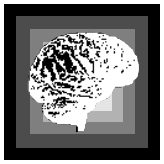


Article

History of Psychiatry
2018, Vol. 29(2) 131–146

DOI: 10.1177/0957154X18757341
journals.sagepub.com/home/hpy

‘A more perfect arrangement of plants’: the botanical model in psychiatric nosology, 1676 to the present day

Daniel Mason
Stanford University Hospital and Clinics, California

Honor Hsin
Stanford University Hospital and Clinics, California

Abstract

Psychiatric classification remains a complex endeavour; since the Enlightenment, nosologists have made use of various models and metaphors to describe their systems. Here we present the most common model, botanical taxonomy, and trace its history from the nosologies of Sydenham, Sauvages and Linnaeus; to evolutionary models; to the later contributions of Hughlings-Jackson, Kraepelin and Jaspers. Over time, there has been a shift from explicit attempts to pattern disease classification on botanical systems, to a more metaphorical use. We find that changes in the understanding of plants and plant relationships parallel changes in the conceptualization of mental illness. Not only have scientific discoveries influenced the use of metaphor, but the language of metaphor has also both illuminated and constrained psychiatric nosology.

Keywords

Carl Linnaeus, classification, DSM, Emil Kraepelin, nosology, plant taxonomy

Introduction

Metaphors, from the Greek μεταφορά, ‘to transfer’ or ‘to carry over’, convey complex phenomena in a manner that is instantly recognizable. Metaphors also have aesthetic elements, however, and these properties may limit interpretation and restrict understanding. In other words, the simplicity or beauty of a metaphor is also its drawback. In the field of pain medicine, for example, metaphors of weaponry and destruction are frequently used to describe the subjective experience of the ‘battle’ against pain – with the potential consequence of constraining treatment perceptions for patients

Corresponding author:
Daniel Mason, Department of Psychiatry, Stanford University Hospital and Clinics, 401 Quarry Road, Stanford, CA 94305, USA.

(Neilson, 2016). Metaphors may be used to describe classification itself; for example, the metaphor of a periodic table of elements suggests a natural ordering arrangement that could predict the existence of yet undiscovered elements (Hempel, 1961). This metaphor may mislead future research if applied to nosological problems where such natural order does not actually exist.

In the classification of psychiatric disorders, metaphors have been used as tools of rhetorical and philosophical debate throughout the history of the field. In perhaps the earliest example, in Plato's *Phaedrus*, Socrates famously likened a classification of madness to a metaphor of butchery, warning of the necessity of 'dividing things again by classes, where the natural joints are, and not trying to break any part, after the manner of a bad carver' (Plato and Fowler, 2015: para 265E). Even the *Diagnostic and Statistical Manual* (DSM) is often referred to as a metaphorical 'Bible' or 'Rosetta stone', images that speak to the reference's perceived roles as authoritative text, historical artefact and deciphering key, among others (Pincus, 2012). Another metaphor, the 'Chinese menu' refers to its manner of operation (Bentall, 2003).

The most influential metaphor for psychiatric classification, however, is that of diseases as plants. This metaphor grew out of a widespread Enlightenment effort to classify diseases *more botanico* (in the manner of plants) and evolved into a conceptual reference point of its own. Previous authors have documented the debt of early psychiatric nosology to botanical models (Berrios, 1999; Kendler, 2009). Yet the use of plants to understand disease relationships did not stop in the Enlightenment. Here we discuss the history of how this metaphor was introduced, elaborated, rejected and then adapted as part of the reasoning behind psychiatric classification. Notably, these changes have co-developed with the study of evolutionary biology itself, from pre-Darwinian idealism to post-Darwinian 'evolutionary' models, while biological species concepts continue to influence nosological species concepts even today.

The introduction of the botanical metaphor to nosology: Sydenham and Baglivi

Psychiatric nosology developed out of medical nosology. The Enlightenment saw a marked expansion in systematic attempts to order elements of the natural world, from chemistry to mathematics, to minerals and animals and disease. Plant taxonomy stood at the forefront of this achievement; between 1623 and 1704, the number of species identified in principal textbooks tripled to nearly 19,000.[1] Despite early inconsistences, botanical taxonomy stood out early as a paradigm of taxonomy in general (Lesch, 1990), perhaps because of the beguiling simplicity of classifying something not only tangible and amenable to enumeration, but stationary and widespread. It is worth emphasizing the rich interaction of medicine and botany at this critical stage in the history of both fields. The list of physicians who were botanists and botanists who were physicians is long. Herman Boerhaave, for example, held a chair in medicine *and* botany, administered the botanic garden at Leiden, and produced an important flora (Morton, 1981: 237); Linnaeus, as we will see, held an appointment in Medicine at Uppsala.

It is not surprising, therefore, that when Thomas Sydenham published his influential *Observationes medicae* in 1676 (Sydenham, 1676), he modelled it on the botanical system. While focused primarily on the classification of fevers and mentioning mental diseases only in passing, Sydenham introduced the botanical model into medical nosology. In breaking from Renaissance classifications of illness based on Galenic theories of the humours, Sydenham proposed a descriptive basis to disease classification that was 'at once graphic and natural':

> In the first place, it is necessary that all diseases be reduced to definite and certain species, and that, with the same care which we see exhibited by botanists in their phytologies; since it happens, at present, that

> many diseases, although included in the same genus, mentioned with a common nomenclature, and resembling one another in several symptoms, are, notwithstanding, different in their natures, and require a different medical treatment. (Sydenham et al., 1848)

Sydenham gave, as an example, the violet: 'whoever . . . should accurately describe the colour, the taste, the smell, the figure, &c., of one single violet, would find that his description held good, there or thereabouts, for all the violets of that particular species upon the face of the earth' (p. 15). Later, Sydenham extended the comparison to a description of malarial quartan fever:

> It begins almost always in autumn; it keeps to a regular course of succession; it preserves a definite type; its periodical revolutions, occurring on the fourth day, if undisturbed by external influences, are as regular as those of a watch or any other piece of machinery; it sets in with shivers and a notable feeling of cold, which are succeeded by an equally decided sensation of heat, and it is terminated by a most profuse perspiration . . . *Now putting all this carefully together, we find reasons for believing that this disease is a species equally cogent with those that we have for believing a plant to be a species.* (p. 19, our italics)

Sydenham's taxonomic system emphasized the importance of identifying 'proper and peculiar signs of the species'. Failure to do so would be like a 'careless botanist', who 'contented himself with the general description of a thistle' (p. 13). He further draws a distinction between peculiar signs and the 'accidental and adventitious ones', such as individual temperament or response to treatment: 'No botanist takes the bites of a caterpillar as a characteristic of a leaf of sage' (p. 14). For Sydenham, specificity of disease implied a parallel specificity of cure, such that a specific remedy (usually a plant) would treat a specific disease, for example cinchona bark for malaria.

