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The birth of the neuromolecular gaze

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Abstract

The aim of this article is (1) to investigate the 'neurosciences' as an object of study for historical and genealogical approaches and (2) to characterize what we identify as a particular 'style of thought' that consolidated with the birth of this new thought community and that we term the 'neuromolecular gaze'. This article argues that while there is a long history of research on the brain, the neurosciences formed in the 1960s, in a socio-historical context characterized by political change, faith in scientific and technological progress, and the rise of a molecular gaze in the life sciences. They flourished in part because these epistemological and technological developments were accompanied by multiple projects of institution-building. An array of stakeholders was mobilized around the belief that breakthroughs in understanding the brain were not only crucial, they were possible by means of collaborative efforts, cross-disciplinary approaches and the use of a predominantly reductionist neuromolecular method. The first part of the article considers some of the different approaches that have been adopted to writing the history of the brain sciences. After a brief outline of our own approach, the second part of the article uses this in a preliminary exploration of the birth of the neurosciences in three contexts. We conclude by arguing that the 1960s constitute an important 'break' in the long path of the history of the brain sciences that needs further analysis. We believe this epistemological shift we term the 'neuromolecular gaze' will shape the future intellectual development and social role of the neurosciences.

Key words genealogy, neuromolecular approach, neurosciences, 1960s, postwar period, styles of thought

> The precursor is a thinker who the historian believes he can extract from one cultural frame in order to insert him into another, which amounts to considering concepts, discourses and speculative experimental acts as capable of displacement or replacement in an intellectual space in which reversibility of relations has been obtained by forgetting the historical aspect of the object dealt with. (Canguilhem, 1968: 21)

INTRODUCTION

The 20th century witnessed the emergence and transformation of a panoply of innovative practices, techniques and knowledges focused around the brain, from neurochemistry and neuroendocrinology, to neurogenetics and neuroimaging. Some of these endeavours can be traced back to the 18th and 19th centuries. Nevertheless we believe that they took a specific form in the second half of the 20th century, in what might be considered to be a 'third wave' that follows the birth of neurology in the 18th century and of psychiatry in the 19th century.

This third wave saw the emergence of new fields of research into the brain and nervous system characterized by (1) a hybridization of concepts, methods and practices drawn from various disciplinary backgrounds into novel thought communities; (2) a neurobiological reductionism in the approach to, and investigation of, complex phenomena; and (3) zones of exchange and collaboration between those distinct specialized thought communities that might be termed 'trading zones', borrowing Peter Galison's notion which he applied to the world of microphysics (1997). The neurosciences, we argue, built on these hybrids, as a kind of hybrid of hybrids, held together by a common name, some common institutional projects, a 'sense of common purpose' (Kandel, 1982) and a common reductionist approach to the explanation of complex phenomena pertaining to the brain, behaviour and the nervous system.

Our aim in this article is to try to characterise the particular hybrid of hybrids that termed itself 'the neurosciences' and that emerged in the 1960s. Specifically we are interested in (1) investigating the 'neurosciences' as an object of study for historical and genealogical approaches and (2) characterizing what we identify as a particular 'style of thought' (Fleck, 1979) that consolidated with the birth of this new thought community and that we term the 'neuromolecular gaze'. By 'gaze' we mean an ethos, an approach, a language, a perception (Foucault, 1973), and a perspective brought about by the diverse techniques and practices involved in the production of this new field of knowledge. More comprehensively perhaps, by 'neuromolecular gaze' we mean a common vision of life itself (Kay, 1997; Rose, 2007). Although the neurosciences were characterized by their founders as an integrated multi-level approach to the brain and the nervous system, it is the molecular underpinning that prevailed (Kandel, 1982; Schmitt, 1990; Smith, 2005) marking both the success and challenges of these new sciences of the brain.

We begin by exploring some ways in which the history of the brain sciences has been written. In doing this we are both critical and parasitic: critical in that we distance ourselves from some of the presuppositions that underpin other ways of writing this history; parasitic in that we build on some elements of these approaches in order to excavate the conditions of emergence of these new ways of understanding – and intervening in – the brain. This forms a prelude to the second half of the article, where we sketch out, in preliminary form, some key features of the birth of the neurosciences in the USA, the UK and France.

HOW SHOULD WE DO THE HISTORY OF THE NEUROSCIENCES?

There are many types of historiographies each of which embodies, explicitly or implicitly, a certain understanding of time. For example, in Eric H. Chudler's 'milestones in neuroscience research', time begins in 4000 BC with the Sumerian records of the euphoriant effects of poppy plants and proceeds as chronological, continuous, linear.[1] Changeux's *Neuronal Man* starts in ancient Egypt, actually in Chicago, where the oldest papyrus scroll of a list of head and neck injuries was deciphered in 1862 by an American collector called Edwin Smith (Changeux, 1997). Smail (2008), on the other hand, thinks in terms of a 'geological time' that, in the 19th century, challenged the creationist's 'sacred or biblical time'. The brain becomes 'the narrative focus for a history that begins with early hominins and balances on the Neolithic era' (ibid.). This kind of 'cosmological time' offers a panoramic world-view that captures everything and nothing at the same time – the time of the neurosciences is bound up with cosmological interpretations of humanity. Time in all these cases is totalized, continuous, all is encompassed in its passage, all marches in step from an origin to the present.

This is the temporality that Foucault sought to disrupt: his was an appeal, against the continuities of history that would read the present as a culmination of a passage from the origin, for a discontinuous genealogy where the present was the contingent outcome of the intersection of multiple distinct accidents and encounters (Foucault, 1972). The lure of chronological continuity is to be avoided: such temporality may present itself as continuous, but historical time is best understood as laminar, intercalated by discontinuous events or 'turbulences' (Serres, 1977; Galison, 1997). Not that a discontinuous genealogy can do without dates. This is precisely why our own excavation of the neurosciences traces back some historical landmarks. But a date is just that, a symbolic landmark. It is there to indicate the 'enigmatic aura of an event' (Foucault, 2002).

Conventional histories of the brain sciences have, in the main, adopted one of three strategies. We mentioned earlier the linear and chronological account of discrete 'events' and discoveries such as Chudler's 'milestones in neuroscience'. The other two strategies provide either a biographical or a conceptual account. The former is usually interested in the phenomenological aspect of history in the making, whereas the latter focuses on the emergence, development and evolution of fundamental concepts; the articulation of problems and questions, their problematizations and transformations.

Biographical accounts have traced the chronological succession of personal histories and (auto)biographical accounts, often highlighting a kind of family tree, with many masters having pupils who study in their schools and carry on their tradition down the generations. Some notable examples are *The History of Neuroscience in Autobiography* (Squire, 1996) – a 6-volume publication of the Society for Neuroscience (SFN) – or the series of interviews with eminent neuroscientists conducted by the SFN or more recently by the University College London (UCL) in the British context.[2] There are also numerous memoirs by famous neuroscientists, abundant articles on the contributions and achievements of brain scientists in the form of 'neuro-anniversaries' (Eling, 2001) or as part of discoveries and the formulation of new concepts and theories. In addition, many classic textbooks in the history of the brain sciences are structured through an individualistic lens, often written by 'the practitioner-historian' (Rosner, 1999). Fielding H. Garrison's classic *History of Neurology* (first published in 1925) or DeJong's *A History of American Neurology* (published in 1982) are two examples among many others (Soderqvist, 2002). Another example of the work of a 'practitioner-historian' is the posthumous compilation of notes, lectures and manuscripts of the neurosurgeon Earl Walker (1998) with a very tempting but rather misleading title, *The Genesis of Neuroscience*. The book starts somewhere in antiquity, is organized along anatomical lines and focuses on the linear development of neurology and neurosurgery, but fails to question the conditions under which neuroscience emerged as a separate project, and hence as an object of historical study.

An interesting contemporary version of this chronological way of writing the history of the brain sciences in terms of kinship is 'Neurotree'.[3] This pedigree of the 'neuroscience academic family' is a volunteer-run website designed to help track the academic genealogy of generations of brain scientists across time and space. But Neurotree is more than just a descriptive display of networks of researchers involved in the field. Although it does not represent an explicit tree of descent, it does replicate a long tradition in medicine, namely the development, formation and transformation of 'schools of thought' through a succession of mentors and their disciples. This was the traditional feature of medical training and practice in France, for instance, whereby '*le choix du patron*' (Bourdieu, 1984) was an absolute condition of success for the chosen protégé.

