Symposium. Monday, 17:00. **32**

Parasite takes fly - A Drosophila model of Microsporidia infection

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More than 150 years of Microsporidia research led to a basic understanding of many aspects of microsporidial biology, yet little is known about the genetic basis and molecular mechanisms of the intimate host-parasite relationship that govern Microsporidia infections. Genetic model organisms such as *Drosophila melanogaster* are relevant to the study of human infectious disease as most disease-associated genes have homologues in the fly genome. The knowledge about *D. melanogaster* host defense against obligate intracellular parasites remained, however, particularly patchy for lack of good infection models. A few years ago, a strain of *Tubulinosema ratisbonensis* infested our laboratory fly cultures and led us to model Microsporidia infections in *Drosophila*. Thus, we developed the first infection model of parasitism by a eukaryotic intracellular parasite of *Drosophila*, *T. ratisbonensis*. A unique feature of the *Drosophila* model is that we have developed infection models both in permissive cell lines and in adults. In addition, we have identified several nonpermissive cell lines that will allow us to identify some host defense genes. The ease to move from insights gained at the cellular level from *Drosophila* cell cultures to the whole-organism level using transgenic techniques will allow gaining an in-depth understanding of the biology of Microsporidia in flies, especially when combined with multi-'omics' and functional genomic approaches that we have started to implement. This infection system provides thus novel opportunities to understand the mechanisms underlying microsporidiosis in other invertebrate such as bees and vertebrates hosts and may hopefully lead to novel concepts relevant to parasitology.

Symposium. Monday, 17:30. **33**

White Sea metchnikovellids: morphology, life cycles; potential ancestral features of microsporidia

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Family Metchnikovellidae (Class Rudimicrosporea Sprague 1977) seemingly a basal taxon of Microsporidia, remains understudied. We present data on ultrastructure of two species of metchnikovellids infecting lecudinid gregarines from polychaetes *Pygospio elegans* sampled in the White Sea silt littoral zone. The first species, *Metchnikovella incurvata,* Caullery and Mesnil was described in 1914, the second, *M. spiralis* -- only recently (Sokolova et al., in press). The two species have similar structure of free spores, vary in intracellular development, and produce dissimilar spore sacs (cysts). The cysts of the latter species exhibit unusual morphology: they are limited by a thick electron dense wall, externally ornamented with spirally wound cords of dense material. Basing on comparison of fine morphology and life cycles of metchnikovelllids and other microsporidia, I believe that the following traits could be treated as plesiomorphic among microsporidia: paired nuclei, meiosis, division by internal budding (endoplygeny), short or anisofilar polar filaments, and sequence producing thick-walled environmental cysts. Metchnikovellidean spores possess short polar filaments (manubria) and likely do exploit the mechanism of dispersion via everting the polar tube with the attached sporoplasm, the major synapomorphy of Microsporidia. At the same time metchnikovellidan spores are devoid of most elements of the extrusion apparatus: a polaroplast, posterior vacuole, rigid spore wall, and long polar filament connected with a polar disc. The minimal apparatus of metchnikovellids may allow dissemination only within one cell (autoinvasion), whereas production of thick-walled cysts enables horizontal transmission of spores among hosts. .

Symposium. Monday, 18:00. **34**

Microsporidia: Pathogens of Opportunity

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Kudo published the first comprehensive treatise on the microsporidia "A Biologic and Taxonomic Study of the Microsporidia" in 1924 which was a critical review and systematic treatment of all literature on the microsporidia at the time. It would be more than 50 years before another treatise would be produced, "Biology of Microsporidia" in 1976 and Systematics of the Microsporidia" in 1977 by Vavra and Sprague. This would remain the "go to" authority on the microsporidia until 1999 when "The Microsporidia and Microsporidiosis" was published containing chapters on microsporidia in vertebrate and invertebrate hosts and the first comprehensive review of the growing field of molecular biology and phylogeny of the microsporidia. With the field rapidly advancing in many aspects of basic and molecular biology of the microsporidia it was apparent that a revision and expansion of the previous volume was needed. This effort has resulted in the Microsporidia: Pathogens of Opportunity L.M. Weiss and J., J. Becnel (Eds.) John Wiley & Sons, Oxford, UK with 25 chapters complied by experts including evolutionary and molecular biologists, veterinarians, entomologists, ichthyologists and physicians who study microsporidia. This is intended as a resource for those students and young researchers with an interest in the study of microsporidia as well as expanding the knowledge base of microsporidiologists from different disciplines within the field. An overview of the various chapters will be presented and topics of current relevance highlighted.