While the most influential nosological writer of the seventeenth century, Sydenham was not the only one to envy the botanical model. The Italian Giorgio Baglivi, in his *Praxi Medica*, first published in 1699, similarly praised the specificity of plant classification. This is from a 1704 English translation:

> This Method, we see, is follow'd by the Botanists, who under the general name of any one Plant, *Carduus*, for instance, comprehend several Species of *Carduus's*, and are so sedulous in describing the Magnitude, Figure, Colour, Taste, and other Accidents of the Plant, in order to distinguish one Species from another, that their Industry can never be too much extoll'd. On the contrary, Physicians finding some Diseases resemble one another in some Symptoms, comprehend them under one general Title, tho' in effect they ought to be divided into as many Species, as there are principal Diseases or violent Causes to foster them, to these they promiscuously apply the same Method of Cure, tho' the Diseases are really of different Natures, and require different Cures, and ought, each of 'em to be rang'd under peculiar Heads; like the Species of a *Carduus*, which tho' comprehended under one Genus, are, all of 'em, treated apart. (Baglivi, 1723: 254)

Although not specifically attributing this thought to Sydenham, the English physician's influence is probably evident in Baglivi's choice of plant: *Carduus* is thistle.

The elaboration of botanical metaphor in the Enlightenment: Linnaeus, Sauvages, Cullen

Sydenham and Baglivi's desire to follow the example of 'the Botanists' was continued in the eighteenth century by François Boissier de Sauvages, a professor at the medical school of Montpellier. He was a vigorous classifier, producing works on plants and venomous animals; the *Éloge* opening his 1771 *Nosologie méthodique* credits him with the naming of at least five plant genera (Sauvages,

1771). While Sauvages directed his most enduring efforts to producing a classification of human disease, he made clear that the botanical model was the aspiration for his nosology. His first work, the pseudonymously published *Nouvelles classes de maladies*, was fully titled (in translation): *Which in an order similar to that of botanists, includes the genera and species of all illnesses, along with their signs and indications* (Sauvages, 1731). Like existing plant taxonomies, Sauvages arranged illnesses into hierarchical levels of organization. Most illnesses that today would be considered psychiatric fell in Class Six, '*Morbi Spirituales*', of the second of three major divisions, Chronic diseases. Class Six was subdivided into four 'sections', each of which contained, in turn, 3–9 diseases, as follows (Sauvages, 1731: 25):

> *CLASS. VI Morbi spirituales, seu animi.*
>
> Sect. I. in judicio *seu deliri.* Amentia, mania, melancolia, daemonomania.
>
> Sect. 2. in imaginatione. *imaginarii* vertigo, terror nocturnus, somnambulatio.
>
> Sect. 3. in desiderio. Rabis, Tarantismus, Erotomania, Satyriasis, Nimphomania, Nostalgia, Polidipsia, Fames, picca.
>
> Sect. 4. in horrore. Hydrophobia, Cacositia, Antipathia.

Among the many physicians influenced by Sauvages was Carl Linnaeus, who first encountered Sauvages' 1731 book while a medical student, then corresponded, praised and later honoured him by giving his name to the plant genus *Sauvagesia*. In 1759 Linnaeus published his own medical nosology, the *Genera Morborum* (Linné, 1759), six years after the culminating volume of his botanical classifications, the *Species Plantarum* (Linné, 1753). By then, Linnaeus had already laid out his belief that species were constant and unchanging.[2] In *Species Plantarum*, he created a hierarchical system mostly based on the number of sexual organs such as pistils and stamens. For higher orders of classification, such as Class, Order and Family, the system was partially 'artificial', that is, created by man; but Linnaeus nevertheless believed that 'all genera and species are natural', meaning created by God: '*Omnia Genera & Species naturalia sunt*' (Linné, 1751). Finally, in addition to each plant's traditional, polynomial description (the *nomen specificum legitimum*),[3] he gave each plant a specific name- the *nomen triviale* or 'specific epithet', a single word, which, when added to the generic name produced the binomial nomenclature still used today (Morton, 1981: 274). To use chocolate as an example, the *nomen specificum legitimum THEOBROMA foliis intergerrimis* ('smooth leafed' *Theobroma*) became *Theobroma cacao.* These principles – a constancy of species, a hierarchical nested taxonomy, classification by observable characters, and binomial nomenclature – make up the core of 'Linnaean classification'.[4]

While Linnaeus was unable to extend all principles of plant classification into his classification of disease, the *Genera Morborum* was nevertheless heavily influenced by the botanical model. In his introduction to the *Genera Morborum*, Linnaeus (1759: 4) argued that just as systematics 'served botanists so to not confuse plants, so imitating this example, can physicians equally bring clarity to disease, by classifying it into Classes, Genera and Species', and he subtended the first page of his classification with a soon-to-be-famous maxim, '*Symptomata se habent ad morbum ut folia et fulcra ad plantam*': 'Symptoms are to disease as leaves and stems are to plants' (p. 1).[5] It should be stated that while the structures of his plant and disease classifications were similar, with each disease 'genus' followed by its *nomen specificum legitimum*, Linnaeus did not actually pursue his classifications down to a 'species' level as he did in *Species Plantarum*. Thus while, for

example, he gave the chocolate plant its binomial, the mental disease *Satyriasis*, is given a *nomen specificum legitimum* (*Appetitus Veneris enormis*– abnormal sexual appetite), but no species name.

Like Sydenham's *Observationes*, Linnaeus' classification by visible external characteristics meant a departure from prevailing Galenic emphasis on aetiology. For nosology, this meant 'a system, in which, as in natural history, all diseases were . . . founded on distinctions taken from the symptoms alone, no regard being had to causes, either remote or proximate' (Pulteney and Troilius, 1805: 183). This deliberate disinterest in causality would have a long influence in psychiatric nosology; today, with few exceptions (such as classification of an illness as 'post-traumatic' or 'substance-induced'), the DSM is agnostic as to aetiology.

While Linnaeus' influence spread, Sauvages continued to develop his nosological system, in significant editions of his *Nosologia Methodica* in Latin (1763) and French (1771). The influences of Sydenham's botanical conceptualization remained central. In his prolegomenon, Sauvages cited frequently and approvingly the man he called 'the English Hippocrates', and the full titles of both editions promised a model built both on 'Sydenham and the Botanists'.[6] Again and again, Sauvages argued that medicine should follow the botanical model of classification by observable signs. In turn, he attacked alphabetical, anatomical and aetiological systems of classification. Much of the problem with medicine, he wrote, was the tendency, inherited from Galen, to classify disease by unseen anatomy and hypothetical causes. Sauvages (1771: 23) asked 'Where is the seat of mania, of melancholy, of somnambulism, tarantism, vertigo, catalepsy, of nightmares?', and his examples suggested that mental disease was particularly difficult to understand. Later he wrote 'Can modern physicians take a license that we would never pardon in a *Botaniste*? Would we allow that, to make a description of plants, they could list what their imagination tells them, instead of sticking to the testimony of their senses?' (p. 395). One would 'mock a botanist' who attempted to distinguish plants by 'hidden, obscure, doubtful and imperceptible qualities, or by their hidden and hypothetical structures' (p. 25). As an example of botanical clarity, he chose a description of jasmine, easily evoked by 'its funnelled flower with the petals divided into five parts and tubular calyx divided the same, the two stamens, one pistol & the berry with two seeds' (p. 17).

