‘An old Chinese proverb’

‘One picture is worth more than a thousand words’. A medical artist should always consider an illustration with this in mind. Unlike the brilliant illustrators of Dickens’s novels, who needed to portray larger than life characters, a medical illustrator has to portray small, often complex structures, which may never be seen in the way it is illustrated, something a photograph could never achieve. Perhaps this is why photographic illustration still plays a relatively small role in medical publishing. A carefully planned and well-executed illustration remains a useful and often the key feature of modern textbooks.

The beginnings of medical illustration are lost in antiquity. Presumably, the paucity of anatomical information in medical practice meant that there was little to illustrate. There probably were illustrated texts but none has survived. The woodcuts prior to Leonardo da Vinci’s anatomical studies and drawings were speculative rather than informative, making the truly amazing work of this genius even more impressive, but sadly they were never seen in his lifetime. There is considerable controversy over how much dissection Leonardo actually did himself and a strong suspicion emerges from the rarity of his illustrations of the brain and spinal cord that he had little knowledge of nervous structures. The only exception was his repeated attempts to illustrate the brachial plexus over a period of 10 years. His best attempt clearly shows five roots, including T1 and a passable drawing of the brachial plexus, spoiled by the failure to recognize the minor local branches as separate entities. His third ventricle appeared to drain into the interpeduncular cistern. This is an area that remains very difficult to show and illustrate.

His illustrations of the musculature of the arms and legs are masterpieces in their own right—still entirely suitable for use in modern textbooks. His technique consisted of the use of silverpoint (a stick made of an alloy of lead and tin), which produces a fine black line (the forerunner of the modern graphite pencil) and a combination of black and red chalk on tinted paper. Highlights were created with white chalk. Leonardo is the undisputed father of medical illustration and a review of all his drawings shows a variety of drawing techniques including schematics, for which only the addition of airbrushing and computer-aided design could offer any improvement. His final results can accurately be described as ‘artistic’ but so subtle that I wonder whether they would have survived conversion to wood-cuts or engravings. The founder of medical illustration was not a qualified physician but the precision of his mind is evident in his writing—‘Oh writer! With what words will you describe the entire configuration with the perfection that the illustration here gives? ... and the more you write at length, minutely, the more you will confuse the mind of the auditor’. What better paraphrase of the Chinese proverb could there be?
Over the next 50 years, the anatomical studies of Andreas Vesalius were widely published and plagiarized. He was a physician and his anatomical knowledge was based on personal dissection. It is also certain that although several of the early drawings were his own work, many were the work of Jan Stephan van Calcar, a student of Titian. The drawing methods employed by the Hunter brothers. His superb illustrations of obstetrical problems were perhaps the nearest to the perfection achieved by Max Brodel 250 years later. His illustrations were so intriguing by these scenes that he spent considerable time researching an area south of Padua in an attempt to identify the region in the Eugenian Hills that forms the basis of these backgrounds.

The impact of Vesalius’s illustrations was such that over the next 200 years there were no competitive illustrators, although two notable medical artists were active during this period. Thomas Willis (1621–1675) was the first physician/illustrator and the first 100 years of medical illustrating enjoyed the interest of two of the greatest artists of all time. An interesting feature of the Vesalius volumes is the detailed backgrounds. These were almost certainly the work of Domenico Campagnola, Titian’s landscape painter. Harvey Cushing (another physician/illustrator) was so intrigued by these scenes that he spent considerable time researching an area south of Padua in an attempt to identify the region in the Eugenian Hills that forms the basis of these backgrounds.

The other major artist of this time was Jan Van Ramsdyke, employed by the Hunter brothers. His superb illustrations of obstetrical problems were perhaps the nearest to the perfection achieved by Max Brodel 250 years later. His illustrations for John Hunter’s book *The Natural History of Human Teeth* include beautiful drawings, probably using a graphite pencil, of the skull and skull-base, although no actual drawings of the brain exist. In the early 1800s, William Clift (aged 16!) became illustrator to the Hunter brothers. Matthew Baillie took over the Hunter Anatomical School following the death of his uncle, William Hunter, and retained Clift to run the Hunter Anatomical Collection. Although not a physician, William Clift was elected Fellow of the Royal Society in 1823 (with the support of Sir Humphrey Davy) in recognition of his work with the collection. This is the highest honour ever received by a medical illustrator.

