, 1999).

A number of issues relating to integration of clinical and basic neurosciences are explored in a Macy Foundation Monograph, The convergence of neuroscience, behavioral science, neurology and psychiatry (Hager, ed., 2005). A number of obstacles prevent closer relationships with psychiatric colleagues. These include guild issues that maintain separation between the two specialties (including reimbursement issues), difficulties in defining relationships of behavioral neurology to psychiatry, and the way we educate and train residents about the other specialty.

Who is responsible for setting the training and certification standards and how do they work? Advances in clinical and basic neuroscience have changed the face of research, practice, and training in the fields of psychiatry and neurology. Board certification in both specialties is under the auspices of a single Board, the American Board of Psychiatry and Neurology (ABPN), which is comprised of eight neurologists and eight psychiatrists. The ABPN is a member of the American Board of Medical Specialties (ABMS), which comprises the 24 medical specialties recognized currently in the United States. The Board works closely with the Accreditation Council for Graduate Medical Education (ACGME), which oversees the nearly 8,000 post-doctoral training programs in the US, by use of their 27 Residency Review Committees (RRCs), which directly visit and review the content and quality of the residency programs in each of the 27 ACGME-accredited specialties. Members of each American Board serve on the RRCs in their specialty, including ABPN members on the Neurology and Psychiatry RRCs.

Although there is close collaboration between the Psychiatry Council (the 8 psychiatrists) and the Neurology Council (the 8 neurologists) on the ABPN, the specifics of the requirements for Board eligibility are left largely to the individual councils. Training in

Neurology did not always require specific rotations in Psychiatry, and vice versa (Price, Adams, & Coyle, 2000), however many programs had local requirements for some exposure. In 2004 the American Academy of Neurology (AAN) strongly recommended that a month of psychiatry be added to the neurology residency experience. That had been requisite in the past, but had been removed from the neurology requirements several decades ago. The AAN recommended it be reinstituted as part of a well rounded neurology residency training program. As training programs recognize that such rotations are beneficial to trainees in both specialties, one objective will be to see that the training exposure is in an appropriate setting, with appropriate kinds of patients and mentoring, rather than dictated by where manpower needs are the greatest in a given department.

The ABPN board certification requires completion of an ACGME-approved neurology residency, and then two examinations. Part I is a written examination for both psychiatrists and neurologists, which include elements of the other specialty in each specialty's written examination. In Neurology this is the "Part B" portion of the written examination, which is made up of the behavioral neurology, neuropsychiatry and psychiatry questions (and whichis written by a "Part B Committee comprised of behavioral neurologists and child and adult psychiatrists). Upon passing Part 1, candidates are eligible to take Part 2, an oral examination. Passing Part 2 completes the certification process. In 1994 the ABPN moved from a lifetime certification to a 10-year certificate, requiring recertification (now termed maintenance of certification) in both neurology and psychiatry every decade.

Beginning with residents who entered their first year of clinical neurology in July 2005, clinical examination and patient interactions will be assessed in 5 clinical encounters during the residency, and the now-computerized examination will include cognitive reasoning (from vignettes) in the computerized exam, the so-called "Part C."
The Part 1 and Part 2 portions of the examination will remain unchanged.
While a number of issues cross the two disciplines, training and practice for the most part remain distinct. Areas in which there has been successful integration of the two specialties have been in the areas of dementia, geriatric neurology and neuropsychiatry, and neuroimaging, genetics, and neuropsychology. Other areas include epilepsy, movement disorders, and sleep disorders although arguably to a lesser extent.
Subspecialty Certification
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ABPN Certificates of Added Qualifications (CAQ) are available in Neurology as well as Psychiatry. However, most of the CAQs in the two specialties do not have "parallels" in the other specialty. An exception to this is one area of specific relevance to both specialties-- geriatrics.
Within the AAN, the increasing development of neurological subspecialties and interest groups led to the formation of "Sections" within the academy. Sections are groups within the AAN for members who have similar subspecialty (or other special interests), who wish to promote their subspecialty field or interest. There are now 28 Sections in the AAN, ranging from the History of Neurology Section to Women in Neurology. Clinical

areas include pain, geriatric neurology, behavioral neurology, neuromuscular disease, movement disorders, vascular neurology, and many others.

