Technology watch

DEVELOPMENTAL BLUEPRINT

Keller *et al.* have generated a digital zebrafish embryo by recording nuclei localization and movement in entire wild-type and mutant embryos over the first 24 hours of development.

Two newly developed technologies were key to the scientists' interdisciplinary approach to track a living zebrafish embryo from the single-cell stage to 20,000 cells: they used a digital scanned laser light-sheet microscope, which scans a living organism with a sheet of light in many different directions so that the computer can assemble a complete three-dimensional (3D) image, and a large-scale computing pipeline. Taking more than 400,000 images per embryo, the team generated terabytes of data on cell positions, movements and divisions that were reassembled into a digital 3D representation of the developing embryo. Analysis of cell-division patterns revealed a maternally defined initial morphodynamic symmetry break, which identifies the embryonic body axis. They also showed that the mesendoderm forms from one-third of the cells of an embryo in a single event.

Movies of the digital embryo and the database will be made publicly available. This technology can also be applied to mouse, chicken and frog, and a comparison of digital embryos of these species is likely to provide insights into basic developmental principles.

ORIGINAL RESEARCH PAPER Keller, P. J. *et al.* Reconstruction of zebrafish early embryonic development by scanned light sheet microscopy. *Science* 9 Oct 2008 (doi:10.1126/science.1162493)

COMPUTING RNA DEVICES

Can we create a programmable molecular device that can function autonomously in a living cell? Win and Smolke now provide a first glimpse of such a tool by assembling RNA devices that can execute higher-order cellular information processing operations from standard components in yeast.

The authors previously created single input–single output RNA devices using three components: a sensor that detects the signal, a transmitter that conveys this signal and an actuator that mediates the intracellular response to the initiating signal. Now, they extend this framework and construct various combinations of these basic modules, creating higher-order RNA devices that perform AND, OR, NAND (not-AND) and NOR (not-OR) operations. RNA aptamers (the sensor) and ribozymes (the actuator) are coupled by an RNA sequence (the transmitter). Binding of an input molecule to the sensor causes a shift in the device to favour the input-bound conformation as a function of increasing input concentration, and this translates to a change in ribozyme activity. Because the ribozyme is fused to the 3′ untranslated region of a target gene, changes in ribozyme activity modulate cleavage of the target transcript, thus altering target gene expression. So, complex computational devices have the potential to control cellular function.

ORIGINAL RESEARCH PAPER Win, M. N. & Smolke, C. D. Higher-order cellular information processing with synthetic RNA devices. *Science* **322**, 456–460 (2008)