The need for a scientific nomenclature was pressing, both for students of medicine, and for physicians to distinguish themselves from ignorant public opinion. As an example of mistaken popular notions, Sauvages turned again to botany, deriding the lack of specificity in popular names like 'false sage' (p. 43). Similarly, just as the lack of a consistent system had meant the loss of ancient botanical wisdom, so had medical wisdom been lost.

> What happens to doctors is the same as to Botanists: Pliny, Dioscorides and the other Ancients, attributed infinite virtues to each plant; however, all of this was useless, because we don't know which plant they were speaking of . . . Pliny's *althéa*, Dioscorides' *rhubarbe*, Homer's *népenthe* . . . this lack of descriptions, leaving us entirely ignorant of the identity of so many diseases described by Hippocrates, like *tiphus* . . . *phrontis, phoenicie* . . . . (p. 112)

To know a plant, but not know its name was 'like the knowledge of beasts . . . who recognized their masters, but not their names' (p. 35).

The restoration of aetiology: late Enlightenment modifications

The late eighteenth century saw a great proliferation of nosologies inspired by botanical classification. But the strict reliance on external characteristics was soon challenged. In Edinburgh, William Cullen's *Synopsis Nosologiae Methodicae* (Cullen, 1780, 1800) credited Sydenham and Baglivi for the botanical impulse such that 'all diseases, in order to be easily and certainly discriminated,

should be arranged, like systems of Botany, by genera and species, with characteristic definitions: that is, by a methodical Nosology' (p. v). Cullen's work contained synopses of the nosologies of Sauvages, Linnaeus, Johann Baptist Michel Sagar and Rudolph Augustin Vogel, but, while praising their efforts, he voiced several objections. The first was one of scale: his predecessors had not gone far enough: 'They have gone at once to constitute the principal genera of the classes and orders, without sufficiently attending to the species of diseases' (p. vii). Then there were the myriad smaller differences of opinion:

> although his [Sauvages'] work abounds in useful observations, collected with great labour, yet it must be allowed that he has greatly erred in enumerating diseases under different names that are really the same, as if they were different species . . . and in considering varieties as distinct species, he has increased their number beyond measure. (p. xiii)

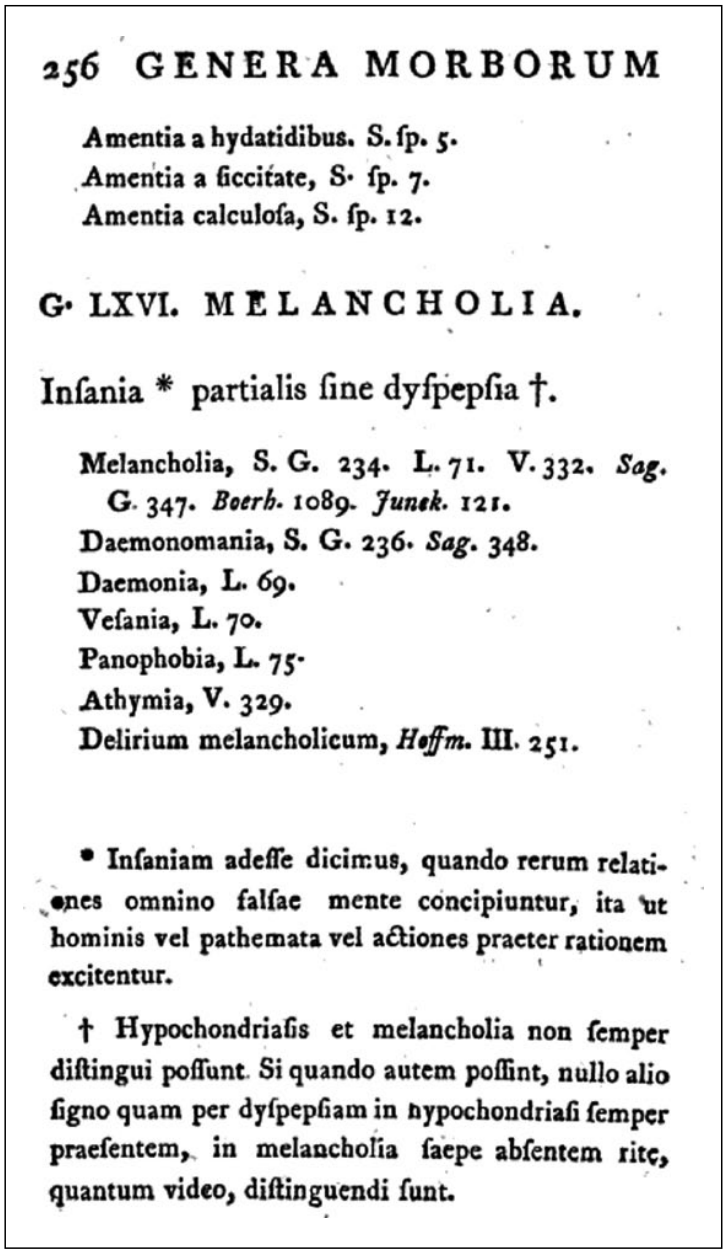
Finally, and most importantly, there was the question of what to consider as marks of a disease. While Cullen agreed with his predecessors about the inclusion of external marks 'easily observable by our senses', he considered that aetiology and natural history could also contribute to a classification (Cullen, 1800).

'Similitude in the cause of the disease, argues a similitude in the disease thence arising' (p. xv); Cullen's emphasis on aetiology marked a departure from the previous approaches that relied solely on descriptive characteristics. For Cullen, aetiology was essential to creating a system that truly represented nature. Ignore this, and one risked falling into a purely artificial system. 'The structure of genera' was 'an effort of the human mind', he wrote; 'nature has made nothing but species' (p. vii). Note here his rejection of Linnaeus' assertion that both genus and species were made by nature ('*Omnia Genera & Species naturalia sunt*'). Yet, despite his disagreements with Linnaeus, Cullen retained enough of the fundamental Linnaean assumptions to produce a work that superficially resembles the *Species plantarum* even more than his predecessors had. Indeed, at a quick glance, it would be easy to mistake Cullen's synopsis for a botanical text, with its breakdown into class, order and genera, its use of full capitals to denote genera, its use of a *nomen specificum legitimum*, and its references to previous authors and their historical varieties of species names (Figure 1).

In France, a similar transition can be noted in the work of Philippe Pinel, chief physician at the Salpêtrière. Between 1798 and 1818, Pinel published six editions of a general nosology, the *Nosographie philosophique*, and addressed mental disease specifically in his *Traité médico-philosophique sur l'aliénation mentale*, appearing in two editions in 1800 and 1809. Pinel, like Cullen, was inspired by the clarity provided by the natural historians. As he exclaimed in the first edition of his *Nosographie*: 'How much could medicine learn from the natural historian's "exactitude in description, precision and uniformity in naming . . . and a simple, regular classification invariably founded in the relationship of structure and organic function of its parts!" ' (Pinel, 1798: iv). At the same time, his enthusiasm marked a departure from traditional classification: one could imagine how Sauvages would not have been happy with this interest in speculative 'relationships'; was not Pinel like the botanists he mocked for their interest in the 'hidden and hypothetical'?

Pinel, while praising their example, saw the efforts by the previous nosologists falling short.