In the AAN the major groups involved in behavioral neurology and biological bases of aging and dementia—the areas most related to psychiatry-- are the Section on Geriatrics and the Section on Behavioral Neurology. For ten years efforts were made to have these two groups unite to propose a curriculum and other needed documents for ABPN subspecialty certification (CAQ) in behavioral or geriatric neurology, which would parallel the currently approved subspecialty geriatric psychiatry. Over this period of time agreement could never be reached by the two

Sections, despite significant overlap in membership, because some members of both groups perceived that their particular area of the subspecialty would be marginalized or neglected in such a merger. This included, for example, behavioral neurology in children or in development, classical aphasiology, traditional brain-behavior correlation behavioral neurologists, or geriatric neurologists who felt aging was not solely about dementia and cognitive change. The primary concern was that any group whose interests were not included in the subspecialty proposal would be left with a smaller body of knowledge or committed members, whose range of interest was too small to ever be considered for separate certification, leaving it without critical mass to grow and thrive. Two other factors weighed against development of an ABPN CAQ. First, in the 1990s ABPN views and responses to inquiries about further neurological subspecialization were discouraging. The pendulum had swung away from further subspecialty creation. Second, one of the requirements for ABMS subspecialty certification required 25 fellowship programs, and the programs in dementia, geriatric neurology and dementia were diverse and self-supporting. It would have taken a good deal of collaboration and probably adaptation of some common curricula (in which some programs had little or no interest). In the early years of the 21st century the AAN organized the Unified Council on Neurological Subspecialties (UCNS), as a way of establishing a recognized subspecialty presence, albeit from a professional organization and not an ABMS-approved program. Training curricula and rules for fellowship training, including relevant interdisciplinary activities are being brought forward from various subspecialty groups (for the most part, from the various Sections of the AAN along with their professional subspecialty organizations). In mid 2004 behavioral neurology was the first subspecialty established and recognized by the UCNS. The proposal for Behavioral Neurology was brought by the Society for Cognitive and Behavioral Neurology (SCBN: formerly the Behavioral Neurology Society) and the American Neuropsychiatric Association (ANPA). Although not the same as a CAQ from the ABPN, the members regarded this as a significant advance in integration of psychiatry and neurology especially since it involved cooperation and collaboration of the behavioral neurology and neuropsychiatry professional organizations, and a fellowship outline was developed and approved.

What's in a name? The problem with Neuropsychiatry.
In discussions among members of the Sections on Geriatric Neurology and Behavioral Neurology of the AAN regarding an application for ABPN subspecialty certification, a conundrum emerged: what to call the primary area of proposed specialization? Geriatric

Neurology was too narrow for the behavioral neurologists, although it would have been a good parallel to the already established ABPN subspecialty of Geriatric Psychiatry. If psychiatry already had a geriatric subspecialty, why not neurology? Behavioral Neurology was not acceptable as much of the initiative came from those with an aging and dementia agenda, while the child and midlife behavioral neurologists did not wish to have the title refer mainly to another (geriatric) group. The name Geriatric neuropsychiatry/behavioral neurology (or geriatric behavioral neurology/neuropsychiatry) was also discussed.

