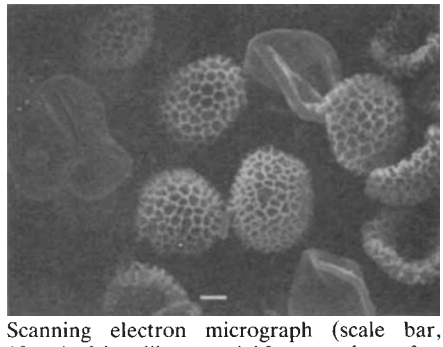
Lycopodium spores found in condom dusting agent

SIR—Following an inquiry from an industrial supplier of botanical products, the use of a potentially hazardous plant product in the production of condoms has come to our attention. The product, spores of the staghorn clubmoss *Lycopodium clavatum* L. (Lycopodiaceae) — also called vegetable sulphur[1] — is used as a dusting agent on at least one major brand of non-lubricated condoms to prevent the rolled latex from sticking to itself.

While trying to locate additional supplies of this product, we discovered numerous references to its use and hazardous nature. The spores contain 50 % of a fixed oil, as well as sucrose and phytosterol[2,3]. Due to the high proportion of oil, the spores are resistant to wetting, have emollient properties, and are highly flammable. Spores of *Lycopodium* species, including *L. clavatum*, have been used for a variety of purposes. Exposure to *Lycopodium* spores can cause allergic reactions ranging from dermatitis to severe asthma attacks. These reactions have been recorded in pharmacists exposed during preparation of spore-coated pills and suppositories; in metal workers exposed to dry parting compound used to prevent metal from sticking to wooden moulds; in theatre personnel and patrons because of exposure to face and hair powders; as a hay-fever response to natural exposure; and in consumers using dry shampoos, face and hair powders, and spore-coated pills[3,4].

Of most concern are reports of *Lycopodium* spores causing adhesions on serous surfaces and foreign-body granulomas in soft tissue through introduction into wounds from rubber gloves and supplies used during surgery[3,5–8]. A foreign-body response causes lesions composed of granulation tissue arranged in the form of nodules, consisting of epithelioid cells, multinucleated giant cells, lymphocytes and fibroblasts with areas of necrosis. It simulates neoplastic disease or infective granulomas caused by bacteria such as tuberculosis or syphilis. The causative agent may be overlooked because the spores are poorly visualized in haematoxylin and eosin, but stain bright red and acid-fast in Ziehl–Neelsen preparation. In animal experiments, granulomas are formed within 2–6 weeks after exposure to *Lycopodium* spores[6]. One of the more disturbing case histories was a report of *Lycopodium* granuloma caused by the use of spore-covered anal suppositories that came in contact with a wound from an external haemorrhoidectomy[7].

By scanning electron microscopy, spores ("Lycopodium, Canadian") provided by the industrial supplier as typical of those used as a dusting agent on condoms, appeared identical to spores of *L. clavatum*, although several species of *Lycopodium* found in Canada have similar spore ornamentation[9,10]. Surveying three commonly sold brands of condoms at a local pharmacy, one (Ramses, non-lubricated) was identified as having been treated with *Lycopodium* spores. Microscopy of the condom surfaces reveals numerous irregular polyhedrons of varying sizes. Some of the polyhedrons, which disappeared after acetolysis, correspond to the typical morphology for grains of corn starch. As shown in the figure, some of the spores which remain after acetolysis appear identical to *L. clavatum* spores, while others are an unidentified larger spore with smooth walls. Because the spores are on the inside and outside surfaces of the condom, they would come in contact with membranes, both mucous and non-mucous, during use.



Scanning electron micrograph (scale bar, 10 μm) of dust-like material from condom, after acetolysis; view of *Lycopodium* spores (reticulations) and unidentified pteridophyte spores (smooth walls). Micrograph by Donald Black.

As condom use is increasing dramatically in response to the AIDS epidemic, physicians should take note of the possibility that granulomatous masses on any of the areas of the body that come in contact with condoms might be traced to the use of these products. These granulomas are non-lethal, do not lead to cancer and are easily remedied; this is a relatively minor health problem compared with AIDS, a lethal sexually acquired disease that might be contracted by discontinuing the use of such protective devices.

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Myosin heads and assembly of muscle thick filaments

SIR—Small in his recent News and Views article[1] analysed new experimental findings concerned with myosin filaments that provide some explanations of the role of magnesium-ATP in filament assembly. But as long ago as 1979, it was found that MgATP is involved in the regulation of the diameter of skeletal muscle myosin filaments[2]. The authors found that, in the absence of MgATP, synthetic filaments are 30–50 nm wide compared with 16 nm for native filaments. In the presence of millimolar concentrations of MgATP, the diameter is 16 nm, indicating the crucial role of this nucleotide in filament assembly. It was also shown that free ATP disrupts the filaments[2]. These authors, however, did not realize the significance of MgATP. But in 1985, Pinset-Härström[3] wrote: "the MgATP interaction sites involved are the high-affinity sites located in the heads, and [this] is to my knowledge the first indication that these sites are implicated in skeletal filament assembly". Other work, however, indicated[4] that the high-affinity sites are not involved in filament structure.

According to Small[1], "even more intriguing are the effects of myosin heads on filament assembly and disassembly". In 1982, we published our hypothesis, according to which one head of a myosin molecule lies outside the filament core while the other is buried in the backbone and interacts with the internal head of the opposite molecule. This hypothesis[5] was based on our discovery of a head dimer[6] whose properties depend on the same parameters as the filaments: strong interaction of the subunits in the presence of MgATP and MgADP; and disappearance of the dimer in the presence of free ATP, free ADP or at high ionic strength.

The head dimer has been seen directly in the electron microscope, both in S1 and on intact myosin filaments. Its existence, therefore, must be accepted. We believe that the problem of the myosin heads is about to be elucidated. The involvement of the heads in filament assembly is becoming generally accepted, and it is now important to discover their exact role.

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