

Moore, D. & Chiu, S. W. (1998). A post-card from Nijmegen. In: *Proceedings of the Fourth Conference on the Genetics and Cellular Biology of Basidiomycetes* (L. J. L. D. Van Griensven & J. Visser, eds), pp. 179-181. The Mushroom Experimental Station: Horst, The Netherlands.

## A Post-Card from Nijmegen

To Professor A. H. Reginald Buller, Buller Library, Research Branch, Department of Agriculture, Winnipeg, Canada<sup>1</sup>

Dear Reginald,

We are just back home from Nijmegen, where we enjoyed an excellent meeting in GCBB4, though we guess that you would have been a little disappointed had you been able to join us. It's clear that the molecular techniques which are now available are being applied with great imagination and skill. Also, enough people seem to be involved to create the necessary 'critical mass'. We heard about the successful construction of expression vectors on the filamentous fungal model, and the successful cloning of many basidiomycetous genes using heterologous probes and their further sequence analyses. Indeed, studies of the dependence of expression on introns and use of hybrid systems to study gene function put basidiomycete genes at the forefront of the development of knowledge of eukaryote gene architecture.

Overall, the cheering message is that there is a real promise of major advances in understanding in the near future. The disappointment is that the breadth of thought and careful comparison between laboratory experiment and events in nature which characterised your own '*Researches on Fungi*' seem to be lacking in much of the current research. A harsh, but not entirely unjustified, opinion would be that few molecular biologists give much attention to **biology**. How many of them have ever read your books, we wonder, or have even referred to the *Dictionary of the Fungi*<sup>2</sup>? How many know they exist?

It's the danger of lost opportunity which is a major worry in this. Take the mating type factors as an example. Your own contribution to this topic is legendary, and you would find it difficult to believe the detail which is beginning to emerge. Mating type sequences have been cloned and nucleotide and amino acid sequences of products determined. The practitioners of these particular arts are now grappling with the protein interactions and the putative functions of pheromones and pheromone receptors. These are rightly considered inspiring and supremely polished (and persistent!) studies, yet most of what is known is limited to those 'text-book' examples, *Coprinus cinereus* and *Schizophyllum commune*. As you know, Reginald, text-book examples they may be, but they are neither closely related nor representative.

The point about relationship matters because increasing care must be exercised in making comparisons as the features which are compared become more detailed. We are now getting to the stage where the cell biological functions of components of the mating type loci can be hypothesised, but the scope of the biology which this encompasses does not go beyond the narrow text-book description of the basidiomycete sexual process. The enormous differences between the biology of the wood-degrading aphyllorphorean *S. commune* and the litter-degrading agaric *C. cinereus* seem to be in danger of escaping notice as they are swept along by an 'if it's got gills it must be an agaric' school of thought. Yet, in agarics (like *C. cinereus*) adjacent basidia in the hymenium arise at the apex of sister branches from parental sub-

hymenial hyphae. On the other hand, in aphyllorphales (like *S. commune*) adjacent basidia arise through proliferation at sub-basidial clamp connections<sup>3,4</sup>. It's that clamp connection bit that interests us. If mating type factor functions include clamp connection biology then there might be more functions for them to perform in *S. commune* than in *C. cinereus*. It might be likened to comparing two animals that swim - it's OK if they are both fish, but one might be a dolphin. If you don't know that dolphins exist, you could miss a lot in your comparisons! It's not just *S. commune* and *C. cinereus*, of course, those other non-agarics *Lentinula* and *Pleurotus* are also too often discussed as though they are also ordinary mushrooms.

We question whether the 'text-book' basidiomycetes could represent all filamentous basidiomycetes. Little attention is directed towards finding out how those constitutionally diploid *Armillaria* species organise their mating type functions. And, amazingly, mating types of *Agaricus bisporus*, the most commercially valuable basidiomycete, were hardly mentioned. What are the mating type factor sequences doing in a secondary homothallic life history of a multinuclear heterokaryon which lacks clamp connections?

In terms of technology, it's amazing how gene mapping has developed and several elegant experimental approaches were described for studies of meiosis, isolation of development-specific genes and location of their sites of activity. Not to mention re-evaluation of nuclear behaviour during conjugate division and clamp connection formation. Accumulation of galactose-specific lectins during fruit body development, the positioning of nuclei and observations of oidiation in *C. cinereus* were among the reports David particularly noted as boosting his prejudices for ideas about attainment of competence and his notion about tolerance of imprecision<sup>5</sup>.

Thought we offer heartfelt thanks for the hard work done by the organisers of the meeting, we are still sad to find that most papers presented these days give only a fragment of the overall picture. Physiology doesn't seem to be popular any more, although all those molecules which people study must be contributing to *something*, and we were left wondering if anybody reads about *organisms*. On the other hand, it was a pleasure to see so many mycologists with interests in basidiomycete cell biology and genetics. Let's hope that as their knowledge matures their interests will move towards the same deep appreciation of basidiomycete biology which so enthralled you.

With thanks for your inspiration over the years

We remain

David Moore

Siu Wai Chiu

## References

<sup>1</sup>Arthur Henry Reginald Buller (1874-1944) was Professor of Botany at the University of Manitoba (1904-36) but never relinquished his British nationality. He died in Winnipeg of a brain tumour on 3 July 1944. He was an ingenious experimenter who devoted his life to research on the activities of fungi, especially spore discharge and heterothallism. He published his findings in seven volumes of his personally financed *Researches on Fungi*, 1909-50 (published by Longmans, Green & Co.). These books have been, and remain, a remarkable resource of knowledge and ideas. His ashes are deposited in the Buller Library of the Research Branch, Canada Department of Agriculture, Winnipeg.

- <sup>2</sup>Hawksworth, D. L., Kirk, P. M., Sutton, B. C. & Pegler, D. N. (1995). *Ainsworth and Bisby's Dictionary of the Fungi*. CAB International: Wallingford, U.K.
- <sup>3</sup>Niederpruem, D. J. & Jersild, R. A. (1972). Cellular aspects of morphogenesis in the mushroom *Schizophyllum commune*. *CRC Critical Reviews in Microbiology* **1**, 545-576.
- <sup>4</sup>Niederpruem, D. J., Jersild, R. A. & Lane, P. L. (1971). Direct microscopic studies of clamp connection formation in growing hyphae of *Schizophyllum commune*. I. The dikaryon. *Archives of Microbiology* **78**, 268-280.
- <sup>5</sup>Moore, D (1998). *Fungal Morphogenesis*. A volume in the Developmental and Cell Biology series for Cambridge University Press: New York.