The adjective geriatric was understandably problematic for the developmental and child neurologists. Use of the term neuropsychiatry also was problematic. Neuropsychiatry was/is an accurate description of the integration of (behavioral) neurology and biological psychiatry, and is utilized by some psychiatrists. It is less well accepted by neurologists, both because it includes the word psychiatry and because historically it has been associated with clinicians who did both psychiatry and neurology in decades past but were not perceived as well trained. Advances in biological bases of psychiatry led to a resurgence in neuropsychiatry within psychiatry, and the term is predominantly used by psychiatrists (especially geriatric psychiatrists and those who worked with post-stroke and post-head trauma patients). Few neurologists use this term. ANPA was established in 1988 to promote practice and training in neuropsychiatry, and has been a significant partner in the interdisciplinary training and practice of neuropsychiatry and behavioral neurology. Membership in a 1992 survey of the organization revealed 40 percent of the membership to be psychiatrists; only 17% were neurologists; and 15% cited both specialties. [E. Coffey, personal communication] With its own voluntary certification program organized by the ANPA Education Committee, ANPA was positioned well to work with the SCBN to propose a subspecialty to the UCNS to significantly integrate behavioral neurology and biological psychiatry. The journals in the field reflect this 'digestive difficulty': trying to absorb several interdisciplinary fields into a cogent one to present to the world (or to professional standard-setting organizations). Their difficulty reflects to some extent the fear of loss of identity while holding out the promise of greater advances through collaborations. Thus, journals in the field include Journal of Neuropsychiatry, Neuropsychiatry and Behavioral Neurology (the journal of the SCBN); The Journal of Neuropsychiatry and Clinical Neurosciences (ANPA's journal); and Dementia and Geriatric Cognitive Disorders--ungainly, but trying to be inclusive.

The ability of the two AAN Sections to develop application for APBN subspecialty certification has deprived the field of an opportunity to develop a certificate of added qualifications (CAQ) in the subspecialty. Such CAQ recognition as an ABPN subspecialty renders a fellowship eligible for Medicare Part A funds that would partially aid support for postdoctoral fellowships, and would boost the field in several ways. It would enable programs with the expertise, critical mass, and appropriate patient populations and research to fund clinical training for fellows in the areas of geriatric neuropsychiatry and behavioral neurology. Growth of fellowship training in these areas has traditionally been stimulated by the availability of funds to train fellows. The severe shortage of geriatric neuropsychiatrists (from neurology) and dementia experts could be expanded—at a time when the need for such skilled physicians is rapidly increasing.

Subspecialties that do not have CAQs via the ABPN (and therefore limited funds for fellowships) result in shortages of needed specialists. This is evident in other areas beside dementia, such as multiple sclerosis, headache, and others. It is the void with respect to recognition of subspecialty training that the UCNS is trying to address, although they will have to do it without the promise of federal funding for the fellowships.

The development of integrated curricula for behavioral neurology via UCNS and evolution of close relationships between ANPA and SCBN will have a positive effect on development of integrated neuropsychiatric programs. It has been a stated goal of leaders in the field to potentially pursue subspecialty status with the ABPN following establishment of UCNS certification. The slow progress is a product of both changing views of integration of two fields of daunting and evolving complexity, and the uncertainty of a specialty with limited ability to generate revenue even as it sits in the borderland between the two guilds. Indeed, the resources to run behavioral neurology clinics are limited, as are those of neuropsychiatry, the overhead for which is high because of the interdisciplinary team needed for proper care of complex cases.
The pervasive effects of Guilds and reinforcement of separation by ICD Codes: training our physicians to be separate.

Nine institutions in the US currently have combined residencies in neurology and psychiatry, approved by the ACGME and leading to neurology and psychiatry board eligibility. Other institutions can propose a combined training program for their residents if they wish. A formal combined training program decreases the total of time spent in training by a year (to 5 years after internship, doing both residencies back-to-back would require 6 years).

