

## Nonlinear Sciences &gt; Pattern Formation and Solitons

# Road planning with slime mould: If Physarum built motorways it would route M6/M74 through Newcastle

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Plasmodium of *Physarum polycephalum* is a single cell visible by unaided eye. During its foraging behaviour the cell spans spatially distributed sources of nutrients with a protoplasmic network. Geometrical structure of the protoplasmic networks allows the plasmodium to optimize transfer of nutrients between remote parts of its body, to distributively sense its environment, and make a decentralized decision about further routes of migration. We consider the ten most populated urban areas in United Kingdom and study what would be an optimal layout of transport links between these urban areas from the "plasmodium's point of view". We represent geographical locations of urban areas by oat flakes, inoculate the plasmodium in Greater London area and analyse the plasmodium's foraging behaviour. We simulate the behaviour of the plasmodium using a particle collective which responds to the environmental conditions to construct and minimise transport networks. Results of our scoping experiments show that during its colonization of the experimental space the plasmodium forms a protoplasmic network isomorphic to a network of major motorways except the motorway linking England with Scotland. We also imitate the reaction of transport network to disastrous events and show how the transport network can be reconfigured during natural or artificial cataclysms. The results of the present research lay a basis for future science of bio-inspired urban and road planning.

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