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### Acoustic Radiation Force Manipulation of PC12 Cells In Vitro

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To understand and prevent brain injuries from head trauma, researchers study mechanically stressed neuronal tissue. To anticipate future application of controllable ultrasonic in-vivo stress, we investigated the effects of acoustic radiation force on in-vitro PC12 cells. Undifferentiated PC12 cells were serum-cultured in DMEM/F12 on poly-L-lysine-coated polystyrene. Some cultures were DAPI stained. The culture plates were placed on an inverted phase-contrast microscope. An f/1.1 ultrasound transducer with a water-filled coupling cone was focused on the culture at a 45-degree angle-of-incidence, and excited with 30-ms 4.7-MHz pulses. Acoustic power was 8 W, and peak pressure was estimated at 300 kPa. Digital images were recorded before, during, and after insonification. Incident-light and fluorescence images revealed three populations: cells that were stationary (apparently outside the effective force field region), cells that elongated about 2  $\mu\text{m}$  under radiation force and returned to approximately their original shapes when the force was removed (apparently adhered to the substrate), and cells that moved about 50  $\mu\text{m}$  with each pulse and did not return (apparently free-floating). We conclude that cell morphology can be influenced reversibly with acoustic radiation force. (Support was provided by the Riverside Research Institute Fund for Biomedical Engineering Research and the Gatsby Initiatives in Brain Circuitry.)