> The multiple, laborious efforts of Sauvages, Cullen, Sagar, Vogel, Linné, Nietzki, Selle, Van-Denheuvell, &c. to distribute all diseases in classes, orders, genera and species, as per the example of the *botanistes*, resulting in an excess of tables, an arbitrary and vacillating classification, with symptomatic conditions taken as primitive diseases, an excessive multiplication of complications of diseases without number, a kind of declared impossibility of attaining a regular grouping through fundamental points, and which finds its place without effort or confusion in memory. (Pinel, 1798: v)



256 GENERA MORBORUM

Amentia a hydatidibus. S. ſp. 5.
Amentia a ſiccitate, S. ſp. 7.
Amentia calculoſa, S. ſp. 12.

G. LXVI. MELANCHOLIA.

Inſania * partialis ſine dyſpepſia †.

Melancholia, S. G. 234. L. 71. V. 332. *Sag.* G. 347. *Boerh.* 1089. *Junck.* 121.
Daemonomania, S. G. 236. *Sag.* 348.
Daemonia, L. 69.
Veſania, L. 70.
Panophobia, L. 75.
Athymia, V. 329.
Delirium melancholicum, *Hoffm.* III. 251.

* Inſaniam adeſſe dicimus, quando rerum relationes omnino falſae mente concipiuntur, ita ut hominis vel pathemata vel actiones praeter rationem excitentur.

† Hypochondriaſis et melancholia non ſemper diſtingui poſſunt. Si quando autem poſſint, nullo alio ſigno quam per dyſpepſiam in hypochondriaſi ſemper praeſentem, in melancholia ſaepe abſentem rite, quantum video, diſtinguendi ſunt.

Figure 1. A page from William Cullen's *Synopsis* (1780: 256) for the entry of the genus *Melancholia* (Order Vesania, Class Neuroses), with brief clinical description and list of historical synonyms.

In later editions, he came to punctuate *botanistes* with a derisive exclamation mark. Linnaeus' 'botanical Philosophy could serve to clarify classification of disease', he wrote, but doubted whether the naturalist had sufficient understanding of disease to shape Nosology (Pinel, 1807: lv).

A similar ambivalence was expressed in the *Traité médico-philosophique sur l'aliénation mentale*: 'How can we understand each other,' he wrote, 'if, using the example of the Naturalists, one doesn't designate each object by signs that are manifest to the senses and proper to distinguish objects from all others?' (Pinel, 1809: lv). Yet later, when considering the divisions of mania put forward by Cullen, he drew a distinction between psychiatric nosology and the classification of plants and animals:

> We must deplore the plight of the human species, to be so often the victim of superficial medical studies, and the negligence that comes from taking as guides the methods of division adopted by the Naturalists. To establish our divisions on solid foundations, wouldn't it be necessary to consider first, with great attention, the particular objects, assembling a great number of observed facts and distribute them in more bundles following their multiple points of conformity and by their striking analogies? It has been by following an opposite route, that in medicine one has established a large number of arbitrary distributions that end up by placing physicians in dispute with each other . . . . (Pinel, 1809: 130)[7]

Part of Pinel's solution was a science further grounded in such signs, citing approvingly the *Séméiotique, ou Traité des signes des maladies* of his assistant Landré-Beauvais (1818; see Pinel, 1809). Another answer to the limits of Enlightenment nosology was to turn back to the classical tradition of Hippocrates, grounded in detailed clinical observation and awareness of the course of disease, a model incorporating life history. Attention to disease course was not unique to Pinel. It was a criterion used by Cullen as well, and even Linnaeus, whom Cullen criticized for including 'characters improperly taken from the duration of the whole disease' (Cullen, 1800: xviii). But Pinel's attention to a patient's life history was unprecedented, and foresaw innovations in the work of Karl Kahlbaum and particularly Emil Kraepelin, to be discussed later.

Botanical metaphors after Darwin

The example of Linnaean classification continued to influence nosologists throughout the nineteenth century. Despite variations in classificatory schemes, the structure of classification remained the same: a hierarchical and trait-based attempt to classify discrete entities. But it was disputed where the lines were drawn (as a synoptic comparison, see Hosack, 1821). Then, as biological understandings of plant relationships began to change, so too did the metaphors. In 1859, Charles Darwin, in his conclusion to *On the Origin of Species*, recognized the liberating force that his theory could have on the often futile effort of classification. 'The endless disputes whether or not some fifty species of British brambles are true species will cease,' he wrote, as the structures of classification would 'come to be, as far as they can be so made, genealogies' (Darwin, 1859: 484). In fact, Darwin explicitly recognized this process as a *liberation* from metaphor, predicting that the 'terms used by naturalists of affinity, relationship, community of type, paternity. . . etc will cease to be metaphorical, and will have a plain signification' (p. 485).

Just as Sydenham's thistle served as a metaphor for disease, Darwin recognized that the implication for his British brambles extended beyond botany. A genealogical approach would reform geology, for example, transforming the study of the earth from collections for a 'well-filled museum' (p. 487) into a more dynamic study of development. While he did not comment on madness per se, he recognized the implication of his theory for the study of psychology, which would 'be based on a new foundation, that of the necessary acquirement of each mental power and capacity by gradation' (p. 488). His statement was prescient. The theory of evolution would lead to changes in psychiatric nosology, both by challenging the static artificial classifications of the Enlightenment, and by providing a new metaphor for nosology.

The metaphor of evolution found, perhaps, its most influential use in the work of the English neurologist John Hughlings-Jackson. While deferential to Darwin, Hughlings-Jackson's use of the concept of evolution owed more to the work of the English philosopher and biologist Herbert Spencer, who believed that evolution was a single universal law that applied to all orders of phenomena, from plants to the nervous system of men. Just as plants had evolved greater complexity and diversity, Spencer maintained, so had the human nervous system. Spencer's Evolution had, as its inverse, a process of 'Dissolution' (Spencer, 1855, 1864). Hughlings-Jackson (1879)

incorporated this model of Evolution-Dissolution into his conception of the mind as having evolved into a hierarchical system, in which higher structures overrode lower. Symptoms, in other words, were not abnormal processes, but *normal* processes revealed by the loss of higher orders of function. As he wrote, 'disease only produces negative mental symptoms answering to the dissolution . . . all elaborate positive mental symptoms (illusions, hallucinations, delusions, and extravagant conduct) are the outcome of activity of nervous elements untouched by any pathological process' (Hughlings-Jackson, 1884: 591). This implied a new way of classifying diseases. Phenomena as disparate as aphasia, epilepsy and hallucinations could all be understood as related: all involved the loss of higher functions and the liberation of lower.