At the same time in Edinburgh, the Bell brothers, who were both surgeons and artists, extensively illustrated their own books. Engraving, which had taken over from woodcuts, was being replaced by lithography. An explosion of anatomical texts was now produced and the Vesalian illustrations were pushed to one side by new drawings. Amongst the most notable of these was the work of Henry Vandyke Carter in 1846, the original illustrator of *Gray’s Anatomy*. These illustrations and diagrams are so good that some were retained in editions well into the 20th century.

The early 20th century saw the arrival of two giants of medical illustration. Max Brödel, a German artist, emigrated to the USA in 1894 at the age 24 to work at the John Hopkins hospital in Baltimore. He is rightly recognized as the finest medical illustrator of all time. He was adept at every single technique of illustrating, but notable for two dislikes: the use of air-brushing, which he felt produced an unnatural flattened effect, and the use of opaque white to produce highlights. He worked with the gynaecologist Howard Kelly illustrating viscera and felt that capturing the glossy appearance of living tissue was essential for authenticity. He achieved this by the use of the chalk-white surface of specially prepared board and the use of deep black carbon dust obtained by sandpapering the graphite from pencils which was then applied with a brush. The end results are simply stunning. His insistence on these techniques stem from his classical artistic training, which always emphasizes the use of background washes that are not strictly uniform in texture or colour, and the rule amongst purists (apart from marine watercolourists) that the white of the underlying paper or board is the only white allowed. One has to agree when looking at a drawing of an artery where the highlight is achieved by leaving an unpainted strip, as opposed to a strip of opaque white up

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Intracranial tumors and abscesses causing communication hydrocephalus by Max Brödel 1924. With kind permission of Springer Science and Business Media.
the middle, that the effect is different and the latter much less effective. Surprisingly, in view of his great friendship with Harvey Cushing, Brödel’s illustrations of the nervous system are relatively few, but those that exist are absolutely incredible. There are informal drawings of Brödel done by Cushing and vice versa.

In England, the premier illustrator was A. Kilpatrick Maxwell, whose work is well known to all users of Gray’s Anatomy. Maxwell, like Brödel, was not medically qualified. He was an established artist who was an official illustrator during both the First and Second World Wars. His anatomical illustrations for Gray’s Anatomy are so good that they still form the core illustrations, even in the latest editions. He was in a position to make more use of colour, which in pure anatomical representation can clarify illustrations enormously. His technique was to ‘colour in’ flat colour leaving the underlying ink drawings with hard black edges so that the colour delineates the nervous structure from muscle but does not try to illustrate the texture of each tissue. Unlike Brödel, he embraced the use of the airbrush and was quite happy to use opaque white to produce highlights. On a personal note, my own efforts embrace both techniques; I find that soft pencil drawings on white illustration board produce very acceptable artistic results. This appearance is lost as I turn them into hard edged line drawings, replacing tonal differences by a combination of varying thickness of line, limited hatching or covering areas with a standard tone. My efforts to improve them further using colour failed and, despite the limitations imposed by pure line drawings, using tones and some hatching produced the most acceptable results. The illustrations are more like technical drawings, but have the advantage of clarity.

One of the finest exponents of pen and ink illustration using linear hatching to produce a three dimensional effect was Wendell Krieg, a non-medically qualified anatomist in the USA. In Functional Neuroanatomy (1942) he states—‘It was impractical to utilise an artist since a great part of the figures were to draw heavily upon a mental picture, which only a person thoroughly familiar with the subject can attain’. In this he succeeded superbly. If you can find a copy of this book it is quite outstanding. It also exactly mirrors my own view on the special role of a physician/illustrator.

This brings us to the final medical illustrator to be discussed and the subject of the book under review. He is the American illustrator Dr Frank Netter. In artistic terms I would refer to him as the Norman Rockwell of medical art. His published illustrations are coloured images either in acrylic or gouache on illustration board. Neither gives the luminosity that one can achieve with oil or watercolour and both tend to produce a rather flat matt finish that destroys the quality of wetness and glistening of living tissue that obsessed Brödel. Both also tend to over-emphasize the normal colour contrast of widely different living tissues; one of the main objections to colour in CNS illustration is the similarity in colour of different tissues.

