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How evolvable are polarization machines? LIEDEWIJ LAAN, ANDREW MURRAY, FAS Center for Systems Biology, Harvard University — In many different cell types proper polarization is essential for cell function. Polarization mechanisms however, differ between cell types and even closely related species use a variety of polarization machines. Budding yeast, for example, depends on several parallel mechanisms to establish polarity. One mechanism (i) depends on reaction and diffusion of proteins in the membrane. Another one (ii) depends on reorganization of the actin cytoskeleton. So why does yeast use several mechanisms simultaneously? Can yeast also polarize robustly in the absence of one of them? We addressed these questions by evolving budding yeast in the absence of mechanism (i) or (ii). We deleted a mechanism by deleting one or two genes that are essential for its function. After the deletion of either mechanism the growth rate of cells was highly decreased (2-5 fold) and their cell shape was highly perturbed. Subsequently, we evolved these cells for 10 days. Surprisingly, the evolved cells rapidly overcame most of their polarity defects. They grow at 0.9x wildtype growth rate and their cell shape is signifigantly less perturbed. Now we will study how these cells rescued polarization. Did they fix the deleted mechanism, strengthen other mechanisms or evolve a completely new one?

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