Here, to defend a theory against charges of having little practical value, Hughlings-Jackson employed a botanical metaphor to contrast two systems of classification:

> There is a classification, or strictly an arrangement, of plants by the farmer for practical purposes, and there is a classification of plants by the botanist for the advancement of biology. I submit that there is no more incongruity in classing together progressive muscular atrophy and insanity, upon the basis mentioned, than there is in classifying the bamboo with common grass, or the hart's-tongue (*Asplenium* fern) with the tree-fern in a botanist's garden. Such kind of classification of plants would be absurd in a farm or kitchen-garden; and so a classification of diseases of the nervous system, upon the principle of dissolution, would be absurd in an asylum or in the wards of a hospital. (Hughlings-Jackson, 1884: 593)

Here, the botanical metaphor serves two purposes. It suggests that just as plants are classified according to two schemes (true evolutionary relationships by botanists, and practical relationships of kitchen-gardeners), so might diseases have both natural (anatomic-physiological) and practical (clinical) classifications. To use his metaphor, Hughlings-Jackson's contribution was to classify the bamboos with the common grass. But botanical classification also served as a metaphor for nosology itself, by suggesting that physicians adopt a multiplicity of perspectives familiar to our interaction with the world of plants. It is perhaps worth noting here the example of the most substantive challenge posed to the DSM: the dimensional Research Domain Criteria used by the US National Institutes of Health to fund psychiatric research. In the public 'reconciliation' between the two systems, in which both are recognized as useful in their own way, one hears echoes of Hughlings-Jackson's metaphor of the dispute between botanist and kitchen-gardener (Insel and Lieberman, 2013).

Botanical and evolutionary metaphors also provided a framework for the American neurologist, George Beard. In *American Nervousness: Its Causes and Consequences*, Beard (1881) proposed a model of psychiatric disorders drawing heavily on plant imagery:

> Out of the soil of nerve-sensitiveness springs the nervous diathesis, which runs into neurasthenia, or nervous exhaustion. Among the many branches of this neurological tree are, in the order in which they are very likely to develop in many cases – nervous dyspepsia, sick-headache, near sightedness, chorea, insomnia, asthenopia, hay-fever, hypochondria, hysteria, nervous exhaustion in its varieties, and in the extreme cases – epilepsy, inebriety, insanity. (p. 55)

Beard's metaphor, illustrated in the frontispiece of his work (Figure 2), marked a significant conceptual departure for the botanical metaphors used by eighteenth-century taxonomists. For Linnaeus, the relationship of for example Hypochondria and Hysteria was similar to that of disparate genera such as *Theobroma* and *Coffea*. For Beard, a single tree symbolized the dynamic framework along which disease develops. The relationship between Hypochondria and Hysteria was that of one 'branch' to another of the same tree, with the implication that they share the same 'soil', the same trunk, the same roots. Notable here is an extension of the metaphor to include not only *folia*

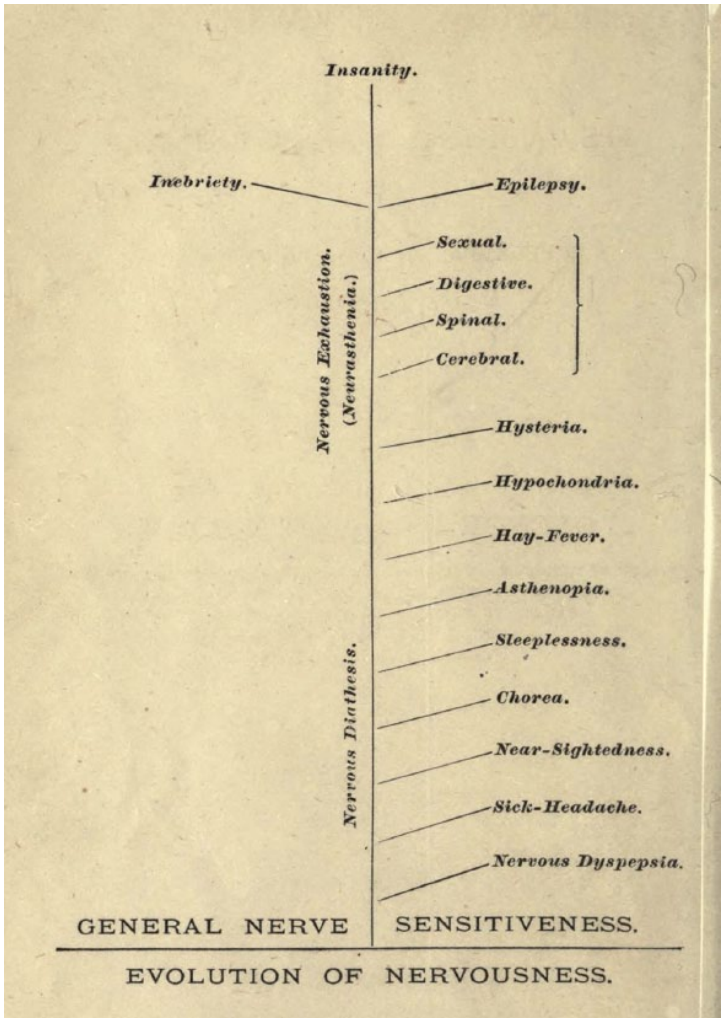


Figure 2. Beard's 'Evolutionary' tree (Beard, 1881: frontispiece).

et fulcra, but the ecosystem in which psychiatric disease, takes root, the 'influences and conditions' that made, for example, neurasthenia, an American disease.

Beard's use of the metaphor was rich and manifold. When 'a worm gnaws at the roots of a tree it is the blossoms that first begin to fade', before the entire tree succumbs to destruction (Beard, quoted in Roberts, 1882: 525). The process of education is 'like a tree drawing its nourishment from the soil' (Beard, 1881: 323): 'We die, not in wholes, but in fractions, branch after branch falling away, until the tree is bare' (p. 242).

Botany rejected, botany embraced: Kraepelin, Jaspers

Despite the development of such alternatives to Linnaean taxonomy, the botanical model continued to influence further efforts at classification. The domination of Emil Kraepelin over modern nosology remains a key element of psychiatric lore, and 'our master' would earn a reputation as psychiatry's most enduring taxonomist – 'psychiatry's Linnaeus', according to Oscar Vogt (1928). Historians of Kraepelin have long noted his interest in botany. In a post-World War I autobiographical paper, Kraepelin wrote of his long-standing fascination with the world of plants

(Engstrom, Burgmair and Weber, 2002: 92). Throughout his life, he travelled with his naturalist older brother, Karl, an expert on scorpions, among other taxa, and popularizer of the natural sciences. There have been some suggestions that Karl's influence, as well as his childhood passion for classification, might have influenced Emil's own fascination with nosology (Berrios, 1999: 149; Hippius et al., 2008: 75; Kraam, 2002; Weber and Engstrom, 1997: 383), though the direct proof of a fraternal influence on nosological thinking has so far eluded us. Hippius et al. (2008: 75) refer to what must be a charming youthful letter by Emil to Karl about a terrarium for poisonous plants.

One of the most enduring aspects of Kraepelin's legacy was his belief in the existence of natural disease entities – '*Natürliche Krankheitseinheiten*' – sharing anatomy, aetiology, and clinical symptomatology, and ultimately knowable to science (Hoff, 1995). Indeed, a belief in such entities is a key component of the neo-Kraepelinian commitment today (Engstrom and Kendler, 2015). Nevertheless, as early as the second edition of his *Lehrbuch*, Kraepelin (1887) recognized the 'purely empirical' nature of his disease categories. Ultimately provisional until science revealed each entity's true form, their use was at first practical and didactic.[8] By the third edition of the *Lehrbuch*, Kraepelin (1889: 236) explicitly rejected the possibility of achieving the Enlightenment dream for psychiatry, stating it was necessary to 'abandon for all time a systematic demarcation of mental disorders along the lines of Linnaeus' (Engstrom and Kendler, 2015), while at the same time persisting to assert the practical utility of a provisional classification. It is important to note that while Kraepelin gave up hope for what Mayer-Groß, would later call the 'visible, silent and relatively timeless, stable' world of plants (Mayer-Groß, 1929), nevertheless, his early belief in (1) discrete entities, (2) identifiable by symptoms, and (3) partially hierarchically organized, remained essentially 'botanical'.