In 2004, 22 residents were in combined-program training in these 9 programs (Benjamin, 2004). However, both in residency and in practice, the separation of the specialties is manifested in both direct and subtle ways.
Residents in neurology and psychiatry, and fellows in geriatric psychiatry and behavioral neurology have many areas of study in common. The richness of experience gained by working in interdisciplinary clinics and observing the examination, formulation, and treatment plans for dementia patients or other geriatric neuropsychiatry patients is valuable to trainees and represents a major way to show them the evolving integration of the two specialties, especially in the cognitive, neuropsychiatric, and neuroimaging domains. Residents and fellows learn, however, that diagnostic codes reinforce the ‘differences’ between the two specialties, and teaches them that even if they do not see it, there must be some fundamental difference between the fields, or in what they do as psychiatrists or neurologists, or how they treat patients with the same diseases. The ICD codes are different for many of the disorders they see—and the reimbursements are different as well. For example, in psychiatric coding, Alzheimer’s disease is coded as 290.1. In neurological coding, it is 331.0. Use of a psychiatric code by a neurologist has been associated with a lower Medicare reimbursement. Thus residents and fellows in neurology are taught to not use the psychiatric codes even as they learn the DSM-IIIR on

which the codes are based. Mild cognitive impairment, or MCI, is increasingly recognized as an amnestic state which places the patient at increased risk of developing Alzheimer's disease (Petersen et al., 2001). In the psychiatric coding it is termed memory disorder not otherwise specified (NOS), 294.8. In the medical/neurological codes, it is coded as Memory Loss or Lapse, 780.93. Thus we unintentionally reinforce in our trainees the idea that no matter what we teach in our integrated multidisciplinary clinics and conferences, that there is something fundamentally different about neurology and psychiatry—even in assessment of disorders that we teach them are shared by our disciplines. In the 'real world,' where payments for services define boundaries, that is a major barrier to integration, that belies our efforts to promote true interdisciplinary care of patients with such disorders. Alzheimer's Disease Research Centers: Convergent Evolution.

One of the great success stories in understanding the longitudinal changes in a chronic and progressive neurodegenerative disorder, and dissecting the pathobiological cascades which lead to the cognitive changes, has been Alzheimer's disease. With recognition of the aging demographics and the increasing incidence and prevalence of Alzheimer's disease (Katzman, 1976), the National Institute of Aging (NIA) initiated a program in the early 1980s to develop Alzheimer's Disease Research Centers. These centers, to be placed in academic health centers, required an administrative component to oversee the operations and facilitate clinical and basic research in dementia; a clinical arm for diagnosis and follow-up; a neuropathological component to confirm diagnoses in cases which came to autopsy and provide brain tissue for research; and a training and information core to educate trainees and clinicians about dementia. In the ADRCs there was significant overlap between the worlds of psychiatry and neurology in many centers (now totaling 29). Although evaluations for dementia are done by generalists, family practitioners and psychiatrists, more difficult or specialized dementia evaluation and diagnosis has been left to the neurologist; follow-up and subsequent treatment of neuropsychiatric symptoms was the domain of the psychiatrist, especially geriatric psychiatry.

ADRCs developed under the direction of either psychiatrists or neurologists. While leadership of the ADRC may have been by either a psychiatrist or neurologist, and sometimes a neuropathologist or basic neuroscientist (and more recently nurse researchers or neuropsychologists) almost all the centers evolved to utilize both neurologists and psychiatrists in what is a quintessential neuropsychiatric disorder. Multidisciplinary evaluation teams are a standard way to follow patients in psychiatric clinics; until relatively recently these were not common in neurology clinics, even behavioral neurology clinics, where the traditional methodology was a careful one-on-one cognitive evaluation. In what might be considered convergent evolution, virtually all of the ADRC clinical programs developed multidisciplinary methods for their memory disorders clinics-especially in neurology clinics where this model had not been widely used. The wisdom of efficient but detailed and standardized cognitive assessment by a neuropsychologist, evaluation of fiscal, safety, vocational, and other concerns of the patient by a social worker; and careful probing for evidence of emerging delusions

