Abstract Submitted
for the MAR05 Meeting of
The American Physical Society

Hydrodynamic Forcing of Spontaneous Helical Growth ARIEL BALTER, Indiana University, JAY TANG, Brown University — Inspired by the biological system of actin "comet tails" formed during bacterial motility, we have modelled the natural evolution of a cylindrical gel growing from a fixed object. We have found that a stable solution, is a kind of helical growth in which the helix pitch and diameter increase, and the pitch angle varies, but the axis remains constant. The growth can be defined by a rotation vector $\vec{k}$. The instantaneous magnitude of this vector is related to the intantaneous pitch and diameter, and is a simple inverse linear function of the contour length, s, along the helix: $\left|\vec{k}\,(s)\right| \approx cs$ for some constant c. The instantaneous pitch angle $\chi(s)$, is a function of the components of $\vec{k}$. Helical growth can spontaneously emerge from random initial conditions. However, by starting with "seed" helices of various shapes we found that a critical value of the pitch angle, $\chi_{crit} \approx \tan^{-1}\frac{4}{\pi}$, governs the growth of the helices. For example, when $\chi(s) = \chi_{crit}$ then $\frac{d\chi}{ds} = 0$. However, this critical value is an unstable fixed point, so growth does not converge to χ_{crit}.

Ariel Balter
Indiana University

Date submitted: 08 Dec 2004 Electronic form version 1.4