The Integration of Neurology, Psychiatry, and Neuroscience in the 21st Century – part 2

The training programs of students in the two fields were initially separated by an artificial division between disorders that were considered either organic or functional. Those with identifiable brain lesions were readily identified as having neurologic disorders. But it has become vividly clear that the major diseases treated by psychiatry, such as bipolar affective disorder and schizophrenia—for which the organic basis was more elusive—are also brain diseases, with accompanying changes in brain structure and function. Since the 1960s the evolution in the understanding of neuropharmacology and the identification of neurotransmitters have led to the emergence of biological psychiatry. At first psychiatric research focused on measuring neurotransmitter levels in the brain, spinal fluid or urine and identifying receptor modifications associated with disease. Now, as we emerge from the “Decade of the Brain,” neurologic and psychiatric research are moving closer together in the tools they use, the questions they ask and the theoretical frameworks they employ. The development of functional imaging techniques, including magnetic resonance imaging, positron emission tomography and computerized tomography with rapid infusion, are now used not only by neurologists and psychiatrists but also by psychologists and cognitive neuroscientists. Recent developments using transcranial magnetic stimulation have provided impressive methods to temporarily interrupt cognitive functions, such as attention, as well as providing promising new approaches besides ECT for the treatment of depression.

As the Society of Neuroscience has grown from a few hundred scientists in 1970 to nearly 30,000, it has become difficult to distinguish the research reported by neurologists and psychiatrists at the society’s annual meeting. This meeting has become the principal forum in which the two disciplines meet and discuss their mutual interests in diseases such as Parkinson’s (with its tendency for depression and dementia), Alzheimer’s disease (with its disorders of mood as well as cognitive function), and other disorders now recognized as either genetic (for example, Tourette’s syndrome) or as having a strong neurochemical basis. A principal lesson to be learned from surveying neuroscience, neurology and psychiatry in the past century has been how often predictions have proven wrong. Meanwhile, issues of turf persist. One might liken neurology and psychiatry to Winston Churchill’s characterization of the United States and Great Britain—two countries separated by a common language. For us, that common language is neuroscience.

Eric Kandel (Nobel 2000) wrote perceptively of psychiatry and neuroscience:

The details of the relationship between the brain and mental processes—precisely how the brain gives rise to various mental processes—is understood poorly, and only in outline. The great challenge for biology and psychiatry at this point is to delineate that relationship in terms that are satisfying to both the biologist of the brain and the psychiatrist of the mind.... As a result of advances in neural science...both psychiatry and neural science are in a new and better position for a rapprochement...that would allow the insights of the psychoanalytic perspective to inform the search for a deeper understanding of the biological basis of behaviour.

With the advent of psychopharmacology, psychiatry was changed, and that change brought it back into the mainstream of academic medicine....When it comes to studying mental function, biologists are badly in need of guidance. It is here that psychiatry, and cognitive psychology, as guide and tutor, can make a particularly valuable contribution to brain science....[They] can define for biology
the mental functions that need to be studied for a meaningful and sophisticated understanding of the human mind.

James Jackson Putnam (one of the seven founders of the American Neurology Association and its president in 1888) told the members of the Massachusetts Medical Society in 1899 to “Remember, when you go to see your patients, that it is after all the man, not the disease, that you are called upon to treat”. Physicians and scientists now accept that brain chemistry plays a role in mental illness, since medications for it are effective. But we also recognize that the best therapeutic responses seem to come from combining treatment modalities—both administering medication and talking to the patient.

**Toward a 21st-Century Revolution**

What are we to do? In a recent article Bruce Price (Associate Professor of Neurology, Harvard Medical School) analyzed the persistent rift between neurology and psychiatry and came up with a series of recommendations. The most important, perhaps, is that “The education of future psychiatrists and neurologists should be redesigned....Both disciplines should emphasize basic neuroscience, genetics, neuroanatomy, neuropathology, neuroimaging, neuropsychology, cognitive neuroscience, behavioural phenomenology, neuropsychopharmacology, and psychological interventions. Neurologists in training should be given a rich clinical exposure to patients suffering from major mental and neuropsychiatric diseases. Psychiatrists in training should be given more exposure to patients with neurologic syndromes, particularly those that are likely to be accompanied by psychiatric symptoms. Introducing the rapidly accumulating neuroscientific knowledge along with other programmatic changes in neurology and psychiatry training programs will be a challenge....Ultimately, given the delicate balance and growing disparities between our rapidly accumulating scientific knowledge and social policies, we need to include perspectives from social scientists, ethicists, philosophers, religious representatives, patient advisory groups, and the legal community.”