A common denominator of accounts woven in terms of chronological and linear frameworks is 'the quest for a precursor' (Canguilhem, 1968). Moreover such narratives assume that their objects – 'the brain', 'nerves', the institute, the discovery, the discoverer – remain static, intact, resistant to mutations and modifications that occur in the multiple translations taking place at every single step of an event. In such histories, each act in this narrative, each text, is enrolled as a precursor of the present. As Georges Canguilhem has pointed out, this quest for precursors fabricates 'an artifact, a counterfeit historical object and ignore[s] the fact that [the precursor] is the creature of a certain history of science, and not an agent of scientific progress' – Canguilhem quotes Koyré: 'It is quite obvious (or should be) that no-one has ever regarded himself as the "forerunner" of someone else . . . to regard anyone in this light is the best way of preventing oneself from understanding him' (Canguilhem, 1994[1968]: 51–2). It would, no doubt, be paradoxical, therefore, to regard Canguilhem himself as the forerunner of his pupil Michel Foucault's rejection of 'indefinite teleologies' and opposition to the quest for origins (Foucault, 1977). That is precisely why we do not consider Francis Schmitt, whom we mention in the second part of the article, as 'the founder' or 'precursor' of the neurosciences. Rather, he exemplifies a moment in the history of the brain sciences, where a change in the scale at which events in the brain came to be understood was unfolded. We call this break, fissure, or epistemological shift exemplified by Schmitt and others, the birth of 'the neuromolecular gaze'.

The second approach to the history of the brain sciences, the 'conceptual account', consists in studying the affiliation and genealogy of concepts. These are often described in terms of a distinction drawn in historiography between 'internalist' approaches, focused upon a history of ideas, and 'externalist' approaches, which see those ideas as products of their socio-historical context (Buchdahl, 1962). Some examples of such conceptual histories are Harrington's (1987) *Medicine, Mind and the Double Brain* or Changeux's (1997) *Neuronal Man*. Harrington does refer to some of the contextual factors where she feels they are important, but her work is fundamentally a conceptual history. Changeux, however, while he analyses the 'neurobiologization' of humankind since Galen's establishment of neurophysiology as a science, is uninterested in the socio-political, technological, ideological and economic factors that might have shaped the emergence of concepts. The same is true of those accounts that have been written along anatomical, structural and 'functional' lines. For example, Finger's (1994) *Origins of Neuroscience* maps the chronological evolution of brain processes in a linear fashion from antiquity to the present, but pays little attention to the locales and practices – what Foucault (1972) might term 'the surfaces of emergence' within which these concepts, objects and authorities found their foothold and from which they were disseminated.

It is true that some conceptual histories are built on a broader sociocultural context – for example, Micale's (1995) rise and fall of the concept of hysteria – or make reference to something like an ethos of a period – for example, Clarke and Jacyna's (1987) analysis of neuroscientific concepts in 19th century Europe. Heims's (1991) account locates the birth of cybernetics in the American socio-political and economic postwar context, while Dupuy (1999) deliberately decontextualizes the emergence of cybernetics, stating his faith in the 'power of ideas'. However, such decontextualized versions give the impression of 'inevitable outcomes' in the hands of a few determined players or enlightened minds – which is rarely the case (Strasser, 2003). Further, most of these histories tend to focus on those texts retrospectively identified as canonical. Wills's (1999) account of the 'birth of neuroscience' is perhaps one text that tries to be different.[4] Although it is another example of the quest for precursors, it nonetheless challenges the canonical versions that place Galen as the 'founding father of neuroscience'. So how is one precursor replaced by another in this form of writing? For Wills, what overshadowed the recognition of Herophilus of Chalcedon and Erasistrasus were underlying economic and socio-political factors and not Galen's sudden, miraculous and inevitable apparition. These factors include the cut of major state-funded research activities in the aftermath of the third Syrian war (246–241 BC), the expulsion of the Alexandrian intellectual elite and the subsequent destruction of their works in the great fire that destroyed the Alexandrian library in AD 391 (Wills, 1999).

A review of this material leads us to agree with Jacyna (1999), when, in her review of a book by Marshall and Magoun on the history of neuroscience, she writes: '. . . Few would wish to dispute this analysis. What one would like to see as a historian is some explanation of why this period and milieu proved of such fundamental importance in laying the foundations of the modern understanding of the nervous system.' For her, what is missing is a 'sociology of modern neuroscience'. We agree, though we would prefer to frame the issue differently: what we need is a *genealogy of neuroscience* as an event. That is to say, an account that does not see neuroscience as inevitable, and does not marshal the past to show how the present was its culmination, but which treated the emergence of neuroscience as a question or a problem, and that sought to elucidate the material and intellectual conditions that made possible the formation of particular concepts, objects and discourses.

It is for this reason that we think there is much to be learned from the approach, and the ethos, developed by Michel Foucault. The archaeological and genealogical approach of the clinic, madness, sexuality, and the prison, aims at delineating and capturing the history of the shift in discursive practices: how discourses, norms, policies, interventions, techniques and technologies, objects and subjects are formed, ordered, governed, sustained, rendered more visible, articulated and transformed (Foucault, 1972, 1973). They do not write a continuous history, or a linear chronology, nor do they see the present as emerging from a single narrative. On the contrary, they explore the contingent interconnections between multiple surfaces of emergence of practices, techniques and knowledges that are important in their articulation and problematization. Genealogy, here, is not interested in the *causes* of events but seeks to 'lighten the weight of causality'. It allows a focus on 'local discursivities' (Foucault, 2003) to work out some understanding of the emergence of what would seem today inevitable. This is precisely why Foucault's work will always be criticized by historians in quest of 'causes and effects', continuums and continuities. Genealogy, as a methodology, is a reversal of historicism (Foucault, 2004).

It is through this genealogical perspective that we think our approach differs from previous ones. Our approach is neither 'externalist' nor 'internalist' and we do not claim to write a history of the neurosciences in this article. We believe, however, that a new 'style of thought' emerged with this new community of scientists that came to describe themselves as 'neuroscientists' in the 1960s. It started with a shift in the gaze, what we identified as the birth of the 'neuromolecular gaze': a gaze that immersed itself in the nascent molecular approaches used in biology, chemistry and biophysics (Schmitt, 1990) and was applied to the realm of neurobiology. We argue that this new gaze is an 'epistemological shift' in the long trajectory of the sciences of the brain and the nervous system; a shift that was made possible through institutional building supported by governmental and philanthropic funding whose diverse aims still await further scrutiny. It is both the institutional form and funding that turned this gaze into a whole new 'style of thought'.

THE BIRTH OF MODERN NEUROSCIENCE OR NEUROSCIENCES?

In this part we focus on that 'break', the emergence of the neurosciences in the 1960s as a new discourse in the sciences of the brain and the nervous system. We trace in preliminary forms some of its 'surfaces of emergence' and 'grids of specification' (Foucault, 1972) by looking at some of the conditions that enabled the emergence of these new objects of study and discursive practices, and the institutional leadership that delineated them.

Perhaps we can take the very term 'neuroscience' as our starting point. If we focus on this, an account begins to take shape which is different from the anatomical *historias* we mentioned earlier. The first journal articles using the term 'neuroscience' appear at the end of the 1960s: an editorial on 'the neurosciences' published in the *Canadian Medical Association Journal* (Anon., 1969), an analysis of the 'trends in neuroscience' by Francis O. Schmitt (1970) published in *Nature*, a discussion on doctoral training in neuroscience by Snider (1967) published in *Archives of Neurology*, and a 'Progress Report on the Neurosciences Study Plan' by Livingston and Bridgman (1969) published in *Transactions of the American Neurological Association*. The first journal that mentions 'neuroscience' in its title is the *Neurosciences Research Program Bulletin* launched in 1963. This is the official publication of the 'Neurosciences Research Program' (NRP), a project to which we will return later. The first book is *The Neurosciences: A Study Program* edited by Quarton, Melnechuk and Schmitt (1967), the proceedings of the first 'Intensive Study Program' organized by the NRP. This book along with two other volumes published in 1970 and 1973 under the same title came to be known as the 'big books of neuroscience' (Schmitt, 1990). Significantly, for a genealogical account, all these publications emerge from a self-consciously new community of scientists (Swazey, 1975) who are trying to forge a novel approach to brain and behaviour by bringing together those who have been trained in, and are working in, a whole range of disciplines and sub-disciplines – it is this hybridization that underpins the approach that they come to term 'neuroscience'.

The oldest initiatives bringing together scientists from different backgrounds in the attempt to better understand brain and behaviour in a cross-disciplinary fashion using the reductionist neurobiological method emerged first in the USA in the 1960s. In the USA, the postwar period was marked by an increase in funding and interest in the brain sciences by philanthropic and governmental agencies and the burgeoning pharmaceutical industry. Such funding was a condition of possibility for the creation of these interdisciplinarity efforts. The first neuroscience initiative in the USA, the NRP mentioned earlier, was mainly supported by federal grants, several different institutes of the National Institutes of Health (NIH) and the bioscience section of the National Aeronautics and Space Administration (NASA) (Schmitt, 1990). The main figure in the NRP, Francis O. Schmitt, has argued that this funding was the key. He writes: 'The National Institutes of Health, through its programming activities and its strong supportive role, was able very effectively to catalyze the formation and further advance of this new "community of scholars" [NRP] with its own society, its own journal and the holding of its own meeting' (Schmitt, 1990: 198).