However, it is worth noting some important distinctions. Linnaeus proposed to describe *all* plants; Kraepelin claimed only to describe a handful of disease categories rather than a complete classification (Engstrom and Kendler, 2015: 1193). Furthermore, while Linnaeus felt his species categories were natural as opposed to artificial, Kraepelin purported to describe only artificial categories. Yet Kraepelin's basic concept of a disease-entity implied that the observed symptoms had some relation to underlying biology – a natural species after all.

Over time however, Kraepelin came even to question this commitment to the idea of discrete illnesses. Indeed, modern historians of Kraepelin have questioned whether the neo-Kraepelinian position truly represents what Kraepelin said (Decker, 2007; Engstrom and Kendler, 2015: 1193). It is clear that by the end of his career Kraepelin was doubting the distinctness of his two great groupings of psychosis (dementia praecox and manic-depressive insanity: his 'pillars', to use a contemporary metaphor). In 1920, he introduced a new metaphor:

> We may compare the clinical signs with the different stops on an organ. They can be set in motion according to the severity or extent of the pathological changes. These clinical signs lend the illness its peculiar colour quite irrespective of the way in which they arise. The disorders which surface in this way cannot therefore be characteristic of a particular process. At best one could say empirically that one pathological process has a preference for this or that organ stop, or even confines itself to one stop. If we are really determined, in spite of all the objections, to diagnose the type of disease process from the clinical picture, then the above findings serve only to say that, in general, the same illness tends to affect the same areas in the same way and to the same extent. (Kraepelin, 1992: 526)

It is interesting to note that in the same paper, while not referencing Hughlings-Jackson specifically, Kraepelin made use of a similar evolutionary model, with insanity being the liberation of earlier stages of evolution, 'which surface because they have not been sufficiently well subjugated to more sophisticated mechanisms' (p. 522). The result was a process described with other vivid metaphors (faeces, mythology), in which 'harmful waste products of development can be let loose

by morbid insults, as out of Pandora's box' (p. 518). The process by which this occurred involved a complex interaction of biology, personal characteristics and external circumstances – a biological-psychological-social model reminiscent of the growth conditions influencing George Beard's nervous 'tree'.

Further proof of the persistence of the botanical metaphor in psychiatric nosology into the twentieth century can be found in the work of Karl Jaspers. Similar to Kraepelin, Jaspers, in later editions of his *General Psychopathology*, rejected the extension of the 'herbarium' model into psychiatry. Yet at the same time, he made use of a botanical metaphor to ask an ontological question:

> We have detailed knowledge of particular phenomena, of causal connections and meaningful connections, etc., but complex disease entities remain an endless, inextricable web. The individual configurations of disease are not like plants which we can classify in a herbarium. Rather it is just what is a 'plant' – an illness – that is most uncertain. (Jaspers, 1959/1997, Vol. 2: 604)

In other words, before classification, we must identify what it is exactly that we are trying to classify. Jaspers' concern echoed that of Pinel, with his critique of ontological errors ('des affections symptomatiques prises pour des maladies primitives'; Pinel, 1798: v). Jaspers rejected any absolute answer to this question, arguing instead for retaining multiple points of view, like 'causes, psychological structure, anatomical findings, course of illness and outcome' (p. 605). He acknowledged that such an approach was a 'fiction'. Why then did psychiatrists, himself included, keep making 'this vain attempt?'. The answer was that the disease-entity concept helped draw broad boundaries of mental illness in general as well as particular categories; it was needed, too, as a starting point for statistical investigations. Perhaps this is why Jaspers, after rejecting Kraepelin's disease concept model as definitive, went on to propose a basic nosology that looked quite like Kraepelin's. But ultimately the concept was provisional: 'in the face of the facts we have to draw the line where none exists'. Only broad 'outlines' of disease could emerge; while there might be 'clear contrast' between diagnostic elements, there could be no joints to carve between diseases (p. 605).

Conclusion

From Sydenham's violets and Baglivi's thistles to Sauvages' jasmine, Darwin's brambles, and Hughlings-Jackson's hart's-tongue, plants have played a critical conceptual role in the classification of mental illness across history. Do they still today? While most recent work has moved us away from classifications *more botanico*, it is striking how both the ICD and DSM remain committed to certain 'botanical' principles of classification: the assumption of discrete natural entities ('disorders'), identifiable by observable marks (symptoms and signs), classified along hierarchical structures (Chapters > Sections > Specifiers; as well as numerical, hierarchical codes, e.g. F31.75, Bipolar disorder, in partial remission, most recent episode depressed). The steady inclusion of new 'disorders' suggests this process of exploration and discovery is alive and well. Indeed, the introduction of ICD-10 into American healthcare bears a keen resemblance to William Cullen's late eighteenth-century effort to pursue classification past the species level and down to ever-smaller units of division; a splitting of the world which has not escaped derision (Pollack, 2013). Every time the question of diagnosis is raised, whether by patients seeking clarity as to their condition, or researchers seeking categories for study, we find ourselves scrutinizing *folia et fulcra* again.

Ultimately, we must ask whether the aesthetic power of this metaphor aids or constrains. For example, we would suggest that the tendency, particularly in the DSM, to denominate syndromes, symptoms and diseases as 'disorders' falsely suggests the existence of a uniform 'unit' of classification. But

there are no consistent criteria as to what constitutes a 'disorder'. For example, can it be defined by aetiology? Does it require a time-course specification? Can it co-exist with other 'disorders' or is it mutually exclusive?

Furthermore, the 'disorderization' of psychiatric syndromes reinforces the notion that there are discrete entities to be discovered, without any proof that such entities exist. Who has not participated in a fruitless discussion about whether a patient 'has' schizoaffective disorder/ bipolar type, *or* schizophrenia with mood symptoms, *or* bipolar disorder with schizotypy, *or* severe borderline personality disorder with transient paranoia . . . and not felt a bit like Darwin's botanists, arguing over British brambles? Would we be better served following a different metaphor? Kraepelin's organ stops, with their more fluid notions of symptoms and symptom clusters, might offer one solution (Regier, 2012), although in mental disease symptoms appear to have causal relationships not represented by the relationship of organ stops. There is also the problem that very few of us – these writers included, sadly – understand how this complex instrument truly works.

Interestingly, this symptom-based approach does have a compelling corollary in the botanical world: might mind-as-plant-community serve as a more accurate metaphor than mind-as-plant? Such a conceptualization not only allows inclusion of various species (symptoms) and species clusters (syndromes), but also allows for consideration of time-course and environmental factors. The ability of species to inhibit or enable one another also opens the way to consider the causal, dynamic relations between mental symptoms. One wonders whether such a model might be more conceptually useful, perhaps opening symptom modelling to the same kind of mathematical modelling of plant communities. Ultimately any metaphor is only an approximation; if 'mind-as-plant' is too simple an analogy, 'symptom-as-plant' is likely as well.