It seems appropriate to consider whether radical changes should be taken to place neurology and psychiatry in direct juxtaposition. One major concern for academic leaders in neurology and psychiatry is the paucity of interest among medical students and residents in pursuing careers in the clinical neurosciences. Less than half of all U.S. neurology and psychiatry residency positions nationwide are filled by U.S. medical school graduates. The acceptance rate for U.S. graduates who apply to residency programs in neurology or psychiatry is close to 97%, with a 70% acceptance rate for foreign medical school graduates. At a time when neuroscience research promises so much to our understanding of the brain in its normal and abnormal conditions, it comes as a shock that we have failed to instil more excitement in our students. Statistics from 2000 show that 46% of neurology residency slots were filled by foreign medical graduates; in the case of psychiatry, the number was 41%.

A more specific set of recommendations might be based on the scientific and clinical interfaces among neurology, psychiatry and neuroscience. The model I propose places mind and brain at the centre of a circle, surrounded by three zones of convergence, represented, respectively, by the broader disciplinary motifs of psychiatry, neurology, and neuroscience.

In psychiatry, lying beyond the centre of convergence are the fields of psychoanalytic theory, psychosocial disorders and many somatoform, mood, and anxiety disorders.

Training in psychiatry must include the theoretical constructs, diagnostic terminology, and treatment approaches for these conditions. In neurology, diseases of the spinal cord, peripheral nerves and the neuromuscular junction and muscle are outside the bounds of neuropsychiatry. Specific areas
aligned to varying degrees with neuroscience are cognitive neuroscience and the allied fields of computer science, artificial intelligence and integrative neural network theory. To prepare students for a career informed by the convergence of these disciplines, universities should introduce the common core concepts of neuroscience in the undergraduate curriculum. It is amazing how many students in our best colleges and universities adopt an interest in brain science. We need to strengthen their experience through a conjoined approach to neuropsychiatry in the early years of medical school and provide an integrated clinical experience in the overlapping areas in the last two years of medical school. At Harvard Medical School, an integrated preclerkship curriculum in neuroscience, psychiatry and neurology has been implemented in the form of a course on the human nervous system and behaviour for second-year students; there is coordination of course content with other relevant learning experiences, such as neurological and mental status examinations and psychiatric interviewing. Students have overwhelmingly endorsed this curriculum, consistently ranking the course as one of their best and stating that it has greatly increased their interest in the subject matter. In the postdoctoral years, residents who have selected brain disease as a focus should be given continuing opportunities to take part in experimental approaches to understanding mind, brain, and behaviour.

To implement these goals, the postgraduate experience might be reconfigured into 2 or 3 years of basic and clinical education on the brain in health and disease—the core area in which the disciplines converge—followed by subspecialty training that extends beyond the core.

To take full advantage of the enormous opportunities for elucidating the causes of neuropsychiatric disorders and seeking effective treatments for them, bold, revolutionary planning and experimentation will be required. Progress will also depend on overcoming social and psychological obstacles, including ingrained, dualistic concepts of brain and mind, rigid educational traditions and protective instincts with regard to professional turf. I do not share the perspective of those who set out to protect psychiatry from the inroads of neurology. They argued defensively, and not persuasively, that psychiatry needs to strengthen its base and protect itself from a takeover by neurology, which, they noted, nearly occurred in the latter part of the 19th century. I argue instead that we need to join forces and create a seamless interconnection in training and in clinical practice.

In a recent article on prospects for neurology and psychiatry, Eric Kandel expressed optimism that the decades ahead will “be remembered as the time when, at long last, neurology and psychiatry came into their own, as among the major beneficiaries of the revolution in biological science that began in the early 1950s.” he and colleagues predict that “We will see a new degree of cooperation between neurology and psychiatry. This cooperation is likely to have its greatest impact on patients for whom the two approaches, neurological and psychiatric, overlap, such as in the treatment of autism, mental retardation and the cognitive disorders associated with Alzheimer and Parkinson diseases. We therefore believe that with further growth, neuroscience will most likely serve to bring neurology and psychiatry even closer together.”