Interestingly enough, funding through lobbying for a certain *neuroscientific* agenda became of crucial importance in countries outside the USA at relatively the same period. In a letter to the editor published in a Canadian journal in 1969, a physician writes: 'The solution must rest with more funds and a greater opportunity to do research in neuroscience through a national source than are presently available' (Hudson, 1969). In the UK, the Brain Research Association (BRA), founded in 1968 and renamed the British Neuroscience Association in 1997, was initially supported by the Wellcome Trust, but to sustain itself it required further funding. The main sources were the government, the pharmaceutical industry and other external funds including firms and diverse scientific associations.[5] By 1978, John Wolstencroft, a British neuroscientist, suggests for the first time that the organization should start acting as 'a pressure group'.[6]

But despite such efforts, European scientists did not enjoy the profusion of grants in the brain sciences that started to become more visible in the USA after the 1960s. More than half of the 1,370 doctorates in the 'neurosciences' that were completed at the 75 leading American institutions were increasingly receiving funds and research grants from the major divisions of the NIH that dealt with neurological, psychiatric and basic neurosciences (Magoun, 1972). In 1969 they received 72 per cent of all research grants, 73 per cent of all training grants, and 82 per cent of all fellowship grants (ibid.). While the USA was enjoying a boom in its economy and investing funds in science and research, Europe was still suffering major economic problems, although funds were flowing in, mainly thanks to transatlantic collaboration (Marshall, Rosenblith *et al.*, 1996; Strasser, 2003). Europe, of course, could also now look to the United Nations and its various bodies, such as the United Nations Educational Scientific and Cultural Organization (UNESCO), founded in 1945. And there was the World Health Organization (WHO), founded in 1948, which also catalysed collaboration, interdisciplinary gatherings and exchanges.

Although some interdisciplinary institutes started to emerge at the turn of the 20th century, in the three decades following the end of the Second World War, many of those working in the area of the brain sciences sought to further their work by new institutes and scientific platforms, often with the explicit aim of bringing together previously dispersed research communities, and many new hybrid fields emerged: cybernetics and biophysics saw the light in the 1950s, neurochemistry in the 1940s and 1950s, modern cognitive psychology in the 1960s, cognitive neuroscience in the 1970s, brain imaging in the 1980s, and molecular biology of cognition in the 1980s. The International Brain Research Organization (IBRO) founded in 1961 was *l'enfant protégé* of UNESCO and it was the 'international' image of the organization that facilitated collaboration among the two main protagonists of the Cold War, the USA and the Soviet Union (Marshall, Rosenblith *et al.*, 1996). The Neuroscience Research Program was founded in 1962, as was the Japanese Society for Neurochemistry. The European Molecular Biology Organisation was founded in 1964, the International Society for Neurochemistry in 1967, the European Brain and Behaviour Organization in 1968, and the Society for Neuroscience in 1969, just to mention a few. The burgeoning of such bodies is illustrated graphically in Figures 1 and 2.

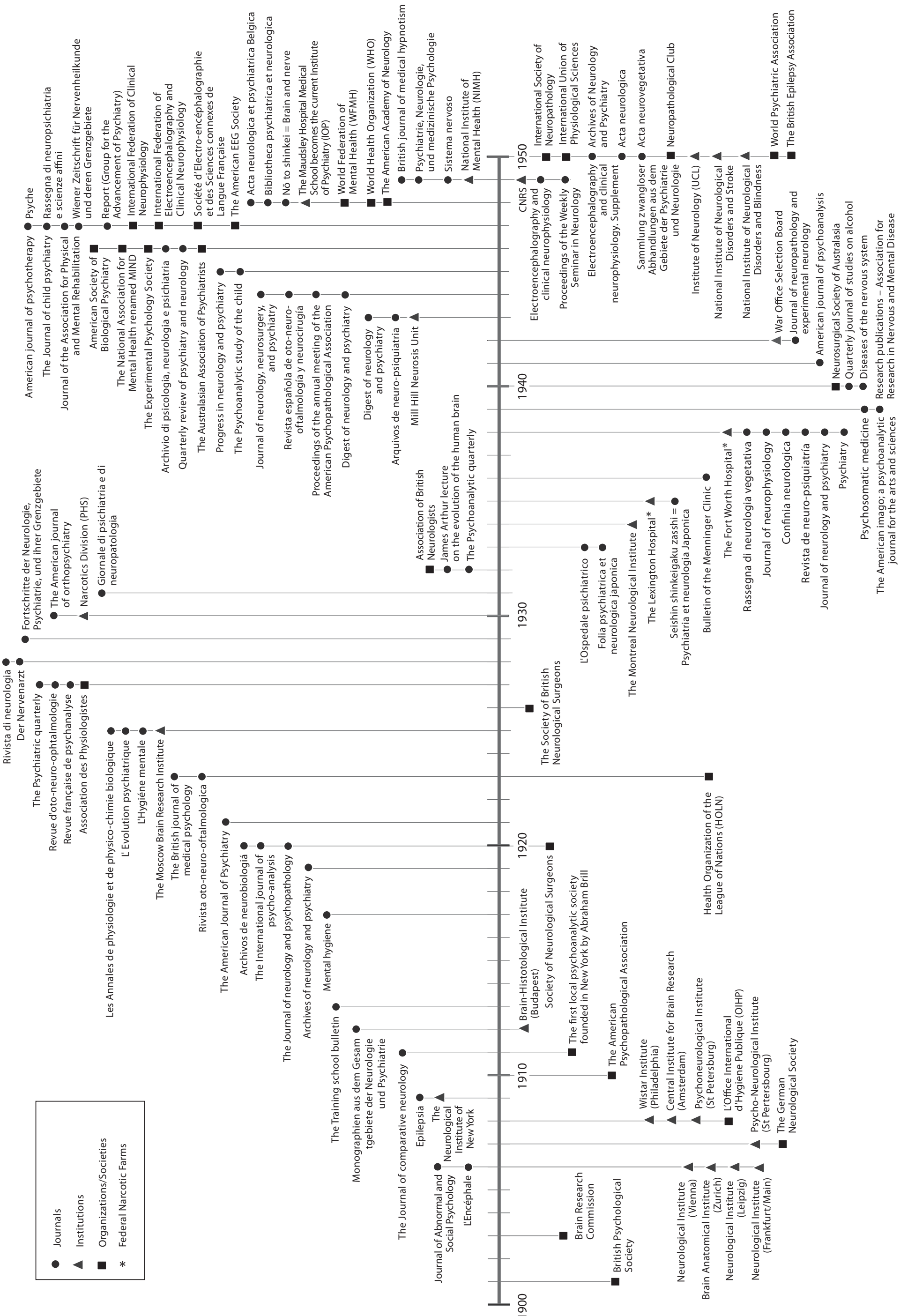
Let us turn to look at some of these developments in more detail. We focus on the American context more exhaustively since the empirical material is more abundant albeit fragmented. The British context is explored through our preliminary archival work. For the French context, we draw heavily on the 2006 colloquium 'Essor des Neurosciences de 1945 à 1975' in which the major French institutions sketched the landscape of the growth of the neurosciences in France (Debru, Barbara and Cherici, 2008).