Doctors (and lawyers consulting anatomy books) are led to believe by colour illustrations that nerves are bright yellow, tendons are green or grey, and muscles are dark brown. They cannot understand how surgeons can accidentally cut nerves during surgical procedures near joints. I think that Netter’s illustrations do not match those of Maxwell, who managed to retain some of the vividness of the colours he used by the black edging, an anathema to any trained artist who never uses true black or pure white. In Maxwell’s illustrations it is clear that the colour is there to delineate structures and not to represent the tissues as seen. The Frank Netter illustrations often lack precision and clarity for the purpose of conveying anatomical knowledge and not an artistic message—although the initial impression is justifiably of superb art work. One still has to question whether colour is essential for clarity as it occasionally seems to blur and confuse.

On the other hand, using pure black and white also has its limitations, particularly when it comes to the problem of enlarging or reducing the illustration. Some areas are of such complexity that they can only be illustrated by drawing the original at two or three times the finished size, and this is where using thickness of line as a way of conveying shape can run into trouble. Thin areas of line may disappear completely when reduced threefold, and any form of cross hatching may ‘black out’ when reduced in size to produce a solid black blob. If standard tones are used, it is essential to use a grade that is three times lighter than the finished intent or else a most peculiar reticulated effect is produced on reduction. There are also the problems of the legend and legend lines. Does every structure need naming? Is there adequate accompanying text to permit brevity? Would an annotation work better, sparing text and clarifying the illustration instantly? Will legend lines overwhelm the illustrations?

The final advantage that the modern illustrator enjoys is the use of computer technology. A recent textbook of neurosciences was entirely illustrated by the non-artist authors using a computer program with extremely effective results. This may mean that the days of the artist/illustrator are
numbered, but one hopes not. As Brödel often stressed, the planning of the illustration, to get the angle of view just right, to perfect the relative position of the structures to be illustrated, and finally to obtain the tonal contrasts and ways of emphasizing the critical areas are exercises that can both excite and intimidate. Anyone who has sat at the drawing board in a rising sea of screwed up sketch paper or spilled a drink on a nearly complete illustration knows the final joy of accomplishment. Many physicians over the past five centuries have been prepared to subject themselves to such an ordeal, for personal satisfaction and the benefit of their colleagues and to the advantage of medical endeavour. We should be grateful to those artists who set standards for these illustrative techniques.

Netter’s Neurology is one of a five volume set which, whatever else is said, represents fantastic value for money. In the late 1950s, I first saw these eye-catching illustrations and was extremely impressed, given the virtual absence of any illustrative material in the textbooks of neurology then available. I did get the impression from those earlier volumes that the text had been added to the illustrations rather than the illustrations being produced to supplement a prepared text. I was extremely surprised when I first went to the USA in 1968 to discover that the majority of American students seemed to buy Netter’s neurological illustrations as a substitute for a more comprehensive volume of neurology then available. Excellent textbooks such as Merritt, Elliot and Grinker were available and A. B. Baker’s three volume text was outstanding.

This new edition represents a genuine comprehensive textbook of neurology embracing the bulk of Frank Netter’s neurological drawings, supplemented by many new illustrations in a similar style, drawn by John Craig and Carlos Machado, both physician/illustrators. Has the best use been made of these illustrations in this present volume and do they satisfy the criteria above? There have been several photographic atlases of neurology in the last 25 years and each has demonstrated the immediate difficulty that certain events do not lend themselves to illustration or photography. These include epileptic events, headaches, facial pain, psychological disorders and, indeed, symptomatology in general. The same problem is apparent here. There is a large section on psychiatric disorders, which reflects the continuing close association of psychiatry and neurology in many US hospitals. Each disorder is illustrated by a full figure painting intended to represent the salient features of various psychiatric disturbances, and the difficulty of achieving this successfully is only too apparent. Furthermore, devoting whole page illustrations to represent progressive dementia, alcohol dependence and similar disorders almost verge on what might be called the ‘Ladybird’ book of neuropsychiatry. To return to the essential premise that a picture is worth a thousand words, there are several places in the book where a whole page picture has replaced very few words. It is hard to see that a rather unpleasant painting of somebody vomiting is necessary to illustrate the word ‘vomiting’. There are also several nice illustrations which leave a disconcertingly wrong impression. The single illustration of a lumbar puncture which appears in several places shows a rather plump lady in a less than ideal position lying on her right side. The majority of lumbar punctures are done by right handers with the patient on their left side. On the few occasions where I have been forced to do a lumbar puncture in a left handed position it has proved extremely difficult: the ‘angle of attack’ is all wrong. It is equally important that the drawings illustrate people who are likely to have the disease. The illustrations for Herpes Zoster are misleading. A young man is shown suffering from first division facial Herpes Zoster and an elderly woman is shown with T8 shingles; in reality the opposite age and sex are more likely. It is disconcerting to see testing for doll’s head eye movements in an alert sitting patient. Such testing is only useful in an unconscious patient in a lying position and then only after careful investigation to exclude coincidental neck injury. This illustration conveys entirely the wrong impression of the use of this test. There is a confusing illustration of chronic subdural haematoma complicating cerebral atrophy due to Alzheimer’s disease. This might seem a minor point, but if this is going to be the sole easily recollected feature from this section it is important to stress that the absence of blood is a feature of chronic subdural haematoma—certainly not fresh drops of blood over the surface of the brain, as shown.

