Neurology and two cultures, co
As a jobbing neuroscientist with day-to-day responsibilities for teaching and research, I am about as far away from 'practical neurology' as any writer of an editorial in this journal is ever likely to be. I don't see patients, I do not have to think about diagnosis, to treat, nor to pass on bad news. My subjects live in the animal rooms of the laboratory, turn up for their appointments on time, and have invasive licensed procedures in which the experimental conditions are precisely matched except for the one variable in which I am interested. It would seem that clinical neurology and neuroscience are two quite different cultures. However, we are not like the two cultures of Arts and Science that F.R. Levis and C.P. Snow argued about two generations ago (Snow 1993; see also: http://www.datasync.com/~pwilz/snow1.htm). We have in common a shared interest in the organ of the human body from which ‘arise our pleasures, joys, laughter and jests, as well as our sorrows, pains, griefs and tears’ (Hippocrates, 5thC bc).

But even if we are two cultures, we should nonetheless have a common destiny and might better reach it as fellow travellers. Specifically, we should grasp the opportunities to create ‘Institutes of Neuroscience’ comprising both basic and clinical neuroscientists, together with representatives of relevant supporting disciplines. The primary argument for creating, within universities, administrative frameworks that

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Practical Neurology, 2002, 2, 312–317

neuroscience: common destiny?
bring basic and clinical neuroscience closer together, has to be centred around ‘effectiveness’, where this concept is considered in terms of day-to-day practice, the conduct of research, and the quality of teaching. Some aspects of effectiveness may seem nebulous, such as what value to put on realizing a common understanding of the different approaches we take to our work. However, building this understanding is preferable to the present situation of near ignorance of each other’s work.

THE RESEARCH ARGUMENT

One reason for creating Institutes of Neuroscience has to do with the maturity of the science that we have in common. Advances in our understanding of neuroscience and related disciplines, along with the rising popularity of the subject over the past 10–20 years, has brought with it vigorous national neuroscience societies and neurological associations, and many international meetings at which ‘basic’ and ‘clinical’ strands of a topic are discussed together. The Society for Neuroscience in the USA now has over 25,000 delegates regularly attending its annual meeting, and the Federation of European Neuroscience Societies attracted 6000 to its forum in Paris last summer. There are a lot of us about, yet many of us remain locked in old administrative frameworks.

In classical areas of our common subject, such as sensory and motor systems, we now have a reasonably mature understanding of such topics as the parcellation of the visual system into distinct areas, and the separation of the motor system into diverse brain regions broadly concerned with the planning, execution and timing of skilled movements. This sits side-by-side with the very practical concerns that a neurologist may face in talking to patients with distinctive patterns of sensory loss, Parkinson’s Disease, or cortical damage affecting sensorimotor function. Similarly, we now have a much deeper understanding of higher functions, including memory, so the long-taught distinction between short- and long-term memory needs to be supplemented by an appreciation of the more comprehensive taxonomy of multiple types of memory and memory disturbance that a generation of work in cognitive neuropsychology and behavioural neurology has revealed (Hodges 1994).

The interdisciplinarity of our field is well illustrated by the programmes of the well-attended international meetings. Symposia on dementia, for example, can range from papers about the skills that carers need, through to the pattern of cognitive deficits seen in Alzheimer’s disease. At the cellular and molecular level, there are sessions on the complexities of abnormal protein folding and the latest news about the enzymes that cleave amyloid precursor protein. In the domain of stroke, cross-talk between researchers whose day-to-day work is radically different can be enormously beneficial. A series of debates in Edinburgh has constructively brought out into the open the suspicions that neurological epidemiologists and basic neuroscientists can have of each other’s work. My clinical colleagues, including the Editor of this journal, reminded us that few, if any, of the research compounds identified as targets for ischaemic protection in animals have yet made it to the clinic. This curious situation has prevailed, in part, because of the artificiality of the tightly-controlled conditions in which so many of the animal studies have been carried out (e.g. the use of young healthy rodents – hardly a good model for the typical stroke patient!). The small number of subjects so often used in experimental studies also render the statistical analysis deeply suspect to those of an epidemiological frame of mind. The basic scientists, for their part, were successfully able to make the case that these potentially-exciting new compounds are only effective if given within hours of the induced ischaemia in animals, while none (or few) of the clinical trials have yet met this absolutely essential condition. In this and other ways, the good-natured banter of the adversaries engendered mutual understanding and so
laid the foundation for better studies on both sides in future.

