



Taxonomy

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‘In natural science the principles of truth ought to be confirmed by observation’.

Carlus Linnaeus (1707–1778).

Swedish botanist and physician. Known as the father of taxonomy.

Taxonomy is a branch of biology concerned with classification, especially of organisms and commonly associated with the Victorians. The most notable taxonomist of the 19th century was probably Charles Darwin (1809–1882), whose ‘evolutionary or Darwinian classification’ published in ‘On the origin of species’ was prophetic although still disputed by some. Other important names to haematologists include Hans Christian Gram (1853–1938), Robert Koch (1843–1910), Paul Ehrlich (1854–1915) and of course Louis Pasteur (1822–1895). Classification of bacteria, fungi and viruses, especially pathogens, is an important aspect of haemopoietic cell transplantation (HCT) that helps doctors in the management of recipients.

During my early HCT career (1980s) gram-negative bacterial infection in HCT recipients was particularly feared, especially *Pseudomonas aeruginosa*. With the advent of pre-emptive use of antibiotics, positive pressure rooms and high-efficiency particulate air filtration, fewer recipients of HCT die of gram-negative infection. As time progressed the emphasis shifted to gram positive organisms [1], vancomycin-resistant enterococci, which although rarely fatal, became a significant cause of morbidity. It became clear to those working in HCT units that a thorough knowledge of the bacterial flora in their centre was paramount together with a close relationship with their microbiologist/infectious diseases colleagues.

Over time it also became clear that fungal infection posed a problem. Local mouth or vaginal infection with *Candida albicans* was treatable/preventable with azoles or prevented with oral nystatin. A much more serious problem, however, was infection with *Aspergillus fumigatus*. Taxonomy studies reveal that this organism is particularly adept at acting as a human pathogen [2]. About 40 of the 240 species of *Aspergillus* have been reported to be human pathogens but *Aspergillus fumigatus* accounts for 90% of systemic infections according to Abad et al.. The conidia (spores 2–3 µm in diameter) are able to reach the pulmonary alveoli so the combination of biological characteristics and the immune status of the patient ‘make *Aspergillus fumigatus* the primary pathogenic mold in the world’ [3]. The ability of the mold to invade blood vessels, Fig. 1, causes infarction and can lead to catastrophic haemoptysis. In spite of blood tests to detect β-glucan, galactomannan and serum antibody precipitin (personal communication Robert P. Gale), high-resolution CT of thorax is still the preferred investigation in an HCT recipient if a diagnosis of pulmonary aspergillosis is suspected.

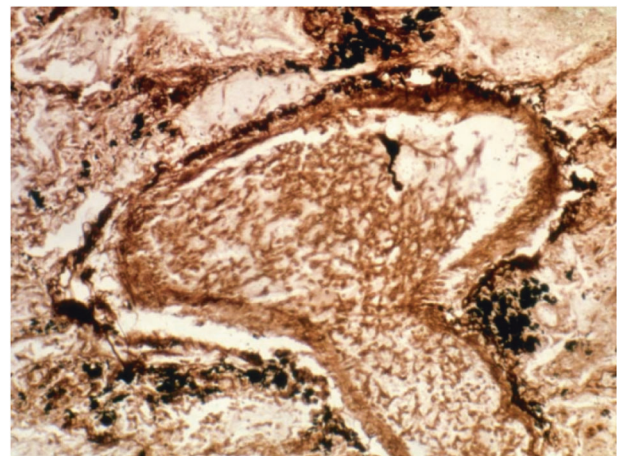


Fig. 1 *Aspergillus fumigatus* invades blood vessels. An autopsy photograph, St James’ Hospital, showing *Aspergillus fumigatus* invading a blood vessel.

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On the other hand, taxonomy of viral pathogens is a contested area. As Siddell, a member of the International Committee on Taxonomy of Viruses (ICTV), points out [4] ‘taxonomy is important, but it is not fixed—changes are continually being made in response to new information on known and novel viruses. The mechanics of virus taxonomy are also changing, ...which may eventually lead to automated classification’. The ICTV Coronaviridae Study Group determined that the virus SARS-CoV-2 belongs to the existing species, severe acute respiratory syndrome related. Hopefully detailed knowledge about the virus will lead to specific treatment while we await an effective vaccine. Although infectious pathogens pose a problem for health care workers and patients, they can also lead to closure of HCT units [5].

The best-known classification to doctors is the Periodic Table of Elements published by Mendeleev in 1869 (I knew those chemistry lectures would eventually be useful). Many important scientists preceded Mendeleev but the person who caught my attention was al-Razi (ابوبکر محمد زکریای رازی), a Persian physician and polymath (854–925 or 932 CE) who made many original discoveries in chemistry and is sometimes referred to as the ‘father of experimental medicine’.

Is taxonomy or classification of wines important? Yes. Originally vines were classified by the morphology of vine leaves but latterly genetic and molecular analyses have taken precedence [6, 7]. Probably the best-known classification of wines was the 1885 classification of Bordeaux wines (Fig. 2). Although that classification has stood the test of time it is interesting to know that the third President of the United States, Thomas Jefferson (1743–1826), suggested his own classification but, according to Jane Anson [8], Jefferson’s classification, although he spent quite a short time in Bordeaux, was preceded by another Founding Father, John Adams (1735–1826). The 1885 classification was requested by Napoleon 3rd for the Exposition Universelle de Paris (1885). A number of other attempts had been made to classify Bordeaux (Medóc) wines but the 1885 classification is still used today. Château Haut-Brion is the only first growth from Graves to be included. Interestingly Jefferson’s classification, at least of the first three growths, is remarkably similar to the 1855 classification. Jefferson was also rather partial to wines from Château d’Yquem, but whether these wines were botrytised or not remains a matter of debate.

If you think you are experiencing difficulties in going to your local wine merchant or supermarket in these COVID-19 times spare a thought for Jefferson who had to worry about shipwreck, poor temperature control during shipping, piracy and adulteration when he imported wines to America.



Fig. 2 A bottle of Chateau Lynch-Bages 2005. It was a present and we kept in a temperature and humidity-controlled environment for 10 years. We drank it during the lockdown. It was beautiful.

In 1898, the engineer Antoine Budker painstakingly mapped the vineyards of Beaujolais [9]. He highlighted the best vineyard sub-regions within the villages and communes of Beaujolais, ranking the best sites from first to fifth class. Unlike the Bordeaux classification, the Budker version was based on the quality of terroir (climate, soil and terrain), rather than wine prices.

So, whether you believe classifications of pathogens or wines are helpful or not it looks like they are here to stay.

Compliance with ethical standards

Conflict of interest The author declares that he has no conflict of interest.

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