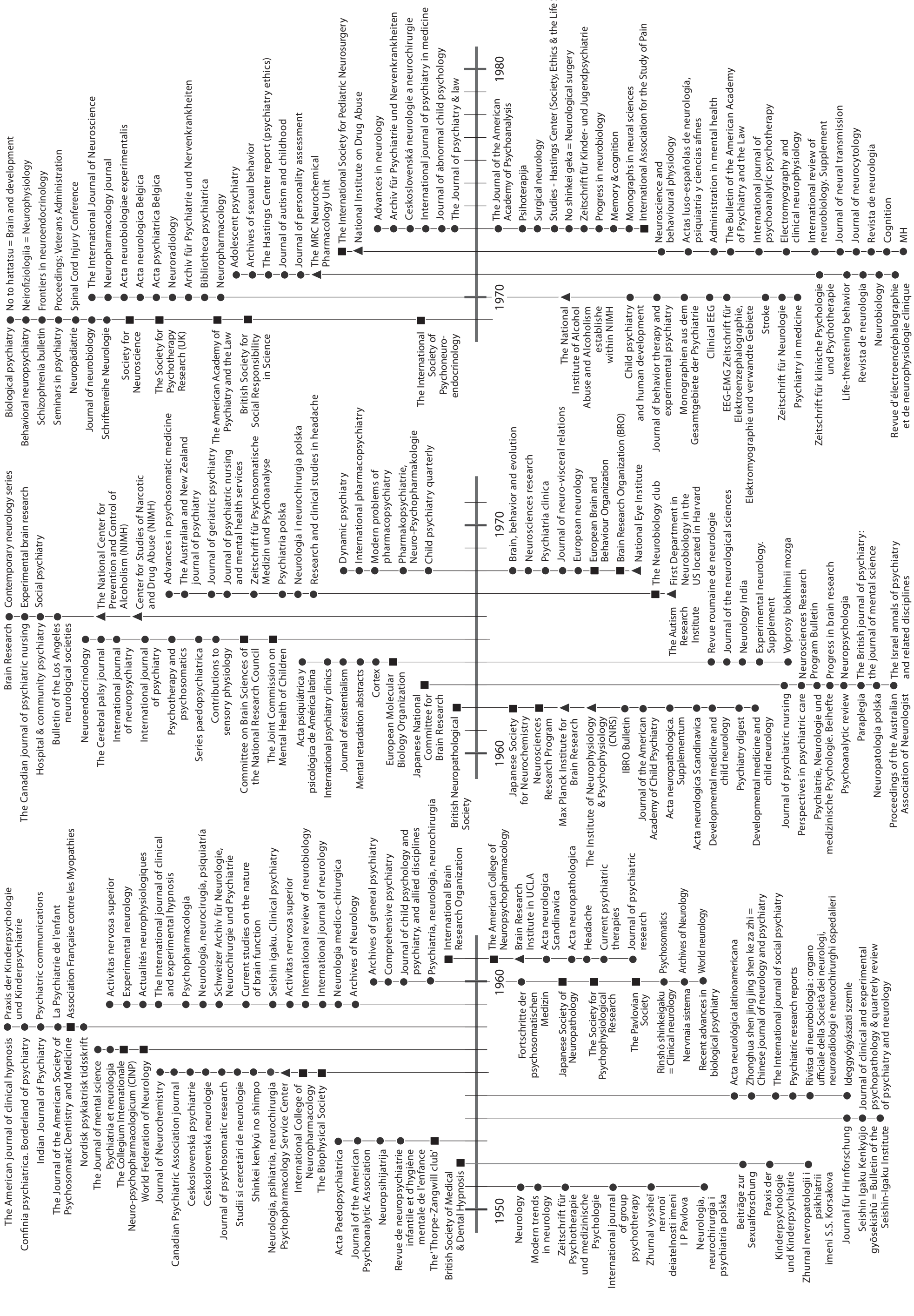
The American context, 1960s

Before the Second World War, the USA lagged behind 19th-century Europe in science in general and the studies of the nervous system in particular (Frank, Marshall and Magoun, 1976). Edward Shorter (1997) argues that the birth of 'clinical neuroscience' took place outside the USA, at the 1st International Congress of Psychiatry in Paris in 1950, where the pathways for a systematic investigation of the brain as the 'physical substrate of the disordered mind' were laid out. But although one finds repeated references to an ultimate aim of accounting for psychiatric conditions by those involved in early neuroscience projects (Kandel, 1982; Schmitt, 1990), the relation of the neurosciences to psychiatry remained ambivalent and contested – while this was one of those 'trading zones' to which we have already referred, 'the disordered mind' does not appear to have been the driving force or primary object of study of the neurosciences projects of the 1960s.

Cowan, Harter *et al.* (2000), however, do argue that 'modern neuroscience' in the USA starts in the mid-1950s with the attempt to combine behavioural psychiatric research with anatomical and physiological approaches, an effort led by psychiatrist and neuroanatomist David McKenzie Rioch at the Walter Reed Army Institute of Research. But it was Francis O. Schmitt who coined the term 'neuroscience' in 1962 (Swazey, 1975; Bloom, 1997). He settled on it to describe his project to create a unified field out of what were relatively distinct disciplines and subdisciplines bearing on 'brain and behavior': not just the 'neuro-' disciplines – neurophysiology, neuroanatomy, neurochemistry, neurology – but also the 'psy-' disciplines of psychology and psychiatry, and some other fields, perhaps not so obviously linked, such as immunology, physics and chemistry.

At the outset, neuroscience does not seem to have been the obvious name under which this programme should develop. In her 'brief history' of the NRP, Judith Swazey tells us that Schmitt first used the terms 'mental biophysics' and 'biophysics of the mind' to encapsulate this attempt to bring together the


Journals
Institutions
Organizations/Societies
* Federal Narcotic Farms
1900
1910
1920
1930
1940
1950
British Psychological Society
Brain Research Commission
Journal of Abnormal and Social Psychology
L'Encéphale
The Journal of comparative neurology
Epilepsia
The Neurological Institute of New York
Neurological Institute (Vienna)
Brain Anatomical Institute (Zurich)
Neurological Institute (Leipzig)
Neurological Institute (Frankfurt/Main)
Monographien aus dem Gesamtgebiete der Neurologie und Psychiatrie
The Training school bulletin
The German Neurological Society
Psycho-Neurological Institute (St Pertersbourg)
Wistar Institute (Philadelphia)
Central Institute for Brain Research (Amsterdam)
Psychoneurological Institute (St Petersburg)
L'Office International d'Hygiene Publique (OIHP)
The American Psychopathological Association
The first local psychoanalytic society founded in New York by Abraham Brill
Brain-Histotological Institute (Budapest)
Society of Neurological Surgeons
The Journal of neurology and psychopathology
Archives of neurology and psychiatry
Mental hygiene
The American Journal of Psychiatry
Archivos de neurobiologiá
The International journal of psycho-analysis
Health Organization of the League of Nations (HOLN)
Les Annales de physiologie et de physico-chimie biologique
L' Evolution psychiatrique
L'Hygiène mentale
The Moscow Brain Research Institute
The British journal of medical psychology
Rivista oto-neuro-oftalmologica
The Society of British Neurological Surgeons
Rivista di neurologia
Der Nervenarzt
The Psychiatric quarterly
Revue d'oto-neuro-ophtalmologie
Revue française de psychanalyse
Association des Physiologistes
Fortschritte der Neurologie, Psychiatrie, und ihrer Grenzgebiete
The American journal of orthopsychiatry
Narcotics Division (PHS)
Giornale di psichiatria e di neuropatologia
L'Ospedale psichiatrico
Folia psychiatrica et neurologica japonica
The Montreal Neurological Institute
The Lexington Hospital*
Seishin shinkeigaku zasshi = Psychiatria et neurologia Japonica
Association of British Neurologists
James Arthur lecture on the evolution of the human brain
The Psychoanalytic quarterly
Bulletin of the Menninger Clinic
The Fort Worth Hospital*
Rassegna di neurologia vegetativa
Journal of neurophysiology
Confinia neurologica
Revista de neuro-psiquiatría
Journal of neurology and psychiatry
Psychiatry
Psychosomatic medicine
The American imago; a psychoanalytic journal for the arts and sciences
Research publications – Association for Research in Nervous and Mental Disease
Diseases of the nervous system
Quarterly journal of studies on alcohol
Neurosurgical Society of Australasia
American journal of psychoanalysis
Journal of neuropathology and experimental neurology
War Office Selection Board
National Institute of Neurological Disorders and Blindness
National Institute of Neurological Disorders and Stroke
Institute of Neurology (UCL)
Sammlung zwangloser Abhandlungen aus dem Gebiete der Psychiatrie und Neurologie
Electroencephalography and clinical neurophysiology. Supplement
Proceedings of the Weekly Seminar in Neurology
Electroencephalography and clinical neurophysiology
CNRS
Digest of neurology and psychiatry
Arquivos de neuro-psiquiatria
Mill Hill Neurosis Unit
Journal of neurology, neurosurgery, and psychiatry
Revista española de oto-neuro-oftalmología y neurocirugia
Proceedings of the annual meeting of the American Psychopathological Association
Digest of neurology and psychiatry
Progress in neurology and psychiatry
The Psychoanalytic study of the child
American journal of psychotherapy
The Journal of child psychiatry
Journal of the Association for Physical and Mental Rehabilitation
American Society of Biological Psychiatry
The National Association for Mental Health renamed MIND
The Experimental Psychology Society
Archivio di psicologia, neurologia e psichiatria
Quarterly review of psychiatry and neurology
The Australasian Association of Psychiatrists
Psyche
Rassegna di neuropsichiatria e scienze affini
Wiener Zeitschrift für Nervenheilkunde und deren Grenzgebiete
Report (Group for the Advancement of Psychiatry)
International Federation of Clinical Neurophysiology
International Federation of Electroencephalography and Clinical Neurophysiology
Société d'Electro-encéphalographie et des Sciences connexes de Langue Française
The American EEG Society
Acta neurologica et psychiatrica Belgica
Bibliotheca psychiatrica et neurologica
Nō to shinkei = Brain and nerve
The Maudsley Hospital Medical School becomes the current Institute of Psychiatry (IOP)
World Federation of Mental Health (WFMH)
World Health Organization (WHO)
The American Academy of Neurology
British journal of medical hypnotism
Psychiatrie, Neurologie, und medizinische Psychologie
Sistema nervoso
National Institute of Mental Health (NIMH)
International Society of Neuropathology
International Union of Physiological Sciences
Archives of Neurology and Psychiatry
Acta neurologica
Acta neurovegetativa
Neuropathological Club
World Psychiatric Association
The British Epilepsy Association