Few would doubt that better communication between basic and clinical neuroscientists is desirable, yet a sceptic might still wonder if our day-to-day functions are too diverse to warrant getting together. Clinical medicine and science are rarely common bedfellows. True, but the problem is that this communication does not happen, or is certainly much harder, unless one puts in place the where-with-all to make communication easier. Academies and scientific associations can play a part, such as the excellent recent meeting of the Academy of Medical Science on Neurological Rehabilitation, which aired the ideas to have emerged from contemporary neuroscience research on adult cortical plasticity (Buonomano & Merzenich 1998). However, we need to be closer together on a day-to-day basis as well.

A good example is in Queen Square in London. Dotted around this famous square, Institutes of Cognitive Neuroscience, Functional Imaging and Neurophysiology are but a stone’s throw from the National Hospital for Neurology and Neurosurgery. This can only be for the good of all concerned. In Edinburgh, as in so many universities across the UK, these different groups are miles apart. Geography cannot guarantee consolidation, but it certainly helps.

THE TEACHING ARGUMENT

The revolution in the way doctors are taught today in the UK, following the General Medical Council’s ‘Tomorrow’s Doctors’ framework (GMC 1993), is gradually bringing about changes in preclinical medical schools, which most regard as beneficial. The hours spent ‘mugging up’ anatomy, biochemistry, physiology and pharmacology of 10-20 years ago, largely separate from their clinical relevance, is giving way to integrated courses with ‘vertical themes’. While there are grounds to worry about certain aspects of these changes, the hope is that the new curriculum will better enable students to see the clinical relevance of any particular domain of medical science. This should provide associative links in a student’s mind between the conceptual understanding of principles and medical practice. This new framework is coupled to the explicit teaching of skills to enable the next generation of doctors to keep abreast of scientific developments through their professional career - with ‘special study modules’ and greater access to Interrelated Honours Courses.

The logical sequitor of this new way of teaching may be the break-up of preclinical medical schools as we have long known them – Departments of Anatomy, of Physiology, or Pharmacology and so on. In their place, it may be better to have administrative frameworks in which medical teaching is organized (though not delivered) by one group of people (medical teaching organizations), while academic research is moved into institutes relevant to their particular discipline. Be it in haematology, oncology, cardiovascular medicine, inflammatory diseases or neuroscience, the opportunity would then be created for clinical and nonclinical colleagues to work as closely alongside as it is practicable to be. Not only would research flourish, but this may also help in the planning of courses for both medical and science students.

Neuroscience teaching to medical students has, in certain respects, lagged behind that of many of our medical colleagues, with some British text books still using somewhat antiquated concepts such as the ‘special senses’ and the ‘limbic system’ years after these have fallen out of favour scientifically. A comparison of books such as Kandel, Schwartz and Jessell’s Principles of Neural Science (Kandel et al. 1999) – the primer for medical students at Columbia University in New York – with the books often used by Departments of Anatomy or Physiology in Britain, reveals how dated our approach to teaching medical students can sometimes be. Whereas Principles marries clinical syndrome with the latest developments in functional imaging or molecular neurobiology (e.g. in the discussion of speech disorders...
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and of Huntington’s Disease, respectively), medical students in Britain are generally attending courses where this marriage is barely dreamed of, let alone consummated.

