Slime moulds that can learn

Physarum polycephalum. Photo: Audrey Dussutour.

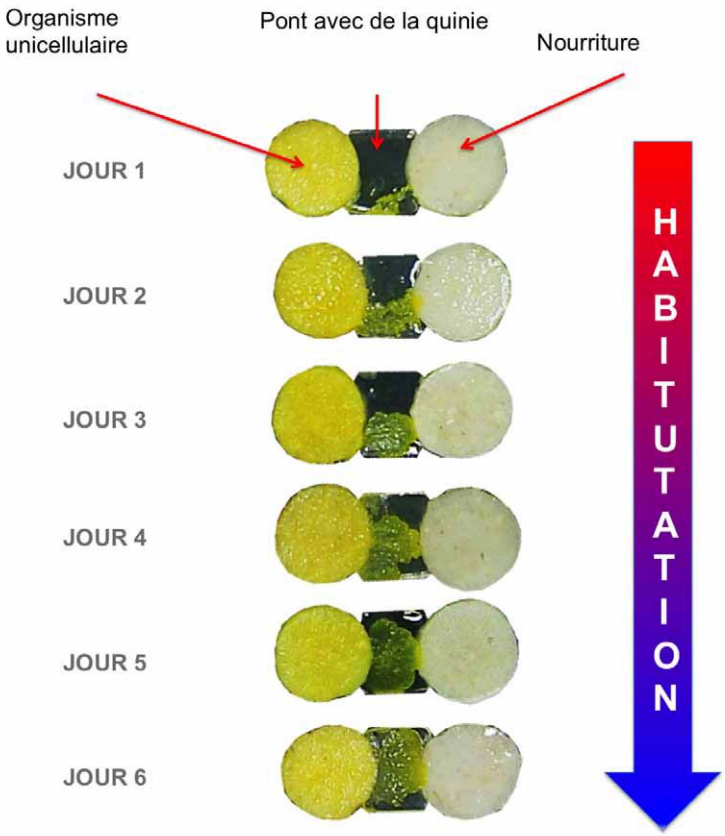
Boisseau *et al.* (2016) explored the ability of the slime mould *Physarum polycephalum* to change its behaviour when confronted by the presence of caffeine or quinine in the medium. They confronted different groups of this slime mould with a bridge containing these bitter but harmless substances, and a bridge without them, that the slime mould needed to get through to reach a food source. All were initially reluctant to travel through the bitter-tasting bridge, crossing untreated bridges three times faster, but after six days they had "realized" the bridges were harmless and crossed them increasingly rapidly. It had learned not to "fear" the substance after being challenged with it for several days. After removal and without having contact with the substance for two days, however, the slime mould returned to its original "mistrust" reaction. It was able to both "learn" to ignore the stimuli when repeated, but then "forgot" after the stimuli had been removed for some time.

The reactions were also quite specific in that ones that slime moulds adjusted to caffeine still exhibited distrust of quinine.

This form of rudimentary learning has been termed "habituation", and has attracted considerable attention (http://www2.cnrs.fr/en/2751.htm) as it has not previously been found in non-neural organisms.

I am indebted to Audrey Dussutour for the figures included here.

Boisseau RP, Vogel D, Dussutour A (2016) Habituation in non-neural organisms: evidence from slime moulds. *Proceedings of the Royal Society of London*, B **283**: doi:10.1098/rspb.2016.0446



Photographs over six days showing habituation of *Physarum polycephalum* crossing an agar gel bridge containg quinine to reach a food patch; the pseudopodium (i.e. feeding arm) becomes larger as the days progress, eventually using the full area of the bridge. Courtesy Audrey Dussutour.

Chaetomium more complex than imagined

Species identification in at least some groups of *Chaetomium* has always been somewhat problematic, and none more so than those referred to *C. globosum*. This situation is most unfortunate in view of the importance of some members of the genus as indoor moulds, spoilage organisms, toxin producers, and cellulase producers. In the last overall revision of the genus, Arx *et al.* (1986) dealt with the issue by treating 28 species as synonyms, including several which had been recognized as distinct by other workers, such as *C. angustispirale, C. cochlioides,* and *C. olivaceum*, commenting that it was "a very variable species". The first large-scale molecular phylogenetic study by Wang *et al.* (2016) shows just how variable the "species" as then understood was. Following an assessment of some 800 isolates of the genus, 80 which were morphologically all in the *C. globosum* complex were selected for critical study.

A concatenated *rpb2*, *tub2*, *tef1*, *rpb1*, ITS and LSU gene region alignment revealed a well-structured tree with many strongly supported nodes, leading to the recognition of no less than 36 species in this single species complex. The analyses showed that some of the species treated as distinct by earlier workers, including the three cited above, were well-founded, and revealed 12 hitherto unrecognized species which are described here as new to

science. The synonymy of the non-ostiolate *Chaetomidium* with the ostiolate genus *Chaetomium* was also confirmed.

The discovery of 12 new species out of 80 isolates merits particular note as it suggests that there are yet many more species still to be recognized just in this species complex of the genus. It seems likely that the 100 or so species generally recognized in the genus is a gross underestimate if this level of novelty is to be expected in other species complexes within it.

What is of particular interest is that many of the species differed in features such as ascospore shape and size, and also the extent of coiling of the terminal setae, all illustrated here by superb photomicrographs in colour. The separation of some will, however, necessitate culture and molecular study for certain determination. A key would surely be difficult to construct, but if one could be attempted it would be helpful to those endeavouring to name these fungi.

Arx JA von, Guarro J, Figueras MJ (1986) The ascomycete genus *Chaetomium*. *Beihefte zur Nova Hedwigia* **84**: 1–162.

Wang XW, Lombard L, Groenewald JZ, Li J, Videira SIR, *et al.* (2016) Phylogenetic reassessment of the *Chaetomium globosum* species complex. *Persoonia* **36**: 83–133.

Chaetomium cupreum. Photo: Xue-Wei Wang.