1950
1960
1970
1980
The American journal of clinical hypnosis
Confinia psychiatrica. Borderland of psychiatry
Indian Journal of Psychiatry
The Journal of the American Society of Psychosomatic Dentistry and Medicine
Nordisk psykiatrisk tidsskrift
The Journal of mental science
Psychiatria et neurologia
The Collegium Internationale Neuro-psychopharmacologicum (CINP)
World Federation of Neurology
Journal of Neurochemistry
Canadian Psychiatric Association journal
Ceskoslovenská psychiatrie
Ceskoslovenská neurologie
Journal of psychosomatic research
Studii si cercetări de neurologie
Shinkei kenkyū no shimpo
Neurologia, psihiatria, neurochirurgia
Psychopharmacology Service Center
International College of Neuropharmacology
The Biophysical Society
Acta Paedopsychiatrica
Journal of the American Psychoanalytic Association
Neuropsihijatrija
Revue de neuropsychiatrie infantile et d'hygiène mentale de l'enfance
The 'Thorpe-Zangwill club'
British Society of Medical & Dental Hypnosis
Neurology
Modern trends in neurology
Zeitschrift für Psychotherapie und medizinische Psychologie
International journal of group psychotherapy
Zhurnal vysshei nervnoi deiatelnosti imeni I P Pavlova
Neurologia, neurochirurgia i psychiatria polska
Beiträge zur Sexualforschung
Praxis der Kinderpsychologie und Kinderpsychiatrie
Zhurnal nevropatologii i psikhiatrii imeni S.S. Korsakova
Journal für Hirnforschung
Seishin Igaku Kenkyūjo gyōsekishū = Bulletin of the Seishin-Igaku Institute
Praxis der Kinderpsychologie und Kinderpsychiatrie
Psychiatric communications
La Psychiatrie de l'enfant
Association Française contre les Myopathies
Activitas nervosa superior
Experimental neurology
Actualités neurophysiologiques
The International journal of clinical and experimental hypnosis
Psychopharmacologia
Neurologia, neurocirugia, psiquiatria
Schweizer Archiv für Neurologie, Neurochirurgie und Psychiatrie
Current studies on the nature of brain function
Seishin igaku. Clinical psychiatry
Activitas nervosa superior
International review of neurobiology
International journal of neurology
Neurologia medico-chirurgica
Archives of Neurology
Archives of general psychiatry
Comprehensive psychiatry
Journal of child psychology and psychiatry, and allied disciplines
Psychiatria, neurologia, neurochirurgia
International Brain Research Organization
The American College of Neuropsychopharmacology
Brain Research Institute in UCLA
Acta neurologica Scandinavica
Acta neuropathologica
Headache
Current psychiatric therapies
Journal of psychiatric research
Psychosomatics
Archives of Neurology
World neurology
Fortschritte der psychosomatischen Medizin
Japanese Society of Neuropathology
The Society for Psychophysiological Research
The Pavlovian Society
Rinshō shinkeigaku = Clinical neurology
Nervnaia sistema
Recent advances in biological psychiatry
Acta neurológica latinoamericana
Zhonghua shen jing shen ke za zhi = Chinese journal of neurology and psychiatry
The International journal of social psychiatry
Psychiatric research reports
Rivista di neurobiologia : organo ufficiale della Società dei neurologi, neuroradiologi e neurochirurghi ospedalieri
Ideggyógyászati szemle
Journal of clinical and experimental psychopathology & quarterly review of psychiatry and neurology
Brain Research
The Canadian journal of psychiatric nursing
Hospital & community psychiatry
Bulletin of the Los Angeles neurological societies
Neuroendocrinology
The Cerebral palsy journal
International journal of neuropsychiatry
International journal of psychiatry
Psychotherapy and psychosomatics
Series paedopsychiatrica
Contributions to sensory physiology
Committee on Brain Sciences of the National Research Council
The Joint Commission on Mental Health of Children
Acta psiquiátrica y psicológica de América latina
International psychiatry clinics
Journal of existentialism
Mental retardation abstracts
Cortex
European Molecular Biology Organization
Japanese National Committee for Brain Research
British Neuropathological Society
Japanese Society for Neurochemistry
Neurosciences Research Program
Max Planck Institute for Brain Research
The Institute of Neurophysiology & Psychophysiology (CNRS)
IBRO Bulletin
Journal of the American Academy of Child Psychiatry
Acta neuropathologica. Supplementum
Acta neurologica Scandinavica
Developmental medicine and child neurology
Psychiatry digest
Developmental medicine and child neurology
Journal of psychiatric nursing
Perspectives in psychiatric care
Psychiatrie, Neurologie und medizinische Psychologie. Beihefte
Psychoanalytic review
Paraplegia
Neuropatologia polska
Proceedings of the Australian Association of Neurologist
Contemporary neurology series
Experimental brain research
Social psychiatry
The National Center for Prevention and Control of Alcoholism (NIMH)
Center for Studies of Narcotic and Drug Abuse (NIMH)
Advances in psychosomatic medicine
The Australian and New Zealand journal of psychiatry
Journal of geriatric psychiatry
Journal of psychiatric nursing and mental health services
Zeitschrift für Psychosomatische Medizin und Psychoanalyse
Psychiatria polska
Neurologia i neurochirurgia polska
Research and clinical studies in headache
Dynamic psychiatry
International pharmacopsychiatry
Modern problems of pharmacopsychiatry
Pharmakopsychiatrie, Neuro-Psychopharmakologie
Child psychiatry quarterly
Brain, behavior and evolution
Neurosciences research
Psychiatria clinica
Journal of neuro-visceral relations
European neurology
European Brain and Behaviour Organization
Brain Research Organization (BRO)
National Eye Institute
The Neurobiology club
First Department in Neurobiology in the US located in Harvard
The Autism Research Institute
Revue roumaine de neurologie
Journal of the neurological sciences
Neurology India
Experimental neurology. Supplement
Voprosy biokhimii mozga
Neurosciences Research Program Bulletin
Progress in brain research
Neuropsychologia
The British journal of psychiatry: the journal of mental science
The Israel annals of psychiatry and related disciplines
Biological psychiatry
Behavioral neuropsychiatry
Schizophrenia bulletin
Seminars in psychiatry
Neuropädiatrie
Journal of neurobiology
Schriftenreihe Neurologie
Society for Neuroscience
The Society for Psychotherapy Research (UK)
The American Academy of Psychiatry and the Law
British Society for Social Responsibility in Science
The International Society of Psychoneuro-endocrinology
The National Institute of Alcohol Abuse and Alcoholism establishe within NIMH
Child psychiatry and human development
Journal of behavior therapy and experimental psychiatry
Monographien aus dem Gesamtgebiete der Psychiatrie
Clinical EEG
EEG-EMG Zeitschrift für Elektroenzephalographie, Elektromyographie und verwandte Gebiete
Stroke
Zeitschrift für Neurologie
Psychiatry in medicine
Zeitschrift für klinische Psychologie und Psychotherapie
Life-threatening behavior
Revista de neurologia
Neurobiology
Revue d'électroencéphalographie et de neurophysiologie clinique
No to hattatsu = Brain and development
Neirofiziologiia = Neurophysiology
Frontiers in neuroendocrinology
Proceedings; Veterans Administration
Spinal Cord Injury Conference
The International Journal of Neuroscience
Neuropharmacology journal
Acta neurobiologiae experimentalis
Acta neurologica Belgica
Acta psychiatrica Belgica
Neuroradiology
Archiv für Psychiatrie und Nervenkrankheiten
Bibliotheca psychiatrica
Neuropharmacology
Adolescent psychiatry
Archives of sexual behavior
The Hastings Center report (psychiatry ethics)
Journal of autism and childhood
Journal of personality assessment
The MRC Neurochemical Pharmacology Unit
The International Society for Pediatric Neurosurgery
National Institute on Drug Abuse
Advances in neurology
Archiv für Psychiatrie und Nervenkrankheiten
Ceskoslovenská neurologie a neurochirurgie
International journal of psychiatry in medicine
Journal of abnormal child psychology
The Journal of psychiatry & law
The Journal of the American Academy of Psychoanalysis
Psihoterapija
Surgical neurology
Studies - Hastings Center (Society, Ethics & the Life Sciences)
No shinkei geka = Neurological surgery
Zeitschrift für Kinder- und Jugendpsychiatrie
Progress in neurobiology
Memory & cognition
Monographs in neural sciences
International Association for the Study of Pain
Neuroscience and behavioural physiology
Actas luso-españolas de neurología, psiquiatría y ciencias afines
Administration in mental health
The Bulletin of the American Academy of Psychiatry and the Law
International journal of psychoanalytic psychotherapy
Electromyography and clinical neurophysiology
International review of neurobiology. Supplement
Journal of neural transmission
Journal of neurocytology
Revista de neurologia
Cognition
MH

wet, the moist and the dry disciplines that addressed central nervous system functioning, later working under the title 'the Mens Project' (from the Latin word for mind), and initially applying to the National Institutes of Health for a grant for a 'Neurophysical Sciences Study Programme' – which was approved in just two weeks; it seems that the project became the Neurosciences Research Program in a subsequent grant application to NASA and the term 'neuroscience' made its first public appearance in 1963 in the title of the *Neurosciences Research Program Bulletin* of that year. Swazey quotes Schmitt's vision, as he stated it on the first anniversary convocation of the NRP in February 1963:

