

Golgi Apparatus of the Basidiomycete *Coprinus lagopus*

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The presence of Golgi dictyosomes in fungi was first demonstrated by means of electron microscopy in the ascomycete *Neobulgaria pura* (R. T. Moore and J. H. McAlear, *J. Cell Biol.* **16**:131, 1963) and later in the phycomycete *Pythium debaryanum* (L. E. Hawker, *Nature* **197**: 618, 1963), the rust fungus, *Puccinia podophylli* (R. T. Moore, *J. Bacteriol.* **86**:866, 1963), and various myxomycetes (M. A. McManus, *Am. J. Bot.* **52**:15, 1965). The presence of a Golgi apparatus in the basidium of higher basidiomycetes has not previously been demonstrated, and its function in fungi is not known. In the present investigation, a Golgi apparatus was found in the basidium of *Coprinus lagopus* Fr., and its morphology was studied during the course of meiosis.

The Golgi apparatus of fungi was characterized by Moore (*J. Bacteriol.* **86**: 866, 1963). In addition, a new feature not hitherto reported for fungal material was shown by this organelle in the basidium of *Coprinus*. This is observed only in medial sections (Fig. 1), where the Golgi apparatus is seen to possess a central, osmiophilic region from which cisternae radiate. The adjacent cisternae are seen to be interconnected (Fig. 2). W. P. Cunningham, D. J. Morre, and H. H. Mollenhauer (*J. Cell Biol.* **28**:169, 1966) recently demonstrated, by whole-mount electron microscopy, that isolated Golgi bodies from plant material also contain a central region from which many interconnecting cisternae radiate.

A second point of interest noted in this material concerns the behavior and possible role of the Golgi apparatus during the course of meiosis. At meiotic prophase stages, there is only one fairly small Golgi apparatus within the basidium. This was found to lie fairly close to the nucleus. The diameter of the whole Golgi apparatus (seen in Fig. 1) is approximately 0.9 to 1 μ . Around the Golgi cisternae, there are some irregularly blebbed Golgi vesicles (Fig. 1, 2).

As the nucleus entered the metaphase I of meiosis, the Golgi apparatus was found to undergo

considerable morphological changes and become proliferated to a size five times larger than that found at prophase stages (Fig. 3). The cisternae appear to be irregularly blebbed and to include a great number of vesicles. It was found that, in a basidium where the Golgi apparatus is proliferated in this way, many vesicles are seen to be closely associated with the dividing nucleus (Fig. 4). A similar proliferation of the complex was found in the rust *Puccinia podophylli* by R. T. Moore (*J. Bacteriol.* **86**:866, 1963), although he did not correlate the event with the nuclear behavior, and at the metaphase stage of mitosis in the bryophyte *Anthoceros* (I. Manton, *J. Biophys. Biochem. Cytol.* **8**:221, 1960). The correlation of this Golgi proliferation with the onset of meiotic metaphase in *Coprinus* appears to be significant. If one can assume that the morphological changes observed reflect changes of activity during the development of the basidium, one must conclude that one function of the Golgi complex of *Coprinus* is related to the processes involved in nuclear division. Because there is no evidence of any secretory activity in fungal cells during meiosis, one of the simplest explanations for the above observations is that the complex is producing or assembling membrane materials necessary for nuclear membrane reconstitution. This suggestion, which has also been advanced by Manton (*J. Biophys. Biochem. Cytol.* **8**:221, 1960), is compatible with the observations (i), that in the course of meiosis, two consecutive nuclear divisions take place within a short period of time, (ii) that the massive vesicles lie near to the dividing nucleus, and (iii) that vesicles were observed by Harris and Mazia (p. 279, in *The Interpretation of Ultrastructure*, R. J. C. Harris [ed.], Academic Press, Inc., New York, 1962) to join to form the nuclear membrane at telophase.