hallucinations or other neuropsychiatric phenomena by a psychiatrist became apparent to all research clinicians in establishment of longitudinal follow-up of their subjects. Alzheimer's disease (and subsequently the other dementias seen in the ADRC clinics) became a common meeting ground for understanding the close relationship of neurology and psychiatry. A new generation of academic dementia researchers has been trained in clinics with both neurologists and psychiatrists, as well as
neuropsychologists, social workers, and geriatric nurses, and for them this is a world understood and appreciated,
rather than a strange experience. In most neurology and psychiatry training programs, rotations in memory disorders clinics are excellent places for neurology and psychiatry trainees and fellows to work closely with members of the other specialty. A good exposure for neurologists is a rotation in geriatric psychiatry (assuming there are geriatric psychiatrists available, since they are in critically short supply), where the neuropsychiatric (behavioral) symptoms of Alzheimer's, frontotemporal dementia, depression, progressive supranuclear palsy and others are seen. In routine rotations for neurologists in psychiatry, usually set in the emergency rooms or consultation services, the opportunities to see the similarities between the specialties are less frequent, and the principles less well taught.

Neuropsychology as a common meeting ground

Successful collaborations between geriatric psychiatry and neurology have been facilitated by evolution of neuropsychological testing as a research and clinical tool. Both more sophisticated neuropsychological testing instruments and development of more simple cognitive screening tools, as well as understanding and use of these common tools, have fostered a common language and recognition of the substantial overlap of the work of both disciplines.

For training and experience of neurology and psychiatry residents and fellows, neuropsychology represents a common meeting ground (as do aging, neuroimaging and research in genetics). While residents in neurology utilize the mini mental state examination (Folstein, Folstein, & McHugh, 1975), they may learn little else about ways to assess function of different cognitive domains (especially quantitatively). Many believe that because it is a common tool it is the complete screening tool—when in fact it does not even contain measures of executive (frontal) function and is probably not linear in its measurement of cognitive change over time in a number of progressive cognitive disorders. The option is open to expand both our trainees' knowledge of cognitive and behavioral disorders and work closely with their colleagues in the other specialty if we focus more attention on cognitive neuropsychology. The growth of Alzheimer's Disease Research Centers (NIA) and Centers for Late Life
Mental Disorders (NIMH) have been instrumental in aiding the support and development of neuropsychologists adept at using both sophisticated and screening instruments, while working closely with both psychiatrists and neurologists. This interdisciplinary activity is a strong impetus to spread of collegial working relationships, since most of the centers with critical mass of academic neurologists, psychiatrists and neuropsychologists are also major training centers for young academic leaders who will seed other institutions and programs and hopefully make such interdisciplinary activities a standard.

Neuropsychiatry of Parkinson's disease and Lewy Body Dementias: the next opportunity for neurology-psychiatry interactions?

Parkinson's disease and Alzheimer's disease are the quintessential neurodegenerative disorders. The models for studying them have been different over the past decades. When research in Alzheimer's disease began to accelerate in the 1980's, there was no treatment (other than antipsychotic or antidepressant medications), little knowledge about variability of presentation of symptoms or rates of decline over time, no reliable data on accuracy of diagnosis, and few known-to-be-reliable cognitive assessment tools (most of those available did not have norms in the normal aged population). There was a dearth of knowledge about clinical-pathological correlations, e.g., what the pathological and neurochemical changes were at any particular point in clinical severity of the disease. Research in Parkinson's disease, however, had accelerated in the modern era after the introduction of levodopa, then levodopa-carbidopa combinations, and the early dopamine agonists. There was less reason to pursue fundamental longitudinal studies of natural history, utilizing clinical-pathological techniques, and the focus was finding the next great drug.

In ADRCs the subjects were followed to death and autopsy, if they consented. Most Parkinson's' disease research clinics did not use such a model. Movement disorders research clinics have most commonly enrolled Parkinson's disease patients in experimental clinical trials for a defined period of time. When patients who were eligible for such studies progressed to levels of severity which were too severe for research trials, or when their studies ended, most were returned to the care of their local physicians.

Improved care and understanding of the disorder and the new medications for the movement disorder aspects of Parkinson's disease were responsible in significant part for the increased duration of survival of people with Parkinson's. With increased longevity, and exposure to medications, however, came new symptoms.

