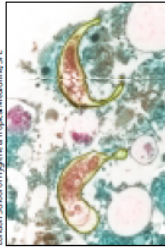


Responsibility in naming pathogens: the case of *Pneumocystis jirovecii*, the causal agent of pneumocystis pneumonia

The purpose of scientific names of organisms is unambiguous communication. Internationally agreed rules (codes) detail procedures to minimise name-changes in different groups of organisms.^{1,2} Why then does the single species causing pneumocystis pneumonia (PCP) in human beings still appear under

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two names, *Pneumocystis carinii* and *Pneumocystis jirovecii*?

The organism first featured in the literature in 1909, but was considered a cyst-like stage in the life cycle of *Trypanosoma cruzi*, the cause of Chagas disease.³ The cysts were first discovered in marmosets, and later in rats. In 1912, the cysts were recognised as independent from the trypanosome, and *P carinii* was introduced as the name for the organism in rats.⁴ In 1951, an organism causing a widespread pneumonia in human beings, especially in disadvantaged children, was identified as *P carinii*, and in the 1980s the number of occurrences increased substantially in immunocompromised adults, especially those with AIDS.⁵ *P carinii* was considered a protozoan, but doubt about its placement was occasioned by ultrastructural studies in the 1960s and 1970s.⁵ However, molecular sequence work in the late 1980s and early 1990s left no doubt that it was a fungus. The fungus actually occupies an isolated position near the base of the phylum Ascomycota,⁵ and a new order and family were described for it.⁶ The latest multigene phylogenies place it near the Ascomycota/Basidiomycota divide and close to the red yeasts,⁷ something hinted at in one of the earliest molecular studies.⁸

The position of the organism was not the only issue to arise from molecular studies; the pneumocystis organism in human beings was not the one in rats,⁹

used, although are to be spelt *carinii* and *jirovecii* (not *carini* and *jiroveci*).

Under the botanical code, the application of names can be fixed by permanently attaching them to a collection different from the original one to maintain current usage—subject to approval of a committee, in this case the Committee for Fungi. Both *carinii* and *jirovecii* are currently used in the medical literature for the same organism. On Nov 25, 2006, PubMed (<http://www.pubmed.gov>) had 6939 references to "*carinii*(i)" and 432 for "*jiroveci*(i)"; the hits in Google Scholar (<http://scholar.google.com>) on the same day were 30200 and 1564 respectively; the "*carini*(i)" citations included ones that were not on human beings. Redhead and colleagues¹³ fixed the application of *carinii* to material from rats, and *jirovecii* to preparations from human lung tissue. But with such a massive predominance in the usage of *P carinii*, would it have been more responsible to have used human material to fix the application of that name? No such formal proposal was made to the Committee for Fungi, but an informal plea for the issue to be examined was made¹⁴—although not supported by leading medical mycologists¹⁵—and is still being argued against.¹⁶ Were the specialists ignoring the best interests of their constituency?

The crucial argument for the adoption of *jirovecii* is that uses of *carinii* include species from mammals

and strains seemed specific to particular mammals.¹⁰ Different infraspecific naming systems were proposed in the 1990s¹¹ since microscopically the organisms seemed indistinguishable, but accruing molecular evidence suggested different species were involved—and *P. carinii* from rats would not infect human beings. The first species-level name for the organism infecting human beings dates from 1976, *P. jirovecii* (as *jiroveci*), originally separated on the basis of host and serological differences.¹²

However, the names *P. carinii* and *P. jirovecii* were introduced in the belief that they were protozoans and were available for use under the zoological code,² but as fungi the botanical code had to be applied. Neither name met the criteria for valid publication under the botanical code until July 2005,¹³ when that code was changed to enable names originally described as “animals”, to be automatically treated as valid.³ Both names then became free of nomenclatural obstacles and could be

other than human beings. By contrast, where *jirovecii* is used it is unambiguously associated with the species attacking human beings not rats. Furthermore, *jirovecii* is now well established (182 vs 242 uses for “*carinii*” in PubMed for 2005–06). When the issue was considered informally by the Committee for Fungi in 2004–05, they deferred action until all nomenclatural issues were clarified.¹³ All options have now been considered, the consensus among specialists is to use *jirovecii* to avoid continuing confusion, and I now concur. The moment to consider a re-fixing of the application of *carinii* has long since passed. That action would now compound the confusion, and be an irresponsible course to take.

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Reflection and Reaction

I declare that I have no conflicts of interest. I am indebted to Scott A Redhead (Agriculture and Agri-Food Canada, Ottawa, Canada) for discussions of this case.

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Editor's note

In describing how the organism that causes pneumocystis pneumonia in human beings has come to be renamed as *Pneumocystis jirovecii* (pronounced “yee-row-vetsee”), David Hawksworth asks: “Were the specialists ignoring the best interests of their constituency?” In my opinion, the answer to this question is that they probably were. However, I agree with Hawksworth that to further contest the name change would only add to confusion.

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Henceforth, *P. jirovecii* will be the name used by this journal and the other Lancet journals.

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