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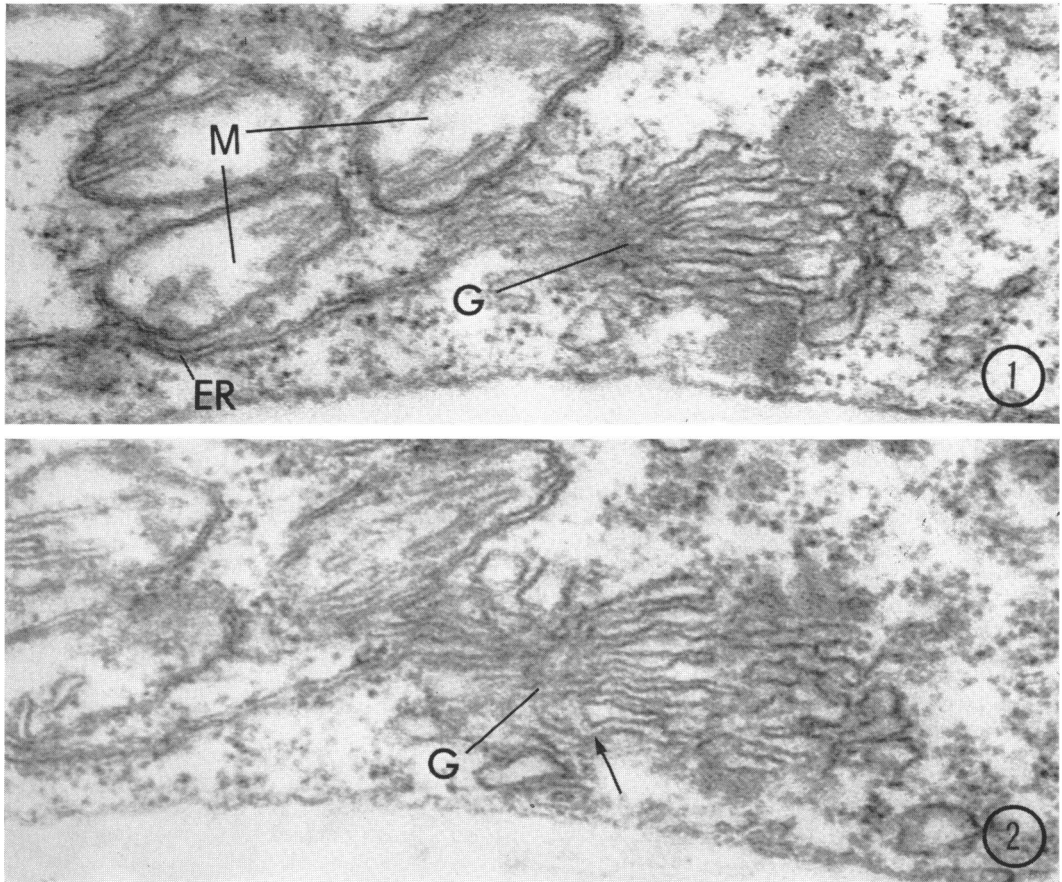


FIG. 1-2. Serial sections of the Golgi complex through the central region. It can be seen that the cisternae radiate from a central region, and are blebbed slightly at their tips. Figure 2 represents a tangential section through the boundary of the central region, showing the continuity of adjacent cisternae (arrowed). M, mitochondria; ER, endoplasmic reticulum; G, Golgi complex. $\times 60,000$.

