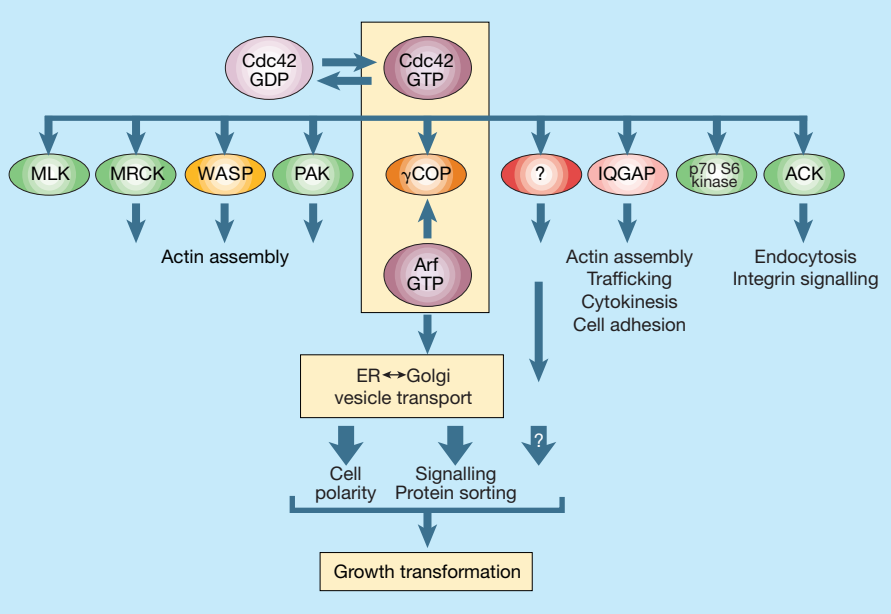

Figure 1 **Diverse targets for Cdc42. The activated, GTP-bound form of Cdc42 interacts with a variety of effectors. These include serine/threonine protein kinases (shown in green), IQGAPs and WASP-family proteins[2,4]. The processes affected by Cdc42-mediated regulation of these proteins are indicated. Wu *et al.*[1] now show that γCOP is also an effector of Cdc42. γCOP is a component of the COPI coatomer protein complex[5]. Like GTP-bound Arf, another GTPase, GTP-bound Cdc42 associates with COPI and regulates vesicle trafficking. Cdc42 and Arf may cooperate to regulate coatomer-mediated vesicle trafficking, or they may regulate distinct mechanisms of trafficking. Surprisingly, γCOP is also required for Cdc42 to induce cellular growth transformation. The cycling of Cdc42 between a GTP-bound (active) and a GDP-bound (inactive) form may be important in regulating the function of γCOP and other effectors (indicated by a question mark) involved in growth transformation.**

tions of the various branches have recently begun to blur. Rho proteins in particular take on many tasks. The aberrant activation of these proteins can induce 'growth transformation' — in other words, it can induce cells to become cancerous[3] — as can members of the Ras branch. Rho-family proteins may also be involved in regulating the movement of vesicles to and from the plasma membrane[2,4]. Now, the boundaries become still less clear, as a Rho-family protein, Cdc42, and Arf can both regulate vesicle traffic through the Golgi by controlling the same effector[1] (Fig. 1). Remarkably, this effector may also account, at least in part, for the growth-transforming activity of Cdc42.

Wu *et al.*[1] use a constitutively activated, GTP-bound, mutant Cdc42 (called Q61L, to denote that glutamine residue 61 is mutated to leucine) to fish for effectors of Cdc42, making the standard assumption that such effectors bind to Cdc42 in its active form. Their search led them to the γ-subunit (γCOP) of COPI, a cytoplasmic 'coatomer' protein complex[5] — so called because it coats membrane regions that will bud and form vesicles. Assembly of this complex onto membranes is controlled by Arf[5]. Interactions between Arf and COPI direct the formation of vesicles that are involved in the selective transport of proteins from the Golgi complex back to the endoplasmic reticulum (ER)[5] and in protein and lipid recycling from the plasma membrane through endosomes[6]. The identification of γCOP as an effector for Cdc42 is consistent with the

Genetics

Fungal get-together

Mushrooms are the tips of icebergs. They are the fruit bodies of basidiomycete fungi that proliferate in soil, extracting nutrients from wood and other solid materials through networks of invasive filaments. Mushroom development usually follows the fusion of two genetically compatible colonies (or mycelia). But research carried out by Robert B. Peabody and colleagues (*Fungal Genet. Biol.* **29,** 72–80; 2000) provides a different picture. It seems that some mushrooms are mosaics that develop from several genetically distinct populations of cells. The mosaics form either through meiosis in the mated mycelium and assortment of haploid strains within the fruit body, or by the copulation of several partners.

Peabody *et al.* looked at a species called *Armillaria gallica* in Massachusetts (a cluster of fruit bodies is shown in the picture). This

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is the fungus that became famous when a 10,000-kg mycelium was discovered that has remained genetically stable for more than 1,500 years (M. L. Smith *et al.* *Nature* **356,** 428–431; 1992). Peabody and co-workers analysed tissue samples from mushrooms collected over the past 20 years, and showed that at least two mycelia had combined to form all mushrooms collected before 1988. They then went on to examine single cells isolated from fruit bodies, the results revealing that some mushrooms contained up to nine genetically distinct individuals.

Although there is strong evidence for mosaicism in specimens collected before 1988, the phenomemon seems to have ended then. The reason is unknown, but it could be due to environmental influences. For example, dry years are less favourable for fungal growth, and in these circumstances the involvement of numerous mycelia might be necessary to support the emergence of fruit bodies.

The identification of mosaicism in *A. gallica* adds a layer of complexity to our understanding of basidiomycete development. Individuals that compete for food in their mycelial phase must intertwine and become sheathed in a common gel-like extracellular matrix to sculpt the tissues of the mosaic mushroom's stalk, cap and the gills that line the cap. Spore formation will then take place after nuclear fusion and meiosis within specialized cells in the gills called basidia.

Further work will be needed to establish the degree of cooperation between individuals that is required to form mosaics. For instance, determining the proportion of spores that reflect the genotype of each participant should reveal any competition for occupancy of the gill surfaces, and also show who fertilized whom. **Nicholas P. Money**

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