As our understanding of biological species changes – with emphasis shifting away from formulating taxonomic descriptions and towards tracing genetic lineage – the question continues to be asked whether such advances might clarify psychiatric nosology as well (Hempel, 1961). A notable recent application of the species metaphor is that of Kendler, Zachar and Craver (2011: 1146), who proposed that psychiatric disorders could be conceived as 'mechanistic property clusters', or species that are defined through these patterns of interaction with their environment. They employ a metaphor from the natural world, perhaps botanical: 'Imagine a species with a large population at the centre of its geographical range and several smaller, distal but still interbreeding, groups inhabiting a variety of different ecosystems.' Large populations of a species may thus constitute that category's 'essence' and, while fringe subpopulations may form sub-species or hybrid species that could blur lines between disease-species, 'the fuzziness of these boundaries does not detract from their stability' (Kendler et al., 2011: 1147). The trade-off of metaphorical accuracy versus aesthetic appeal is clear here: while this species metaphor may describe disease relationships more accurately than the clean joints of the Linnaean model, it lacks the aesthetic clarity of Sauvages' jasmine, a challenge for a widespread acceptance by us 'kitchen-gardeners' on the wards.

One legacy of a botanical metaphor has been indisputably beneficial: as a metaphor for psychiatry's attempts to clarify its own nosological challenges. The metaphor of competing botanical taxonomies enabled Hughlings-Jackson to propose the coexistence of two classificatory schemes, and gave clarity to Jaspers' ontological question of 'What is a plant?' More recently, the historical problems of botanical classification have themselves served as effective conceptual models for understanding the challenges facing psychiatry. Such a discussion looks to the arguments between seventeenth-century naturalists and sees the questions facing psychiatry (Kendler, 2009). How does one reconcile incompatible, if internally consistent, taxonomies? Or determine which features of psychiatric disorders reflect essential nature? Or accept artificial structures, if, as Locke wrote, 'boundaries of species are as men and not as Nature makes them' (Locke, 1877: 371)? Is Kraepelin's assumption that disease outcome was the decisive feature of mental disorders any different from

the sixteenth-century botanist Cesalpino deciding that plants should be classified according to their fruits?

So we continue to search for violets and hart's tongues. Despite psychiatry's frustrations, there is little to suggest we will stop any time soon. Indeed, a long tradition of thought suggests that the drive to classify might in fact an innate human instinct (Berrios, 1999: 146). If so, plants, in their beauty, simplicity and ubiquity, will be quite difficult – if the metaphor is allowed – to uproot from our nosologies. It remains to be seen whether we allow it to help or hinder our collective thought.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Notes

1. Gaspard Bauhin's 1623 *Pinax* listed over 6000 plants (Morton, 1981: 145); the first two volumes (1686, 1688) of John Ray's *Historia Plantarum* had 6900, to which another 11700 were added by the 3rd volume in 1704 (Boulger, 1896).
2. '*SPECIES tot numeramus, quot diversae formae in principio sun creatae*' (We reckon the number of SPECIES as the number of different forms that were created in the beginning); Linné and Freer, 2005: 157.
3. The *nomen specificum* (translated often as 'diagnostic phrase name' or 'diagnosis'– another illustration of the fluidity of botanical and medical systematics) was essentially a short phrase, highlighting what were felt to be key classificatory features. Prior to Linnaeus, this technique had been employed in different ways by different writers, with different opinions about which character should be used to classify a plant. Thus, while the Italian botanist Andrea Cesalpino used the structure of fruiting bodies to define higher classes (Morton, 1981: 137), the Englishman John Ray emphasized dividing seed-plants based on the presence of one or two cotyledons (p. 203). The result was a multiplicity of systems which, though internally consistent, were difficult to reconcile with one another.
4. As Morton (1981: 264) points out, the legendary clarity of Linnaeus' system was actually a bit muddier. Thus, while he insisted that the essential classificatory characters for plants should be based on fructification (flower and fruit), in practice he admitted other characters, most notably 'habit', a term which included almost all vegetative features.
5. In turn, in his 1751 *Philosophia Botanica*, Linnaeus would compare his system of classification to 'Ariadne's thread', which led Theseus from the labyrinth – metaphors all the way down.
6. *Nosologia Methodica, Sistens Morborum Classes, Genera et Species, Juxtà Sydenhami mentem & Botanicorum ordinem* (1763), and *Nosologie Methodique, dans laquelle les maladies sont rangées par classes, suivant le systême de Sydenham, & l'ordre des Botanistes (1771).*
7. In Pinel's method of assembling a great number of observed facts before any a priori selection or rejection, one is reminded of another botanist of the Enlightenment, Michel Adanson, who stood outside the Linnaean tradition. During a six-year stay in Senegal beginning in 1748, Adanson had found Linnaeus' sexual system inadequate, leading him to examine all plant features 'from roots to embryo, folding of leaves in the bud, manner of sheathing, development, position and folding of the embryo and radicle in the seed relative to the fruit; in a word, a number of features to which few botanists pay attention' (Morton, 1981: 303). Adanson's subsequent masterpiece *Familles des Plantes* (1763) is considered a touchstone of natural (vs. artificial) classification and a forerunner of modern numerical taxonomy beyond botany; Berrios, 1999; Kendler, 2009.
8. Here we recall Linnaeus: '*Artificiales classes succedaneae sunt naturalium, usque dum omnes sint detectae*' (Artificial classes are substitutes for natural ones, until the discovery is made of all the natural classes); Linné and Freer, 2005: 115.

References

Baglivi G (1723) *The Practice of Physick, reduc'd to the ancient way of observations containing a just parallel between the wisdom and experience of the ancients, and the hypothesis's of modern physicians*, 2nd