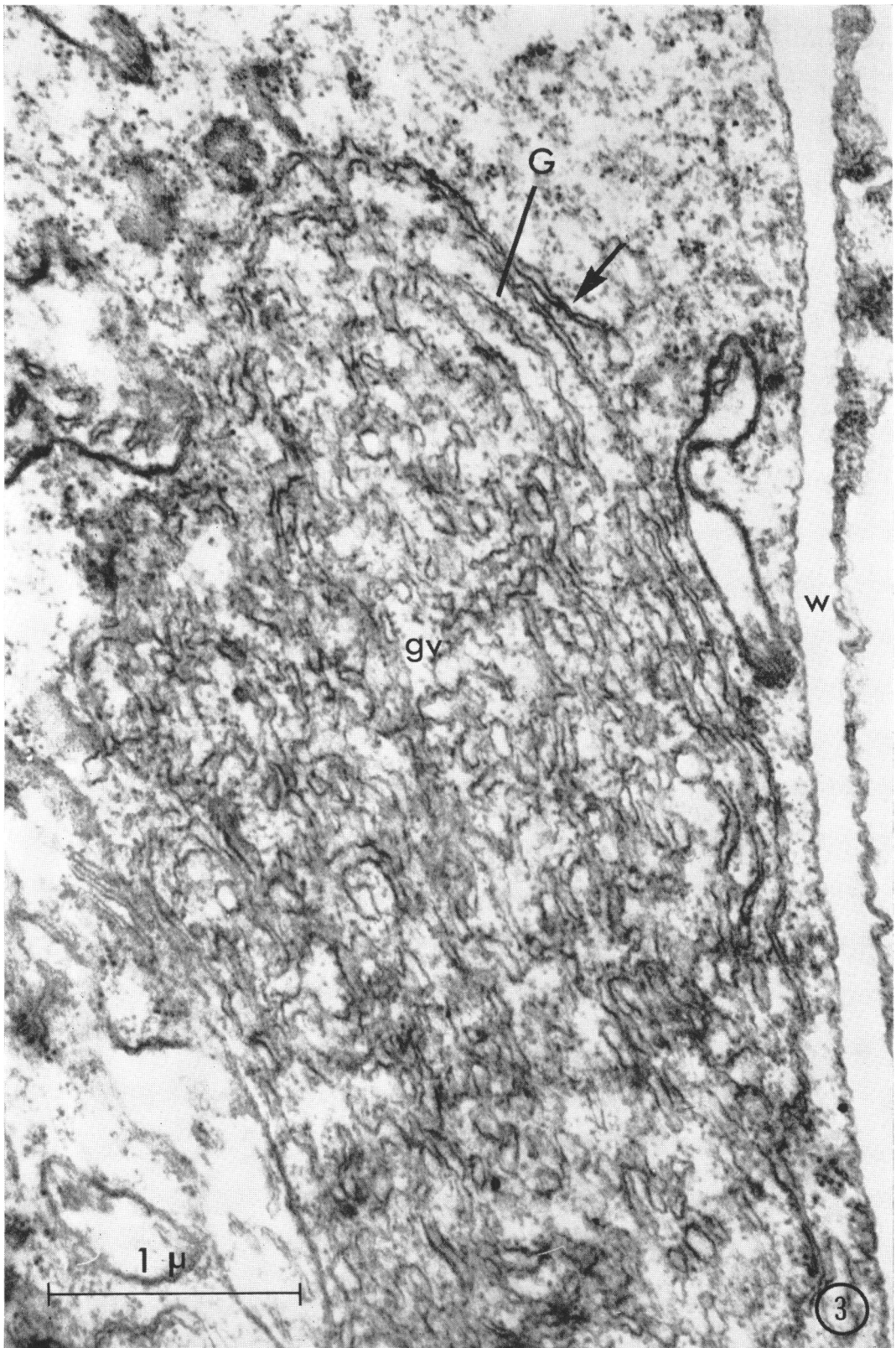


FIG. 3. Golgi apparatus (G) from a basidium of *Coprinus* in which the nucleus is at meiotic metaphase I. This photograph shows a tangential section through the parallel cisternae (arrowed) which are irregularly blebbed and appear to include many vesicles. This complex is five times larger than that shown in Fig. 1. $\times 40,000$.

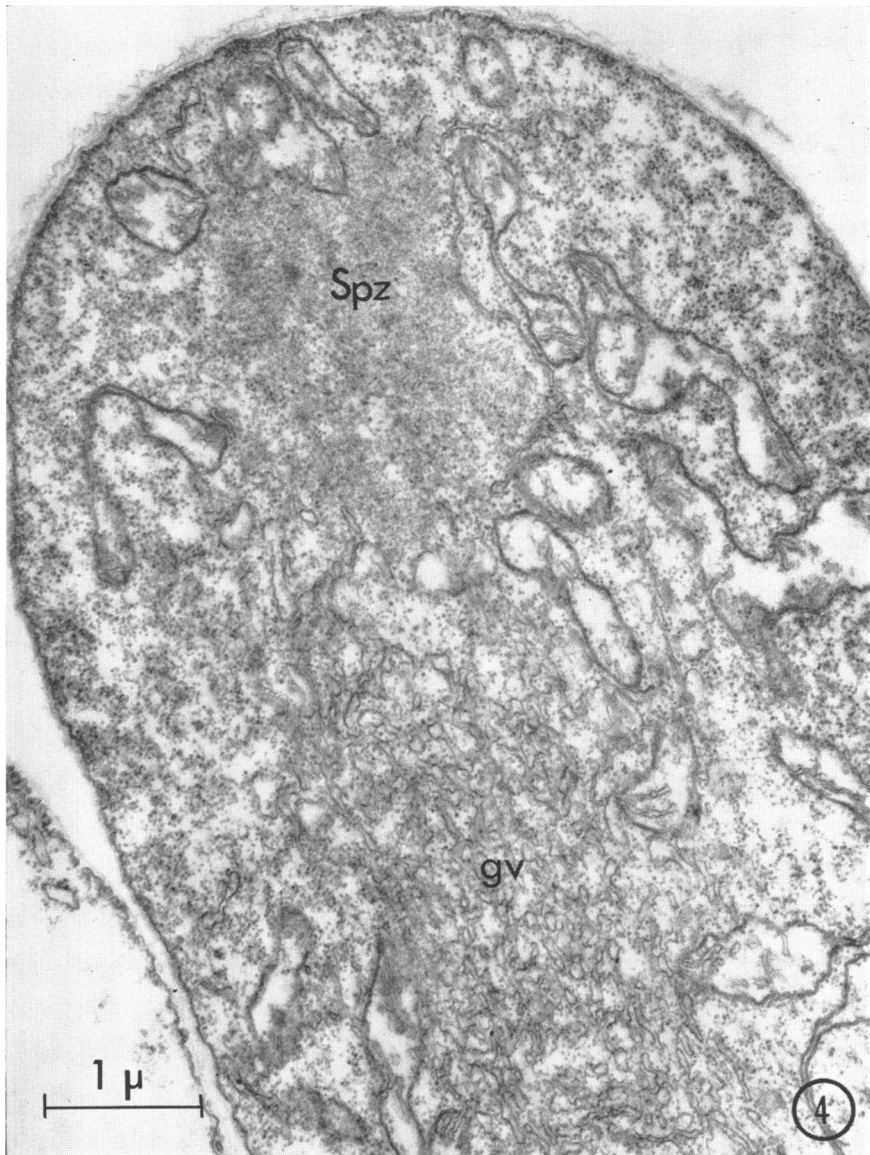


FIG. 4. Basidium of *Coprinus lagopus*, in which the nucleus is at meiotic metaphase I, showing Golgi vesicles (gv) in close association with the spindle zone (Spz). This is a longitudinal section of the basidium, passing through the spindle fibers. $\times 20,400$.