> There is urgency in effectuating [a] quantum step in an understanding of the mind; not only as an academic exercise of scientific research; not only to understand and alleviate mental disease, the most crippling and statistically significant of all diseases; not only to create an entirely new type of science through vastly improved intercommunication between minds and hence to survive this present world crisis and advance to a new quantum jump . . . in human evolution; but perhaps through an understanding of the mind to learn more about the nature of our own being. (Worden, Swazey and Adelman, 1975: 529)

We can note the repeated reference to understanding 'the mind' in Schmitt's remarks – no deference to the mind–body problem here – and also the very ambition of this enterprise. The neurosciences were thus born, not as a fact or as a given object but as a project that took shape in the 1960s modelled by Schmitt explicitly on the advances that had recently taken place in biophysics, molecular genetics and immunology through the interaction of physical and chemical sciences with the life sciences. 'It now seems possible', Schmitt wrote in a 1963 progress report, 'to achieve similar revolutionary advances in understanding the human mind. . . . By making full use of [the approaches of physiology and the behavioral sciences] and by coupling them with the conceptual and technical strengths of physics, chemistry, and molecular biology, great advances are foreseeable' (quoted in Worden, Swazey and Adelman, 1975: 530). A multidisciplinary approach was thought to be the ideal route to solve complex biological problems because 'research is most productive when such disciplinary distinctions or shibboleths are ignored' (Schmitt, 1990: 189).

Canguilhem (1966) argues that while the normal may seem ontologically prior to the abnormal, historically speaking it is the abnormal that has priority – knowledge of normality, that is to say, begins from the study of abnormality, dysfunction, disorder, disease. As a general principle for genealogical studies, Canguilhem's maxim is productive, but for our particular question it seems less so. For the early neuroscientists, what needed to be analysed was not complex disordered biological states but complex states *tout court*. To be able to dissect dysfunctionalities one needed a thorough knowledge of the normal, known and elementary behaviours. Schmitt makes reference to the problem of mental disease, it is true. But there was nothing related to 'mental' abnormality or dysfunctionality in the sea hare *Aplysia* studied by Eric Kandel, the worm *C. elegans* dissected by Sydney Brenner, or indeed *Drosophila melanogaster* examined by Seymour Benzer. Although clearly essential for the understanding of psychopathologies, these models and approaches did not stem from the problems posed by disordered states of the human mind, let alone those posed by problematic forms of human behaviour. The reductionist molecular approach that underpinned early neuroscience projects aimed at studying primarily 'simple' behaviour as a way to shed more light on more complex patterns of 'abnormalcy', dysfunctions or disorders. This is exemplified by Seymour Benzer's pioneering work on mutagenic forms of flies and its importance to understand more complex forms of behaviour and indeed human brain processes (Benzer, 1967; Dudai, 2008). The idea thus was that it was necessary to bring disparate fields together to understand the complexity of neurobiological systems. And because the normal state of biological systems is complex enough, it needed to be tackled from a new perspective, a molecular approach that could let us progress one cell at a time (Kandel, 2006), one neuron at a time, indeed a single mutation of an elementary behaviour at a time (Benzer, 1967).

All of this entailed an epistemological shift in the understanding of the brain and the nervous system. The brain was now conceived of as a complex biological system that needed to be dissected and studied from different levels of analysis – cellular, morphological, developmental, behavioural, physiological, etc. – and in an integrated manner – what was termed a 'synthetic approach'. However, the fundamental underpinning of such a synthetic approach was the 'molecular' rationale; the molecular techniques, technologies and practices. This effected a mutation in the object of study itself: on the one hand, there was the brain and its 'products', and on the other, there was the subject, the organism now seen as dissectible, reducible to traits, behaviours, cells, genes, brain processes (like vision or consciousness), to atomic elements: neuromolecular parts that could be 'dissected out' and studied separately from the whole. Hence consciousness, learning, behaviour, memory and all aspects of neurobiology could now be investigated by an approach that, on the one hand, radically simplified the problem to be studied, and, on the other, drew on an interdisciplinary dialogue characterized by a shared molecular perspective. There was thus a 'molecular biology of cognition', 'a molecular biology of memory' and 'a molecular biology of behaviour'. Even the so-called field of 'social neuroscience' is seen by Eric Kandel (2006) as a kind of 'molecular sociobiology' in the making. We term the birth of this new approach to neurobiology 'the birth of the neuromolecular gaze' (on molecularization see Kay, 1997; Rose, 2007).

This neuromolecular gaze was to structure the form of the new interdisciplinary approach in investigating brain and behaviour. The interdisciplinary approach to brain, behaviour and the nervous system, though not new to the 1960s, emerged only at the turn of the 20th century. In Europe, perhaps one might mark its beginning with the launch of the Brain Research Commission (BRC) in 1903 in London at the suggestion of Wilhelm His, Professor of Anatomy at Leipzig. In the USA, perhaps the creation in 1908 of the Wistar Institute in Philadelphia under Henry H. Donaldson marks the debut of interdisciplinarity (Cowan, Harter *et al.*, 2000; Richter, 2000). But they were both premature attempts and short-lived endeavours. And it is only in the 1960s that IBRO, the successor of the BRC, which really gave form to this interdisciplinarity, was born. It was at this time that the 'power' of interdisciplinarity became visible to those who would be the pioneers of neuroscience, as they reflected on developments in the 1940s and late 1950s, such as the emergence of 'neurochemistry' and 'biophysics'. For Schmitt, those new 'hybrid sciences' had shown how valuable 'physical approaches [were] at all levels of biological organization' (Schmitt, 1985; Schmitt, 1990). This is why we suggest that it was the 1960s, with the rapprochement between biological, physical, chemical and behavioural sciences, that marks the birth of the 'neurosciences' – with the argument by the protagonists that the science of the brain and nervous system could not be carried on by one discipline in isolation from the insights being developed elsewhere in the scientific community. Knowledge of the nervous system had grown so much since the 1950s that the individual scientist, however diligent, could not keep pace with it (Schmitt, 1990).

It is worth exploring the NRP in a little more detail: it illustrates clearly both the neuromolecular form taken by reductionism in the neurosciences, and the faith placed in hybridization of disciplines as the pathway to progress. Francis O. Schmitt was a biophysicist. He was recruited to the Massachusetts Institute of Technology (MIT) in 1941 at the request of MIT's president, Karl Compton and then vice-president, Vannevar Bush, who were keen on establishing a 'new kind of biology' or 'biological engineering' that would combine physics, mathematics and chemistry (Bloom, 1997). *The Neurosciences: A Study Program* (Quarton, Melnechuk and Schmitt, 1967) grew out of the first Intensive Study Program (ISP) that took place in 1966 at the University of Colorado at Boulder where more than 100 participants from diverse professional backgrounds gathered to 'unify the disparate neurosciences' and shed the light on the emerging trends, issues, hypotheses and findings that could further advance our knowledge of the human brain. The aim of the first ISP was to answer the question 'What is neuroscience?' (Schmitt, 1985, 1990). This 'new science' which was to be born out of the disparate neural and behavioural sciences defined itself first by its set of objects of study: the brain, the nervous system, and all of its arising 'products' (learning, sleep, arousal, reflex, etc.). The second defining feature was its novel approach characterized by a 4-level analysis: molecular; neuro-anatomical; physiological; and cellular[7] (Quarton, Melnechuk and Schmitt, 1967). These nonetheless were predominantly informed and influenced by development in molecular biology (Schmitt, 1990) that was at its height in the 1950s–60s. The ‘new kind of biology’ that Schmitt was called upon to establish at MIT actually consisted in a ‘molecular biology’ heavily-rooted in biophysics, biochemistry and biophysical chemistry (ibid.). It is this molecular approach and method that will underlie the early neuroscience projects.