Neuropsychiatric manifestations, both spontaneous and in response to medications, appeared frequently. After duration of disease of 5 to 8 years, significant numbers of Parkinson's subjects became demented, with a classical 'subcortical' pattern accompanied by frontal symptoms (Mayeux et al., 1990). While Parkinson's disease, especially with complications or complex medication dosing strategies, has been the province of movement disorders specialists from neurology, the neuropsychiatric symptoms led to increasing involvement of geriatric psychiatrists and neuropsychiatrists. Introduction of the 'atypical antipsychotic medications," such as clozapine, risperidol and olanzepine, with their lower levels of parkinsonian side effects, were used to treat the hallucinations and delusions of such patients, with increased success (Friedman & Fernandez, 2002).

The other long term development that emerged with the extended life expectancy in Parkinson's disease was dementia, termed the dementia of Parkinson's disease (PDD). Just as the extension in life expectancy in Down's Syndrome led to the discovery that most if not all subjects with Down's develop Alzheimer's disease after age 40 (Isacson, Seo, Lin, Albeck, & Granholm, 2002), the longer lives of Parkinson's patients let the natural history of the dementing illness emerge (Mayeux et al., 1990). Parkinson

himself noted that mental function was not affected in what came to be called Parkinson's disease; in the absence of life-extending treatments few subjects likely lived long enough to manifest the cognitive decline. In addition to the dopaminergic and other monoaminergic neurotransmitter deficits found in Parkinson's disease, cholinergic deficits were identified in postmortem studies (Perry, McKeith, & Perry, 1996), and have been confirmed in living patients with PDD using positron emission tomography (PET) methods and cholinergic ligands (Bohnen et al., 2003). The cholinergic decline is even more marked in PDD than in Alzheimer's disease, for a given level of disease severity (Bohnen et al., 2003). In addition to interventions aimed at the motor dysfunction in Parkinson's, disease, use of the cholinesterase inhibitors to treat the dementia have been successful in alleviating symptoms (Emre et al., 2004).

These studies have united neurologists who work in Parkinson's disease, Alzheimer's disease and dementia, with geriatric psychiatrists whose domain was the psychoses and depression common in Parkinson's disease.

Dementia with Lewy Bodies (DLB).

In the past decade, geriatric psychiatrists and behavioral neurologists working in memory disorders clinics began seeing patients in whom both cognitive impairment and other characteristic symptoms had begun within a year of each other. The symptoms were extrapyramidal (parkinsonian) symptoms, complex visual hallucinations, or waxing/waning levels of consciousness. Parkinsonian symptoms develop frequently in later stages of Alzheimer's disease, but the early occurrence of such symptoms led investigators to define a new entity, Dementia with Lewy Bodies (McKeith et al., 2004). In DLB the Lewy Bodies characteristic of Parkinson's disease (which were usually confined to the substantia nigra, in the source neurons of dopaminergic supply to the forebrain) spread to the diencephalon and cortex. The pathology of DLB appears identical to that of DPD, with Lewy Bodies and alpha asynuclein deposits in the cortex as well as diencephalon and brainstem. While the pathology at autopsy is seemingly identical, the differences in the clinical presentations of these two dementias are striking. In PDD motor symptoms can cognitive decline by 5 or more years, while in DLB there is contemporaneous onset of motor or cognitive symptoms. The complex clinical symptoms include parkinsonism, cognitive decline and dementia, and psychiatric symptoms (hallucinations, delusions, agitation, depression, anxiety). Use of some antipsychotic medications my induce worsened morbidity or more rapid decline (McKeith et al., 2004). Because there is a loss of cholinergic innervation, DIB responds to cholinesterase inhibitors (McKeith et al., 2000), like PDD (Emre et al., 2004). DLB and PDD are common and likely to increase with the aging of the baby boomer population. Thus both neurologists and psychiatrists will need to study this area. It is clear that both neurologists and psychiatrists need to have training and understanding of fundamentals of the other specialty if they are to advance research or provide accurate diagnoses and therapies to such patients. Our ability to do this in the current environment is a challenge. While it is much easier to have our trainees meet in the neutral (and guild-free) world of research, the clinical practice domains are more difficult to breach. We must find ways to address this shortcoming in our current interdisciplinary clinical training.

