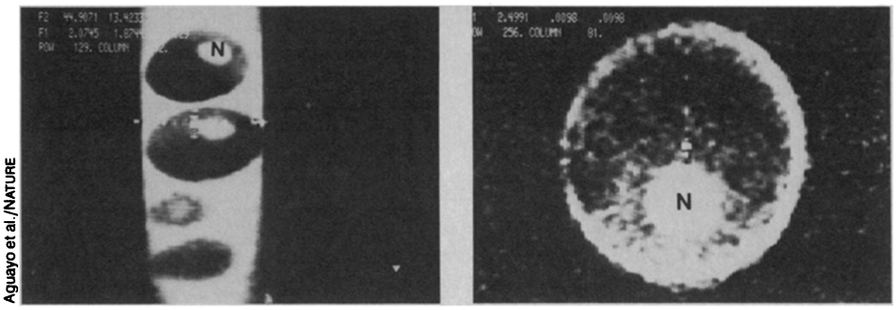
Seeing the cell and letting it live



Aguayo et al./NATURE

Four ova of the African clawed toad, Xenopus laevis, *at different stages of development, are NMR-imaged at a resolution of 16×27 microns (the smallest dimensions at which the object can be distinguished). The nucleus (N) of the cells is distinct from the dark cytoplasm, as it is also in a single ovum (right), imaged at 10×13 microns.*

One of the difficult things about research on large, living bodies is that in order to take a close look at what's going on inside, you have to take what's inside out. That can throw a kink into the processes under investigation. Now, researchers have taken a first look inside a single cell using a new class of instruments that eventually may make it possible to watch cellular biochemistry inside the body, or to perform "biopsies" without needles or surgery. A group of researchers, led by James Aguayo of Johns Hopkins University in Baltimore, reports in the July 10 NATURE "the advent of the NMR [nuclear magnetic resonance] imaging microscope."

NMR relies on magnetic fields and the rotation of atomic nuclei to generate images (SN:1/25/86,p.59). It compares favorably with advanced X-ray techniques for some diagnostic purposes, such as scanning brain areas covered with a thick layer of bone. But NMR, like X-ray, has been limited to imaging organs or the whole body. Now, by boosting the magnetic fields and refining some of the machinery used, Aguayo's group has been able to get the resolving ability of NMR down to 10 microns, so that it is capable of "seeing" intracellular structures. Cells range in size from about 10 microns to about a millimeter. "We wanted to see what the limits were," Aguayo told SCIENCE NEWS. "We just extended [the technology]."

(A group led by Truman Brown at the Fox Chase Cancer Center in Philadelphia is also developing an NMR microscope, and reported early success with the technology last year. They have not yet been able to get the resolution of the microscope low enough to image intracellular structures.)

According to Aguayo, most conventional techniques for investigating single cells are destructive; electron microscopy, for instance, requires the cell to be coated with platinum. "You can't always tell if what you're seeing is artifact or not," Aguayo says. "With NMR, we don't touch the cell at all. We can follow it through time, watch its development." By showing the structure of cells, and possibly their metabolism, the NMR microscope may eventually tell investigators as much about the pathology of tissue in the body as biopsy does now, Aguayo says. The researchers write that they expect the new technology to have "considerable impact" in biology and materials science as well. *– L. Davis*

NASA submits its 'road map' for getting the shuttle flying

Exactly a week after the presidential commission investigating the space shuttle Challenger disaster had submitted its detailed findings, President Reagan ordered NASA Administrator James C. Fletcher to report back within a month about what the agency was going to do about it. "Specifically," wrote the President on June 13, the response "should include milestones by which progress in the implementation process can be measured."

The resulting document, said Fletcher this week after delivering it in person, "really is a road map. And you can watch our progress as we follow the milestones in the report."

One of NASA's conclusions, in the course of planning the steps along the way, is that shuttle flights are not likely to resume before at least the first quarter of 1988. This is a half-year later than the agency's previously mentioned goal, but it came as little surprise. Besides the question of how radical a redesign will be required for the shuttle's solid rocket motors (SRMs), one of which suffered a leaking O-ring seal that triggered the explosion, the commission's recommendations included major reworkings of NASA's safety policies and management methods. Even before responding to the commission's report, Fletcher had appointed Sam Phillips, former director of the Apollo moon program, to study "every aspect" of NASA's management. And "General Phillips's job," Fletcher told the press this week, "seems to be getting more complex as we go on."

In laying out the milestones for a return to flight, Fletcher acknowledged that "we're being a little conservative." But he also noted that, at the other extreme, "there were some that wanted to launch right away, but at a higher temperature." (The extreme cold on the morning of the Jan. 28 launching was cited as a factor in the O-ring's failure.)

Former astronaut Richard Truly, now associate administrator of NASA's Office of Space Flight, told the press that "we're in the business of flying in space, not getting ready to fly." But neither he nor anyone else in NASA management wants to be accused this time of too much hurry. Agency officials have repeatedly denied that launch-safety concerns were shortchanged due to political or public-relations "pressure to get off the ground." Now, NASA is clearly in the spotlight of people sensitized to any signs of irresponsible haste.

Now that NASA has laid out its envisioned milestones in writing, there could be a host of occasions that might be perceived as "missed dates" on the shuttle's return to orbit. But the plan is in place, and, says Fletcher, "we have a good running start on recovery." *– J. Eberhart*

Planned shuttle milestones

Late July: SRM test configuration to be proposed. **Aug. 15:** Recommendations on shuttle program management changes. **Aug. 15:** Report on improved shuttle-management communications. **August:** Recommendations on rate of shuttle flights. National Research Council report on NASA's safety-items overview. **Sept. 1:** Shuttle safety panel set, with direct access to program manager. **September:** Decision on management changes. Completion of preliminary SRM design review; reassessment of design schedule. **November:** Submit cargo-scheduling policy changes. **December:** Crew-escape system decisions. **Dec. 31:** Completion of Phillips's overall management review. **March '87:** "Critical design review" of SRM redesign, tests and checkouts. **May '87:** Completion of NASA HQ critical-item review and hazard analysis. **June '87:** NASA to submit one-year progress report to the President. **August '87:** Delivery of new brakes for the shuttle orbiter. **December '87:** Final SRM design certification review. **January-March '88:** The space shuttle flies again?