edn. London: D. Midwinter [etc.]; first edition published in 1704 as translation based on 1699 book in Italian.
Beard GM (1881) *American Nervousness, Its Causes and Consequences*. New York: G.P. Putnam's Sons.
Bentall RP (2003) *Madness Explained: Psychosis and Human Nature*. London: Penguin.
Berrios GE (1999) Classifications in psychiatry: a conceptual history. *Australian & New Zealand Journal of Psychiatry* 33: 145–160.
Boulger GS (1896) John Ray. In: *Dictionary of National Biography*, 47: 339–344.
Cullen W (1780) *Synopsis nosologiae methodicae: exhibens clariss. virorum Sauvagesii, Linnaei, Vogelii, et Sagari, systemata nosologica*. Edinburgh: Gulielmum Creech.
Cullen W (1800) *Nosology: Or, a Systematic Arrangement of Diseases, by Classes, Orders, Genera, and Species*. Edinburgh: William Creech.
Darwin C (1859) *On the Origin of Species by Means of Natural Selection*. London: J. Murray.
Decker HS (2007) How Kraepelinian was Kraepelin? How Kraepelinian are the neo-Kraepelinians? – From Emil Kraepelin to *DSM-III*. *History of Psychiatry* 18(3): 337–360.
Engstrom EJ and Kendler KS (2015) Emil Kraepelin: icon and reality. *American Journal of Psychiatry* 172: 1190–1196.
Engstrom EJ, Burgmair W and Weber MM (2002) Emil Kraepelin's 'Self-Assessment': clinical autography in historical context [Introduction to Classic Text No. 49]. *History of Psychiatry* 13(1): 89–98.
Hempel CG (1961) Introduction to problems of taxonomy. In: Zubin J (ed.) *Field Studies in the Mental Disorders: Proceedings of the Work Conference on Problems in Field Studies in the Mental Disorders*, February 15–19, 1959. New York: Grune & Stratton, 3–22.
Hippius H, Möller H-J, Müller N and Neundörfer-Kohl G (2008) *The University Department of Psychiatry in Munich from Kraepelin and his Predecessors to Molecular Psychiatry*. Heidelberg: Springer.
Hoff P (1995) Kraepelin. In: Berrios GE and Porter R (eds) *A History of Clinical Psychiatry: The Origin and History of Psychiatric Disorders*. London: Athlone Press, 261–279.
Hosack D (1821) *A System of Practical Nosology: To which is Prefixed, a Synopsis of the Systems of Sauvages, Linnœus, Vogel, Sagar, Macbride, Cullen, Darwin, Crichton, Pinel, Parr, Swediaur, Young, and Good*. New York: C.S. Van Winkle.
Hughlings-Jackson J (1879) On affection of speech from disease of the brain. *Brain* 2: 323–356.
Hughlings-Jackson J (1884) The Croonian Lectures on Evolution and Dissolution of the Nervous System. *British Medical Journal* 1(1213): 591–593.
Insel TR and Lieberman JA (2013) DSM-5 and RDoC: shared interests [WWW Document]; accessed (8 May 2016) at: http://www.nimh.nih.gov/news/science-news/2013/dsm-5-and-rdoc-shared-interests.shtml
Jaspers K (1997) *General Psychopathology*, Vols 1 and 2. Baltimore, MD: Johns Hopkins University Press; reprint of 1962 translation by J Hoenig and MW Hamilton from 7th German edition (1959).
Kendler KS (2009) An historical framework for psychiatric nosology. *Psychological Medicine* 39: 1935–1941.
Kendler KS, Zachar P and Craver C (2011) What kinds of things are psychiatric disorders? *Psychological Medicine* 41: 1143–1150.
Kraam A (2002) The legacy of Kraepelin [Essay Review]. *History of Psychiatry* 13(4): 475–480.
Kraepelin E (1887) *Psychiatrie. Ein kurzes Lehrbuch für Studirende und Aerzte*, 2nd edn. Leipzig: Abel.
Kraepelin E (1889) *Psychiatrie: Ein kurzes Lehrbuch für Studirende und Aerzte*, 3rd edn. Leipzig: Abel.
Kraepelin E (1992) Die Erscheinungsformen des Irreseins (The manifestations of insanity) [Classic Text No. 12]. *History of Psychiatry* 3(4): 509–529.
Landré-Beauvais AJ (1818) *Séméiotique, ou Traité des signes des maladies*. Paris: J. A. Brosson.
Lesch JE (1990) Systematics and the geometric spirit. In: Frängsmyr T and Heilbron JL (eds) *The Quantifying Spirit in the 18th Century*. Berkeley, CA: University of California Press, 73–111.
Linné C von (1751) *Philosophia Botanica*. Stockholm: Godofr. Kiesewetter.
Linné C von (1753) *Species Plantarum*. Stockholm: Laurentius Salvius.
Linné C von (1759) *Genera Morborum*. Upsaliae.
Linné C von and Freer S (2005) *Linnaeus' Philosophia Botanica*, trans. S Freer. Oxford: Oxford University Press.
Locke J (1877) *An Essay Concerning Human Understanding*. London: William Tegg and Co.

Mayer-Groß W (1929) Die Entwicklung der klinischen Anschauungen Kraepelins. *Archiv für Psychiatrie und Nervenkrankheiten* 87: 30–42.

Morton AG (1981) *History of Botanical Science: An Account of the Development of Botany from Ancient Times to the Present Day*. London: Academic Press.

Neilson S (2016) Pain as metaphor: metaphor and medicine. *Medical Humanities* 42: 3–10.

Pincus HA (2012) DSM-IV: context, concepts and controversies – Oxford Medicine. In: Parnas J and Kendler KS (eds) *Philosophical Issues in Psychiatry. II Nosology*. Oxford: Oxford University Press, 145–160.

Pinel P (1798) *Nosographie philosophique ou La méthode de l'analyse appliquée a la médecine*. Paris: Crapelet.

Pinel P (1807) *Nosographie philosophique, ou La méthode de l'analyse appliquée à la médecine*. Paris: Brosson.

Pinel P (1809) *Traité médico-philosophique sur l'aliénation mentale*, 2nd edn. Paris: Brosson.

Plato and Fowler HN (trans.) (2015) *Euthyphro: Apology; Crito; Phaedo; Phaedrus*. Cambridge, MA: Harvard University Press.

Pollack A (2013) Roughed up by an orca? There's a code for that. *New York Times* (12/29/13); accessed (3 Jan. 2018) at: http://www.nytimes.com/2013/12/30/technology/medical-billing-nears-a-new-era-of-ultra-specific-codes.html

Pulteney R and Troilius C (1805) *A General View of the Writings of Linnaeus*. London: J. Mawman.

Regier DA (2012) The Kraepelinian pipe organ model (for a more dimensional) DSM-5 classification. In: Kendler KS and Parnas J (eds) *Philosophical Issues in Psychiatry II: Nosology*. Oxford: Oxford University Press, 95–99.

Roberts MJ (1882) Transactions of American Neurological Association. *Journal of Nervous and Mental Disease* 9: 517–577.

[Sauvages FB de] (1731) *Nouvelles classes de maladies qui dans un ordre semblable à celui des botanistes, comprennent les genres & les éspeces de toutes les maladies avec leurs signes & leurs indications*. Avignon: D'Avanville.

Sauvages FB de (1771) *Nosologie méthodique: dans laquelle les maladies sont rangées par classes, suivant le système de Sydenham, et l'ordre des botanistes*. Paris: Hérissant.

Spencer H (1855) *The Principles of Psychology*. London: Longman, Brown, Green & Longmans.

Spencer H (1864) *First Principles*. New York: D. Appleton and Company.

Sydenham T (1676) *Observationes medicae circa morborum acutorum historiam et curationem*. London: Gualteri Kettilby.

Sydenham T, Greenhill WA and Latham RG (1848) *The Works of Thomas Sydenham, M.D*. London: Sydenham Society.

Vogt O (1928) Gründung eines Kraepelin-Preises und seine erste Verleihung bei der Weihe des Neubaues der Deutschen Forschungsanstalt für Psychiatrie (Kaiser Wilhelm-Institut) in München am 13. Juni 1928. *Zeitschrift für die gesamte Neurologie und Psychiatrie* 117: 195–201.

Weber MM and Engstrom EJ (1997) Kraepelin's 'diagnostic cards': the confluence of clinical research and preconceived categories. *History of Psychiatry* 8(3): 375–385.