Of course, we do not mean to suggest that the field of the neurosciences as it became established today arose from the project of one person, namely Professor Schmitt. What is interesting, rather, is the motivation behind an initiative of this type, and the conditions and factors that allowed such a project to succeed and flourish. Schmitt, like other prominent scientists of the time (Kay, 1997), genuinely believed that it would be through the unification or ‘synthesis’ of these diverse and separate disciplines and through the reductionist molecular approach that substantial breakthroughs could be delivered (Schmitt quoted in Swazey, 1975: 530). He based this belief on his perception that the success of molecular biology, genetics, immunology and indeed biophysics arose from the ‘interdisciplinary’ dialogue between three traditionally separate disciplines: physics, chemistry and biology. He writes: ‘by making full use of these approaches and by coupling them with the conceptual and technical strengths of physics, chemistry, and molecular biology, great advances are foreseeable’ (ibid.).

There are many indicators of the renewed interest in brain research specifically in the postwar period (Figures 1 and 2). But the burgeoning of neuroscience was not an inevitable outcome, inscribed either in its institutional origins or in the compelling nature of its approach or its problems. This epistemological shift that we have termed a ‘neuromolecular gaze’ was accompanied by a shift in the mode of governance; with the state, the industry and the scientific community gathering around the same object of interest (‘the brain’) albeit with different aims, drives, expectations and motivations. Scientists, philanthropists and policy-makers believed that what was required was collaboration, professional cooperation and exchange. Many scientists sought to collaborate with colleagues across the political divisions of Europe that were set in place after the war. The political tenor of efforts of collaboration was clearly significant in brain research, particularly in the role IBRO played during the Cold War era. Volker Bigl and Wolf Singer (1991) write in their report on brain research in the former German Democratic Republic: ‘[IBRO] was one of the few platforms for legal contacts with international neuroscientists’. The famous Moscow colloquium in 1958 initiated by the French clinical neurophysiologist Henri Gastaut is also telling. Frank Morrell recalls: ‘That time . . . was the time of the thaw and there was tremendous hope that the stultifying restrictions of the Stalin era would be dispensed with and that Soviet scientists would be able to interact on an equal footing with their counterparts in western countries’ (Marshall, Rosenblith *et al*., 1996).

Beyond the political significance of such collaborative efforts, several technological advances had a significant impact on biomedical research. New techniques were developed that rendered visible previously invisible entities and processes. It suffices to mention a few: the introduction of new intracellular recordings and the development of electronic equipment were crucial to developments and advances in neurophysiology (Schmitt, 1990; Smith, 2005) such as the establishment of the chemical basis of neural transmission (Debru, Barbara and Cherici, 2008). The discovery of nerve growth factor (NGF) in the 1950s opened a new 'partnership between neuroembryology and modern biochemistry' (Kandel, 1982: 320). The belief that the first antipsychotic, chlorpromazine, had a very specific effect through its mode of action in the brain marked the birth of a new relation between psychiatry and neurobiology, and from that time on, psychopharmacology was the site of a new molecular anatomization of neural pathways, and of the elements of the brain (Healy, 2001). This was undoubtedly an exciting time for scientists, an age polarized around great scientific and technological advances (Schmitt, 1990).

Over the next 15 years, there was also a gradual redistribution of intellectual leadership between two schools of thought, psychoanalysis and neurobiology, that further exemplifies the shift to a neuromolecular gaze. Psychoanalysis in the USA had grown into the predominant force in psychiatry since the 1940s. Prominent psychoanalysts were increasingly gaining influence, holding prestigious chairs and positions in many departments in psychiatry and even neurology (Shorter, 1997). However, there was also mounting discontent with psychoanalytic approaches, on the grounds of their lack of rigour, their lack of interest in replication, and their expansive approach to mental troubles, which seemed unable to distinguish between neurosis and normality. One leading psychiatrist and neuroscientist on sleep and dreaming, J. Allan Hobson (1999), hints at the growing scepticism towards psychoanalysis or 'skirmishing', as he puts it, between psychoanalytically oriented theories and the neurobiologically determined ones in the decade after the Second World War. He writes: 'Neuroscience was in the air and many of us who were critical of psychoanalysis wanted to find new ways of studying the mind and such functions as memory and dreaming' (Hobson, 1999: 334). This faith in a more rigorous method was an important motivation. A defining moment came with the discovery of the so-called 'Activation theory', which ascribed memory failure and related cognitive defects of dreaming to the loss of aminergic modulation of the forebrain in rapid eye movement (REM). As Hobson puts it, the time had come 'to take on the psychoanalysts' (ibid.).

The capacity to 'take on the psychoanalysts' was to be enhanced by the rapid increase in the numbers of those who were skilled and credentialled in the new neuromolecular style of thought. Magoun has identified 1,400 doctorates in 'neuroscience' in the 1960s (Magoun, 1972). But this is the product of a retrospective vision. Before the 1970s the term ‘neuroscientist’ barely existed. And its early definition was associated with the ‘invisible college’ founded by Schmitt and colleagues.[8] In addition, the qualifications that Magoun counts were dispersed around a broad range of disciplines such as psychology, physiology, biology, zoology, anatomy, pharmacology, biochemistry and biophysics. Perhaps it was only in 1973 that neuroscience developed from a project into a discipline in its own right, when Amherst College became the first institution to offer an undergraduate degree in neuroscience. This new disciplinary track most probably emerged from the ‘NRP-style’ of approaching the brain. However, this was not the only pathway to the ‘disciplinization’ of the neurosciences: similar initiatives started to develop in Europe and in the UK, which came to the neuromolecular gaze and its hybridization of disciplinary approaches by different pathways.

British neuroscience: the 1950s and 1960s

In Britain, neuroscience as a project and distinct interdisciplinary discipline had a similar trajectory to its North American counterpart. Although the discipline of neuroscience was institutionalized much later than in the USA – the first undergraduate course at Cambridge, for instance, was introduced only in 1988 – the first interdisciplinary gatherings can be traced back to the 1950s. The intellectual climate undoubtedly helped to bring together professionals from different disciplines, primarily because of the availability of many new techniques to address directly the question of the role of the brain in controlling behaviour and other brain/mental processes. As in the American context, cross-disciplinary meetings were crucial in the conception of the hybrid that would become the neurosciences. These gatherings initially brought together zoologists, ethologists, physiologists and psychologists and were joined in the 1960s by pharmacologists and biochemists. These new scientific thought communities started to proliferate in the 1970s.[9]

An Experimental Psychology Society (EPS) was formed in 1946. More significant, in 1953, Oliver L. Zangwill, an experimental psychologist, and William Homan Thorpe, a zoologist and ethologist, both at Cambridge, teamed up and created a small interdisciplinary discussion group, which came to be known as the ‘Thorpe–Zangwill Club’ creating the first documented interdisciplinary and cross-departmental approach to behaviour in the UK (Hinde, 1987). Although behaviour was a crucial aspect of the development of the neurosciences, it was not its exclusive object of study. A closer parallel to the American NRP is the British BRA founded in 1968 on the initiative of Derek Richter and Donald MacKay, UK representatives on the Central Council of the IBRO.[10] The ‘London Neurobiology discussion group’, formed a few years earlier, was considered to be a key model for this collaboration.[11] Perhaps there were others, but the point is clear: in Britain too, one can date the emergence of the neurosciences out of a hybridization of disciplinary perspectives from the 1960s.

University College London opens its 'milestones in the history of neuroscience' in 1873 with the publication of the first map of the cerebral cortex by David Ferrier.[12] But, as we have argued, it was in the 1950s that the bases were laid for the birth of neuroscience, through the institutionalization of a 'new kind of science' grounded in interdisciplinary collaboration and the molecular approach. Of course, while it was only in 1950 that an Institute of Neurology is founded in the UK, neurology as a discipline and practice had been established in the 18th century. But 'neurology' does not reflect this new sort of thinking that emerged with the project of the 'neurosciences' as already discussed. In fact, the institutionalization of 'neuroscience' en bloc started to become more visible in the UK only in the US-branded 'Decade of the Brain' of the 1990s. Key moments here were the establishment of the Functional Imaging Laboratory (now the Wellcome Centre for Neuroimaging) in 1994, the Institute of Cognitive Neuroscience in 1996, the Gatsby Computational Neuroscience Unit in 1998, and the Centre for Behavioural Neuroscience in 2007. In Cambridge, the interdisciplinary Research Centre for Brain Repair was established in 1992, a neuroimaging centre opened in 1997, and the Brain Mapping Unit in 1999.

