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Virtual fungi: progress in modelling fungal morphogenesis

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Abstract: In mycelial fungi the formation of hyphal branches is the only way in which the number of growing points can be increased. Cross walls always form at right angles to the long axis of a hypha, and nuclear division is not necessarily linked to cell division. Consequently, no matter how many nuclear divisions occur and no matter how many cross walls are formed there will be no increase in the number of hyphal tips unless a branch arises. Evidently, for the fungi, hyphal branch formation is the equivalent of cell division in animals, plants and protists. The position of origin of a branch, and its direction and rate of growth are the crucial formative events in the development of fungal tissues and organs. Kinetic analyses have shown that fungal filamentous growth can be interpreted on the basis of a regular cell cycle, and encourage the view that a mathematical description of fungal growth might be generalised into predictive simulations of tissue formation. Development follows rules. If those rules can be formalised there's no reason why models that describe mycelial growth cannot be modified to provide simulations of morphogenesis. In this presentation I will show a few reminders of basic hyphal growth kinetics on the one hand, and the patterns of development observed in mushroom tissues on the other. Finally, I will discuss recent progress in devising a model able to simulate aspects of tissue development.