Fingering instability in an inverse Saffman-Taylor experiment

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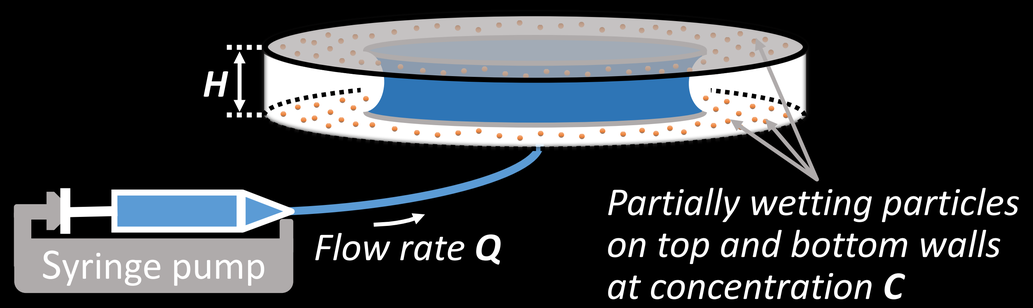
STANDARD Saffman-Taylor fingering instability

- It occurs when a low viscous fluid displaces a more viscous fluid.
- It results from the decrease of flow resistance as the fluid of lower viscosity replaces the more viscous one.

INVERSE Saffman-Taylor fingering instability

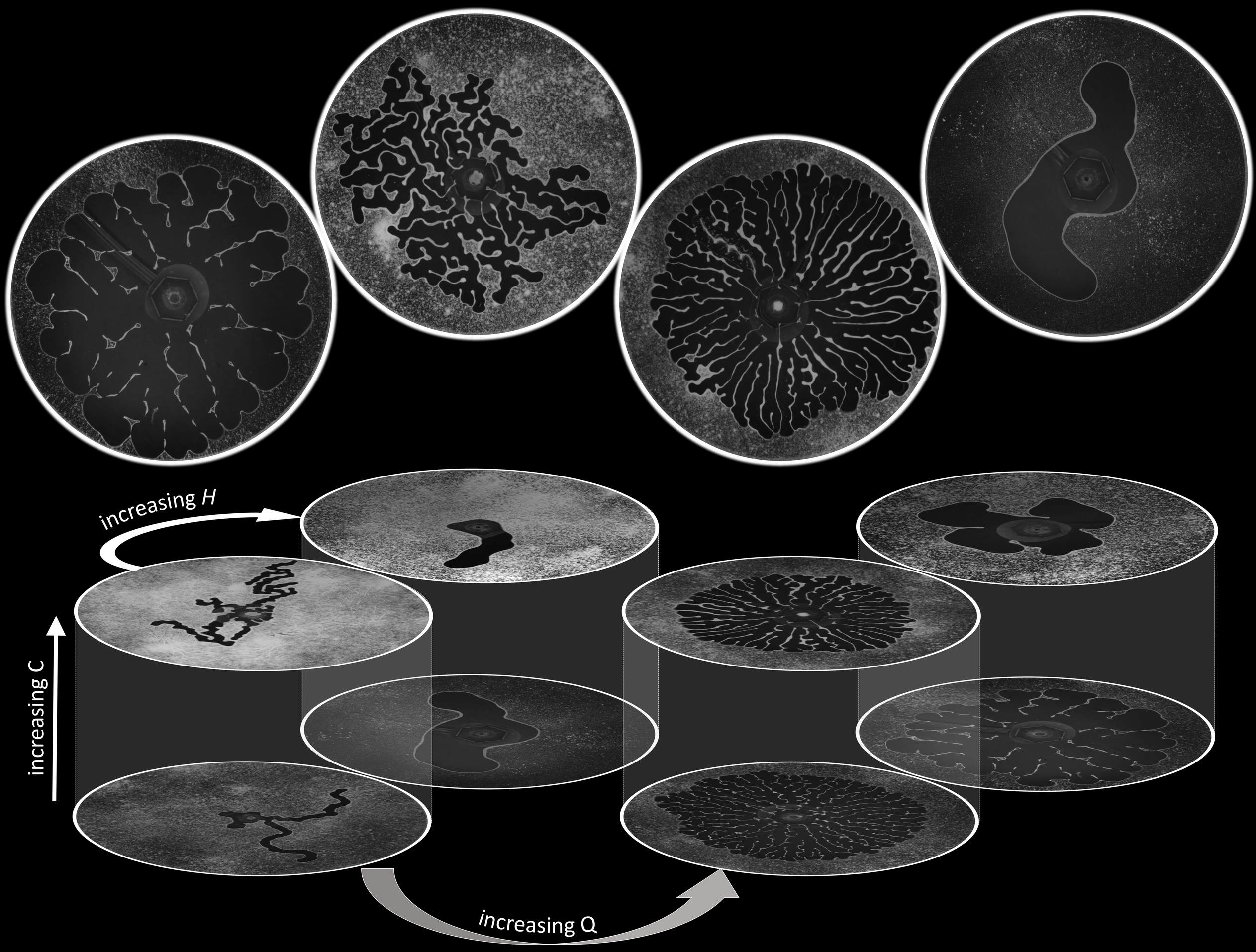
- It is revisited experimentally when a viscous fluid (water) displaces air when partially wetting particles are lying on the walls.
- Though the displacement of air with a liquid is typically stable, the presence of the particles results in a fingering instability

Radial Hele-Shaw of 8cm diameter



Varying experimental parameters:

*2ml/h ≤ **Q** ≤ 2000ml/h, 0.01 ≤ **C** ≤ 0.7 and 0.1mm ≤ **H** ≤ 1mm*



Conclusion: This inverse Saffman-Taylor fingering instability is driven by the integration of partially wetting particles into the liquid-air interface which results from the minimization of the interfacial energy.

Reference: I. Bihi, M. Baudoin, J.E. Butler, C. Faille, F. Zoueshtiagh, (2016) Inverse Saffman-Taylor Experiments with Particles Lead to Capillarity Driven Fingering Instabilities, *Phys. Rev. Lett.* 117, 034501

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