There are also several areas where the illustrations have been allowed to overwhelm the text in a way that distorts the basic principles of illustration. It also accounts for the fact that there are 108 chapters, many of which are merely a whole page illustration and a rather brief accompanying clinical note. One wonders whether combining some of these brief chapters and considering whether the illustration is really adding information might be helpful in future editions. Once again the myth has been perpetuated that cerebral tumours in adults present as headache, vomiting and papilloedema. This triad is only applicable to children with posterior fossa tumours and in my own and most of my colleagues’ experience, I suspect, such presentations are extremely rare; it
is the subtlety of presentation of cerebral tumours that makes early diagnosis a minefield for the unwary neurologist. It has been my lifetime experience that the more one knows the harder it is to be a confident neurologist. The tendency to over-simplify neurological presentation is unjustified and misleading. One would question the value of illustrations showing patients undergoing procedures such as electroencephalography and electromyography, which really do not convey any useful clinical information at all but take up a whole page. Several detailed neurosurgical procedures are also perhaps more extensive than necessary in an undergraduate textbook. However, the newer illustrations on metabolic pathways and the numerous tables are excellent and I was pleased to see that in general the adjacent text does indicate the likely occurrence of the various conditions included in the list, as opposed to the impression sometimes left by a straight list that all conditions have equal loading and likelihood. Overall, this is an excellent addition to the literature and the text is right up to date. It also gives me the best example that I have seen of the problem with legend lines confusing an illustration. Turning the subject on its head, as it were, the lateral view showing all divisions of the Vth nerve has no less than 51 captions and 51 legend lines. In spite of these reservations, I think that Frank Netter’s life’s work at last has the vehicle it deserves and will undoubtedly continue the success of previous volumes.

*Neurological Disorders in Famous Artists* is the latest in the ‘Frontier’s of neurology and neuroscience’ series edited by Julien Bogousslavsky and is based on the effects of the known or suspected clinical illnesses on the special skills of famous figures from the arts. As might be anticipated, there is much about the ravages of syphilitic infection. Schubert and Delius escape reconsideration here, although the latter might have been interesting in the view of the analysis of Alphonse Daudet’s similar experience of tabes dorsalis, with severe lightning pains, which he was able to describe with frightening precision. Several, for example de Maupassant, have been discussed elsewhere, notably by Macdonald Critchley. Some of the artists such as Carolus Horne were unknown to me and I found the detailed analysis of his paintings somewhat unconvincing and perhaps no different to the alteration in style seen over time in many other artists with no known illness. Ravel probably had Pick’s disease, Mussorgsky died of alcoholism, Handel had multiple strokes and Haydn subcortical vascular encephalopathy. A good case is argued for Robert Schumann’s forced change of career from a concert pianist to composer due to focal dystonia affecting his right hand, although, as might be anticipated, during his lifetime this was assumed to be of psychological origin. The most alarming analysis was George Gershwin’s final illness—glioblastoma multiforme. Over a period of 3–4 months he developed focal and generalized seizures with olfactory hallucination, behavioural changes typical of non-dominant hemisphere involvement and catastrophic headaches. The impairment of his musical skills was noted only days before he became unconscious and died, following emergency craniotomy. The clinical diagnosis had been hysteria and migraine!

This is a fascinating compilation of the illnesses of famous and lesser known figures in the arts, although just how much impact neurological disease had on their abilities is not clear—as one might have expected—in spite of the amazingly detailed documentation.

Together, these books show the artist as an illustrator and victim of neurological disease; both are valuable to us as the informed spectator of how the nervous system works in health and disease, and each makes clear the wisdom of proverbial Chinese.

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**References**