The Role of Neuroimaging in Fostering Collaborations Between Psychiatrists and Neurologists

Neuroimaging is the province of both neurology and biological psychiatry, and is now the fundamental modality for clinical pathological correlation in living subjects. As autopsies in academic medical centers have declined over the past two decades, neuroimaging has become even more valuable in providing insights into disease pathology.

Large scale brain banks are now being extended from Alzheimer's disease and other neurodegenerative dementias to late life depression, schizophrenia, and other primarily psychiatric disorders (Sweet et al, 2005).

This development increases even further the need for psychiatric trainees and fellows to learn and understandgross and microscopic neural connectivity and cellular neuroscience, less traditionally learned by psychiatrists. This emerging need parallels that of neurologists needing to know much more about psychopharmacology and cognitive side effects of medications (especially medications for cognitive and psychiatric disorders).

Neuroimaging is an acceptable biological meeting place for bringing psychiatrists and neurologists together to study clinical neuroscience-- and venture into each other's domains. It has the advantage of involving researchers from areas of neurology that do not usually get involved in neuropsychiatric research, such as demyelinating diseases or cerebrovascular disease. Involvement of colleagues who study different aspects of neurological or psychiatric disease in the same cases with neuroimaging represents an excellent opportunity to foster cross-training and integrated research and education.

Advances in neuroimaging since the 1970s, in CT imaging, MRI imaging and spectroscopy, SPECT and PET scanning, coupled with advances in computing technology, have enabled significant insights into the pathobiology of neurological diseases. They have also made diagnosis and follow-up of neurological and psychiatric disorders easier, and allowed longitudinal assessment of brain structure and function and correlation with clinical status. The structural, neurochemical and metabolic studies have now been supplemented with imaging studies that identify and quantify the abnormal proteins in specific diseases such as Alzheimer's (Klunk et al., 2004; Shoghi- Jadid et al., 2002). (Ironically, leaders of both of those research teams were geriatric psychiatrists).

The ability to add biological markers to the clinical and longitudinal characterization of geriatric neurodegenerative disorders has added additional opportunities for psychiatrists, neuropsychologists and neurologists to work together. These advances also add 'basic science' components to the legitimate targets for psychiatric researchers to address, further blurring the distinctions between biological psychiatry and neurology. When trainees and researchers focus on brain-behavior relationships, there is no distinction between neurologists and psychiatrists. This arena is clearly an area of neurobiological insights and discoveries which is complemented by the collaborations of the disciplines.

Future possibilities for psychiatry-neurology interactions

Psychopharmacology. Neurologists' and psychiatrists' areas of clinical expertise are a function of their focused training. Neurologists have particular strengths in neuroanatomical structure and neural connectivity, and particularly in the neuropharmacology of epilepsy and movement disorders. Psychiatrists have special strengths in behavioral observation and psychopharmacology, especially in pharmacological side effects of medications.

Cognitive side effects have particular importance in geriatric medicine, and are both a cause and a complication of treatment of geriatric neurological and psychiatric disorders. Thus advances in psychopharmacology, especially training the neurologist in what the psychiatrist knows, are a fertile area for neuropsychiatric collaboration.
Genetics. Genetics research has opened immense opportunities for collaborations between neurology and psychiatry. Definition of neuropsychiatric disorders associated with mutations, determination of risk alleles, and assessment of differential expression of proteins involved in the pathobiological cascades as a function of allelic variants are all targets for such interactions in late life neurodegenerative diseases. Increasingly, genetic studies are performed looking at allelic variants in complex behavioral traits (Sweet, 2002; Bacanu, 2005). These studies generally require large populations of followed prospectively subjects, with serial neurological and psychiatric evaluations. As with Alzheimer's disease, these symptoms cannot be studied usefully in isolation, so interdisciplinary studies are the most appropriate.

