Intracellular location of mycoplasmas

Mycoplasmas associated with animals have generally been regarded as extracellular and their specific attachment to the surface of eukaryotic cells has been widely reported. However, in recent years evidence has accumulated that certain species, including Mycoplasma fermentans, Mycoplasma genitalium and Mycoplasma hominis, may have an intracellular location, and Mycoplasma penetrans, isolated from the urine of AIDS patients, has been shown to penetrate a wide range of cultured animal cells (1). The ability of mycoplasmas to survive within host cells is significant and might help explain the chronic nature of many mycoplasma infections and the persistence of asymptomatic carriers. Furthermore, their survival within professional phagocytic cells might lead to dissemination within the host.

M. fermentans has been implicated in human diseases affecting diverse body tissues. We have obtained electron micrographs of M. fermentans (PG18) with human polymorphonuclear leukocytes (PMNL) which show mycoplasmas clustered within phagosomes and also single mycoplasma cells apparently free within the cytoplasm (Fig. 1). There is an apparent interaction between the cytoplasm and these intracytoplasmic mycoplasmas that leads to the formation of an electron-dense layer completely enclosing the mycoplasma cell and approximately 30 nm in thickness. This electron-dense layer may be surrounded by a membrane. The frequency with which intracytoplasmic mycoplasmas were seen was greater where mycoplasma cells were non-opsonized than when non-specifically opsonized by incubation for 45 min in 10% human serum. In contrast, when mycoplasma cells were opsonized, intracellular mycoplasmas were almost always internalized within phagolysosomes.

It has been argued that in electron microscopic studies the appearance of mycoplasmas within cells might be artefactual and due to the presence of the mycoplasmas within imaginations of the cell membrane. Thus, Taylor-Robinson et al. (2) claimed that unequivocal evidence of the intracellular location of mycoplasmas required specific staining of both the mycoplasma and host cell surface. This was achieved in their study using gold-labelled anti-mycoplasma antibody and ruthenium red, which bound to the exposed polysaccharide surface of both mycoplasma and eukaryotic cell surfaces, but not to the membranes of cell vacuoles. Jensen et al. (3) found ruthenium red staining of the Vero cell membrane to be weak and of little value in confirming the apparent intracellular location of M. genitalium cells. They argued that where mycoplasma cells appeared close...
to the cell nucleus, this was good evidence for an intracellular location. Interestingly, the apparently intracytoplasmic M. genitalium cells seen in their electron micrographs were embedded within electron dense material. This reaction may be similar to that for M. fermentans cells within human PMNL, suggesting a phagosome-independent uptake route for mycoplasmas and confirming an intracellular location.

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Fig. 1. Electron micrographs showing M. fermentans cells within human PMNL. Bars, 100 nm.