In conclusion, two points need to be made. First, I want to urge some humility as we begin the 21st century. Although we must acknowledge the power and seduction of science, we need at the same time to be aware that much of what we do today will in 10 to 20 years seem foolish—naïve, oversimplified and self-promoting. The “brain problem” is arguably the most difficult we will ever encounter. It is a challenge that will excite and test the limits of our creativity and imagination. We need all the help we can marshal, which leads to the second point. The success of our endeavours will increasingly depend, as I have already implied, on interdisciplinary, interdepartmental research: chemists, physicists, engineers and computer scientists working in close collaboration with neuroscientists, physicians and psychologists. The reductionist approach to biomedical research has been a powerful and enormously fruitful one. But in the 21st century, we must focus on putting
Humpty Dumpty back together again, which will require the collaboration of scientists from diverse disciplines. Koch (Christof Koch, Lois and Victor Troendle Professor of Cognitive and Behavioral Biology, at the California Institute of Technology) and Laurent (Gilles Laurent, Hanson Professor of Biology and Computation and Neural Systems at Caltech) argued that further progress in neuroscience will depend on the integration of a number of distinct and complementary approaches to studying brain and behaviour. “Advances in the neurosciences have revealed the staggering complexity of even ‘simple’ nervous systems,” they wrote. “This is reflected in their function, their evolutionary history, their structure, and the coding schemes they use to represent information. These four viewpoints need all play a role in any future science of ‘brain complexity.’” They concluded that “Perhaps the most obvious thing to say about brain function from a ‘complex systems’ perspective is that continued reductionism and atomization will probably not, on its own, lead to fundamental understanding.”

Each brain is a tremendously heterogeneous patchwork. Understanding the function of any of its parts requires a precise knowledge of its constituents but also of the context in which this part operates. Leaders in academic medicine and the sciences at each of our institutions and at a national and international level must work to break down the barriers between disciplines to remove the obstacles to fuller collaboration and integration. We must move beyond the turf battles of the past to a recognition that the ground we are now breaking in the science of brain and mind is common ground.

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Alzheimer’s disease prevention: a reality check

The NIH-sponsored document presents the conclusions of an independent panel of health professionals and public representatives, who were not experts on Alzheimer’s disease (AD). Their unbiased judgments were based on presentations by and discussions with AD experts and on the findings from an exhaustive evidence report, commissioned by the Agency for Healthcare Research and Quality (AHRQ). The panel concluded that recommendations cannot be made for disease prevention because the available evidence is not robust enough for safe advice to be given. Before any interventions are implemented, the underlying risk factors should be characterized; however, according to the rigorous systematic review produced for the panel by the AHRQ, no definitive evidence exists on the association of modifiable risk factors with either cognitive decline or AD. Only for genetic factors, particularly the APOE ε4 allele, is there strong evidence of an association with increased risk of late-onset AD. There is moderate evidence for an association of risk of AD with some non-steroidal anti-inflammatory drugs and, in women, with conjugated equine oestrogen with methylprogesterone treatment. The evidence is weaker still when addressing relations between factors thought to be associated with increased risk of both cognitive decline and AD. These factors include diabetes mellitus, current smoking and depression, but the level of evidence seems moderate at best. Findings are not conclusive on the association of cognitive engagement and physical activity with decreasing risk of cognitive decline and AD, and data are also limited on the protective effects of a Mediterranean diet.

If decades of research can support only scant conclusions, how could the necessary evidence be obtained in the future? The panel proposes a set of challenging but fairly uncontroversial priorities, and the good news is that some clinical researchers are already working on these areas. The panel recommends the development of consensus-based diagnostic criteria. For a disease with a long asymptomatic prodromal phase, moving from syndromic to pathophysiological definitions is crucial, and several efforts are ongoing in this respect, such as those by the Dominantly Inherited Alzheimer Network to track the prodromal phase and by an NIH Task force to update diagnostic criteria. But diagnostic criteria rely on understanding the natural history of the disease. To accomplish this better understanding, the panel recommends the standardization of outcomes and measures of exposure to potential risks; only reliable and validated measures can provide the evidence required to track the progression of cognitive decline and AD in large long-term population-based studies.

These recommendations can be put into context by the AA report, which explores the consequences of a hypothetical advance that could lead to a preventive intervention. It is estimated that 13.5 million US citizens aged 65 and older will have AD in 2050. (About 4% of the total population, equivalent to 180,000 New Zealanders and that’s just Alzheimer’s, it does not include all the other dementias). Moreover, the annual costs for their care will increase from US$172 billion in 2010 to $1.08 trillion in 2050. A hypothetical breakthrough intervention that could become available in 2015 and would delay onset by 5 years could reduce the number of patients in 2050 by over 40%, to less than 8 million. The cost of their care would then be reduced to $631 billion. The AA report remarks that this hypothetical scenario is based on assumptions that have been translated into real achievements for other chronic disorders, such as heart disease and HIV/AIDS; hence, it provides an optimistic counterpoint to the down-to-earth conclusions of the NIH Conference Statement.

In crisis, Friedman thought, the actions taken depend on the ideas that are prevalent at the time. Both reports, released in the space of just a few weeks, have unambiguously exposed the crisis in AD prevention and laid down a useful set of ideas; now action must be taken.