**GETTING TOGETHER - VIRTUAL INSTITUTES**

Getting together needs money for buildings and infrastructure. The providers of such funds - be they government health services, the research councils, medical charities or private individuals - have different agendas and priorities. Financial considerations mean that realizing these distinct goals will require that each of us ‘piggy-back’ on the contributions of others. It would not be unreasonable for these parties to ask for what evidence is at hand that the new venture I am proposing would work. It is a classic ‘catch 22’. An interim solution is the ‘virtual’ institute. Short of physically getting together, an administrative framework could be assembled consisting of a common budgetary framework, some shared appointments and joint teaching committees, some cross-talk of seminar programmes, the encouragement of some kinds of ‘interdisciplinary’ research and so on. These virtual institutes would consist of separate – indeed, and very importantly - independent departments of the various subdisciplines of neurology, neurosurgery, neuroradiology and neuroscience. The clinical departments would need certain kinds of infrastructure support – such as medical physics – whereas the basic scientists may need animal facilities, molecular biology laboratories and the like.

I used ‘some’ as a frequent qualifier in the paragraph above because I do recognize that a simple fusion of neurology and neuroscience would not work. We really are two cultures, and we have all grown up to have different expectations at different stages of our careers, and with this, different life experiences and loyalties. The supposition that these could be put aside is absurd and simplistic. However, over a generation, the proposed new institute framework could gradually create a different set of expectations. Aspects of these could include MD/PhD programmes enabling movement out of clinical training into laboratory work for a period and the opportunity for basic scientists to see clinical practice at close hand and so help guide them in their choice of research projects. Integrated project management for large-scale projects on neurological diseases would also emerge where advances come from harnessing the latest in basic science (e.g. stem cells) to clinical imperatives.

**CONJECTURE AND REFUTATIONS**

My conjecture, then, is that we should work towards creating Institutes of Neuroscience, embracing both basic and clinical neuroscientists within their walls. Karl Popper (1992) taught us that any conjecture is the more secure if it has been tested against conflicting evidence or argument. By way of conclusion, let me consider three potential concerns.

One refutation is to assert that attempting to cross the basic/clinical divide is forlorn. If economies of scale have to be considered, better to have large-scale departments of medicine, and of surgery, each divided into their organ-specific specialities, along with separate institutes of biomedical science subdivided similarly. I know that some of my colleagues in biomedical science are suspicious of my conjecture, believing that medics and scientists are different tribes best kept well apart. More than that, they see technical developments in protein chemistry and laser physics on the horizon that will help neurobiologists do their laboratory work. Thus, far from wanting to join clinicians, these col-
leagues look to a rapprochement of the physical and biological sciences as a higher priority. This is a difficult refutation to counter, but I think it is fundamentally dishonest. These same colleagues often claim that their work should be funded by a Medical Research Council because it could lead to better understanding of some aspect of neurological disease. It does not make sense to me to hold this view of why a piece of research should be funded, while turning one's back on the very institutional framework that could improve communication and understanding about brain diseases and so help set priorities for fundamental research. Moreover, the infrastructure that physicists need to do their work (e.g. in the development of magnetic resonance imaging) is radically different from that which neuroscientists require to use these new tools.

A second concern relates to salaries. These are certainly very different across the two cultures, and envy could quickly eat away at any attempt to create a common culture. I am open-minded on this worry, but it may be that it is the issue that dares not speak its name. I hope the medical profession may yet judge particularly able scientists to be worth more than they are generally paid, and to reflect on whether they are at ease with the situation when they are not. Given the breadth of salaries across the various professions within hospitals, I doubt this issue need be limiting.

Last, I am acutely conscious that it is important to keep separate what is ‘useful’ from what is merely ‘interesting’. My conjecture may be fundamentally flawed in this respect. Perhaps there is no need for practical neurologists to be side-by-side with laboratory scientists, the real need being merely one of ensuring that the clinical demands of the former and the findings of the latter are quickly and effectively communicated to each other. We may not need common institutes to achieve this end. Integrated project management on exciting new advances, including stem cells, does not need the molecular engineers to be alongside the neurosurgeons. All it needs is that they talk and plan together. Some universities (e.g. Bristol) have explicitly taken this stance, dividing their Medical Schools into two distinct halves along basic and clinical lines. However, I worry that brilliant science will then advance along avenues that are wholly divorced from clinical need and that clinical practice will run the risk of stagnation. Crossing the rubicon of clinical and basic neuroscience should not be beyond us – we should take up the challenge.

REFERENCES

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