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Characteristics of proportionate growth observed in instability patterns of miscible fluids IRMGARD BISCHOFBERGER, RADHA RAMACHANDRAN, SIDNEY R. NAGEL, University of Chicago, NAGEL LAB TEAM — As a baby mammal grows, different parts of its body develop at the nearly the same rate and thus to a good approximation in direct proportion to one another. This type of growth is called proportionate growth. As familiar as it appears to us, it is very rarely found in physical systems outside of the biological world. We here show an example of proportionate growth that occurs in the instability formed when a less viscous liquid, of viscosity η_{in} displaces a more viscous miscible one, of viscosity η_{out}. We investigate the growth of these patterns in a quasi-two-dimensional geometry. Within a range of viscosity ratios $0.1 < \eta_{in} / \eta_{out} < 0.3$, we observe the formation of small blunt structures that form at the edges of an inner circular region devoid of fingers. As the pattern grows, the size of these structures increases in proportion to the size of the inner circle, such that even small details in the shape of the pattern remain essentially unchanged during growth. These characteristics of proportionate growth are reflected in the shape of the interface in the third dimension as well.

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