Departments of Psychiatry and Neurology in Academic Medical Centers.
Can neurology and psychiatry departments integrate more? Would this only occur naturally as the fields merge, or as a shotgun marriage due to fiscal problems in one or both departments? Only if the dean is holding the shotgun. Departments in the red want white knights with income streams, not noble but ne'er do well departments with their own fiscal struggles. For departments of neurology, moving toward income stability involves areas that for the most part are unrelated to neuropsychiatric services. Departments have embraced vascular neurology (with invasive studies and stent placement), infusion of IgG and newer antibodies for multiple sclerosis treatment, and more EMGs and nerve conduction studies, because of the attendant revenue streams. Epilepsy monitoring units are a staple. And few departments want to merge and lose hard-gained autonomy. Departments of psychiatry in the US began leaving their psychoanalytic roots and embraced biological psychiatry 50 years ago. Although some departments of neurology were evolved in and then split from departments of psychiatry (Price et al., 2000), many departments of neurology separated from departments of internal medicine, where they had been divisions/subspecialties, in the last 1960s and 1970s. If neurology was to merge with another department it would most likely be internal medicine or neurosurgery at most institutions, and not psychiatry—unless it was a subgroup of the behavioral neurologists.Several years ago Randy Schiffer, who is boarded in both neurology and psychiatry, detailed the merger (it appears to have been more of a shotgun marriage) of psychiatry and neurology at the Texas Tech School of Medicine (Schiffer et al., 2004). He reported difficulties and successes, and some significant cost savings by decreasing overhead—largely by eliminating administrative duplication. However, this would not be unique to psychiatry and neurology; the same could probably be achieved by any such department merger, e.g., neurology and neurosurgery, or neurology and internal medicine. Schiffer's clear-eyed commentary also indicated that after the merger, with a few exceptions, the two disciplines largely engaged in parallel play, with little true integration. We can learn from such experiments what truly integrates our specialties, and what has grown too far apart and specialized. Neurology's relationship to psychiatry is probably best viewed as a Venn diagram, with overlap that is strongest in neuropsychiatry, neurodegenerative disease such as

Alzheimer's and Parkinson's disease, and in some aspects of stroke, epilepsy and multiple sclerosis—where there is psychiatric comorbidity (Martin, 2002). In such areas there is great need and opportunity, but little interest by the neurological subspecialists. In many areas of neurology, the overlap/relationship is much stronger with internal medicine—regarding vascular disease, multiple sclerosis and neuroimmune diseases, or neuromuscular diseases. Respecting our differences, however, should only make us focus our efforts to integrate clinical training in areas that are low-hanging fruit--where the synergies and benefits of cross-training are manifest: neuropsychiatry and neurodegeneration.

Focusing on these areas as requisite training areas for both specialties would advance research, increase understanding of our specialties. It would generalize neurology residents' skills to recognize comorbid psychiatric disease in neurological diseases and introduce psychiatry residents to more of the neurological underpinnings of psychiatric disorders.

We have not integrated the training of our psychiatry and neurology residents as well as we can, or as well as we should in order to have them provide optimal care to our patients or advance research. We do have the means to do so, and this monograph has tried to point out some of the successes as well as some of the promise that such integration could achieve. We are at a time when few program directors want to give up resident time in their own specialty training to allow training in the sister specialty. To assure that such training is effective for education, and can subsequently effect change in clinical practice, is a significant task. The potential benefits and rewards are great, as the results in interdisciplinary neuroscience education and research have already demonstrated. Anyone who has dealt with psychiatric co-morbidities of neurological diseases, the complexities of the neurological and psychiatric symptoms of neurodegenerative diseases, or has sought the best way to explain such diseases and their consequences to patients and families understands it well. The challenges remain, in integration of clinical training, assuring relevant materials and clinical experiences in residency for both disciplines, and maintaining such integration in practice, where practice and referral patterns tend to segregate patients to one specialty or the other.

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