Both Oxford University and the Institute of Psychiatry (IOP) in London seem to have followed the same kind of trajectory. Although the history of IOP starts in the late 19th century with the proposal of a new student training course in psychiatry, it was only in 1914 that the training effectively started. It was in 1948 that the Maudsley Hospital Medical School became the current Institute of Psychiatry and that the British Postgraduate Medical Federation was established. It seems that the first UK degree in 'neuroscience' was offered in the 1970s: once more marking the date of the 'disciplinization' of the neurosciences.[13]

The French context, 1945–75

The term 'neurosciences' is mentioned in a French publication for the first time only in the 1984 issue of *Le courrier du CNRS*, the official publication of the Centre National de La Recherche Scientifique. In an article by André Holley (1984), a French neuroscientist known for his pioneering work on taste, the neurosciences are defined as the diverse disciplines that, since the 1970s, have gathered around 'one common object: the knowledge of the nervous system, its function and the phenomena that emerge from this function'. Yet despite the fact that it is only in the mid-1980s that the term neuroscience is introduced in France, French historians and philosophers (Debru, Barbara and Cherici, 2008) situate its emergence in the immediate postwar era. They argue that the postwar period saw the emergence of new disciplines, new techniques and methods, and new trends, particularly new forms of interdisciplinarity as an innovative way to investigate the brain. Interdisciplinarity was the watchword of new ways of articulating the objects of study, mental and neural functions. This cross-disciplinary trend led to the development of new disciplines such as neuroendocrinology or the neurobiology of aggression or 'psychophysiology' which later merged with neurophysiology as a new hybrid called 'cognitive psychology' in the 1950s and 1960s.

The French historians also point to the fact that the postwar years saw an internationalization of science, more specifically the brain sciences, through increased professional exchange and collaboration that were not only politically important but also crucial to their growth and development. The influence of American neuroscience in the training of French neuroscientists was particularly vital. Many young French neuroscientists such as Jacques Glowinski, Pierre Buser, Jean-Pierre Changeux and Yves Laporte received their professorial training in Anglo-American laboratories prior to becoming leaders in their own fields of research (Debru, Barbara and Cherici, 2008). And Debru and colleagues also argue that the international collaboration and exchange of expertise and training allowed this interesting 'hybridization' of styles of thoughts, a mixture of different practices, theories and models, which accelerated progress, innovation and creativity in the postwar flourishing of the neurosciences in France (ibid.).

The period 1945–75 also represents the lifetime of an important institute, l'Institut Marey, that since 1939 has housed what would become one of the major electrophysiology laboratories in the world under the direction of Alfred Fessard (Debru, Barbara and Cherici, 2008). This is also a time that witnessed the development of major institutes and laboratories directed by leading neuroscientists; the CNRS's Institut de Neurophysiologie et Psychophysiologie was established in 1962 under the direction of Georges Morin and Jacques Paillard (ibid.).

In France, the three decades after the Second World War witnessed remarkable changes in the scientific investigation, techniques and objects of study related to the brain sciences. The mid-1930s had witnessed a revival in electrophysiology which has grown significantly since the 1940s. Neurophysiology consolidated with the establishment of new techniques such as the intracellular recording of neural conduction which became possible in the early 1950s. Some of the key research was carried out by French neuroscientists Denise Albe-Fessard and Pierre Buser, both from the Institut Marey. French work on immunohistochemistry is credited by French historians with leading to the discovery of neurotransmitters (Debru, Barbara and Cherici, 2008) although perhaps this is to ignore the developments made elsewhere. Other key areas of work of special interest to French neuroscientists in the 1950s included research on neuro-vegetative aspects by Paul Dell and Michel Dussardier from the Institut Marey, and research in neuroendocrinology under the leadership of Jacques Benoit from the Collège de France (ibid.). The discovery of the antipsychotic effects of chlorpromazine in 1950 by the French surgeon Henri Laborit, and psychiatrists Jean Delay and Pierre Deniker, had a global impact; this new drug was welcomed as the 'psychic penicillin' (Turner, 2007), 'the magic bullet' that at last gave psychiatry some therapeutic optimism (Healy, 1997, 2001). Moreover, leading research on sleep and dreams by neuroscientist Michel Jouvet in Lyon was influential to such an extent that it attracted American neuroscientists like Hobson (1999) and others to pursue further training in Europe. Although some, as we already mentioned, have started to sketch this aspect of the historical development of the new brain sciences, it remains unclear where the institutionalization and disciplinization of 'neuroscience' as the new biology of brain, mind and behaviour fit in the French context; this crucial aspect yet awaits a more careful analysis.

CONCLUDING REMARKS

Histories of the brain sciences, including the neurosciences, have been written in many ways, from different perspectives and in different versions. However, most of them, in particular those applied to the development of the neurosciences, start in Greece, Egypt or antiquity and progress linearly as if the same logic, language, objects of study, questions and problems were maintained throughout. As we have argued in this article, there is much to learn from a genealogical approach that disrupts the linearity of all-encompassing narratives. Ours was neither an 'externalist' nor an 'internalist' account. Rather, it was an exploration of what we believe is a 'break' in the history of the brain sciences or what Foucault might call an instance of a 'local discursivity'.

We have suggested that the 1960s marks something like an event: a 'hybridization' of different styles of thought, practices and knowledges in the investigation of brain, mind and behaviour and the introduction of a reductionist and predominantly molecular approach to the realm of the nervous system that turns out to be insightful and useful. This hybridization worked with an earlier generation of hybrids formed in previous decades, notably neurochemistry, biophysics and molecular biology. Borrowing the words of MIT's president and vice-president, one might say that a 'new kind of neurobiology' started to take shape in the 1960s, characterized by an integrated approach rooted in diverse disciplines and immersed in the cellular and molecular methods which allowed, for the first time, a 'direct' investigation of complex neurobiological phenomena like memory, learning or consciousness. We argued that this development led to the emergence of a new 'style of thought' and was an important epistemological shift in the long history of the brain sciences. We termed it 'the birth of the neuromolecular gaze'.

Our three preliminary case studies show the diversity of factors that contributed to the postwar flourishing of the neurosciences, and of this new ‘style of thought’. We have merely sketched these processes here. Today, four decades after the birth of the neuromolecular gaze, we are seeing a concerted attempt, across Europe and North America at least, to argue that the discoveries of these neurosciences hold the key to the management of all manner of human activities and experiences, from psychiatric illness to economic behaviour, from human sociality to spirituality and ethics. It remains to be seen whether these attempts to translate from the molecular understanding of the nervous system to the molar management of human affairs represent a genuine advance in our understanding of the kinds of creatures we human beings are, or a premature and unwise extrapolation to society of the modest and always uncertain and correctible knowledge of the laboratory sciences.

NOTES

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1 The University of Washington; http://faculty.washington.edu/chudler/hist.html

2 SFN produced numerous archival interviews with prominent neuroscientists: http://www.sfn.org/index.cfm?pagename=HistoryofNeuroscience_autobiographies
Similarly UCL conducted a series of interviews with prominent British neuroscientists, ‘Today’s Neuroscience, Tomorrow’s History’: http://www.ucl.ac.uk/histmed/audio/neuroscience

3 Neurotree: http://neurotree.org/neurotree/

4 Wills probably means by ‘neuroscience’ the brain sciences broadly speaking and not ‘modern neuroscience’.

5 Brain Research Association (1968–92), Archive Reference: SA/BRA. File name: (Executive) committee minutes (1968–1987), Archive reference: SA/BRA/A. File name: Committee papers (1977–1992), archive reference: SA/BRA/B. Archives and Manuscripts Collection, the Wellcome Library, London, UK: http://library.wellcome.ac.uk

6 ibid.

7 Although Schmitt considered 'the behavioural approach' an additional level of analysis, all the behavioural topics were studied along these 4 levels.

8 The earliest entry for 'neuroscientist' in the *Oxford English Dictionary* refers to the March issue of the year 1964 in *Technological Review*: 'A neuroscientist sees "invisible colleges" as a means of meeting the information problem and gives a case history of one recently created, namely the Neuroscience Program (NRP), which was activated and made "visible" in Boston.'

9 File name: Local Brain Research Association Groups (1977–1984), archive reference: SA/BRA/C.1/2. Archives and Manuscripts Collection, the Wellcome Library, London, UK: http://library.wellcome.ac.uk

10 Brain Research Association (1968–92), archive reference: SA/BRA. File name: (Executive) committee minutes (1968–1987), archive reference: SA/BRA/A. File name: Committee papers (1977–1992), archive reference: SA/BRA/B. Archives and Manuscripts Collection, the Wellcome Library, London, UK: http://library.wellcome.ac.uk

11 Brain Research Association (1968–92), archive reference: SA/BRA. File name: Local Brain Research Association groups (1977–1984), archive reference: SA/BRA/C.1/2. File name: Events held by the Brain Research Association (BRA) and other organizations (1977–1984), archive reference: SA/BRA/C.1/1. Archives and Manuscripts Collection, the Wellcome Library, London, UK: http://library.wellcome.ac.uk

12 Milestones in Neuroscience at UCL: http://www.ucl.ac.uk/neuroscience/Page.php?ID=3

13 Personal communication from Steven Rose, a prominent British neuroscientist who served on the committee of the BRA in the late 1960s.

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