ics, household products, agricultural and industrial chemicals, and chemical warfare agents. The test can simultaneously evaluate effects of a substance on various parts of the eye, identify corrosiveness, irritation, swelling, opacity, initial pain response, speed of healing, and possible systemic effects.

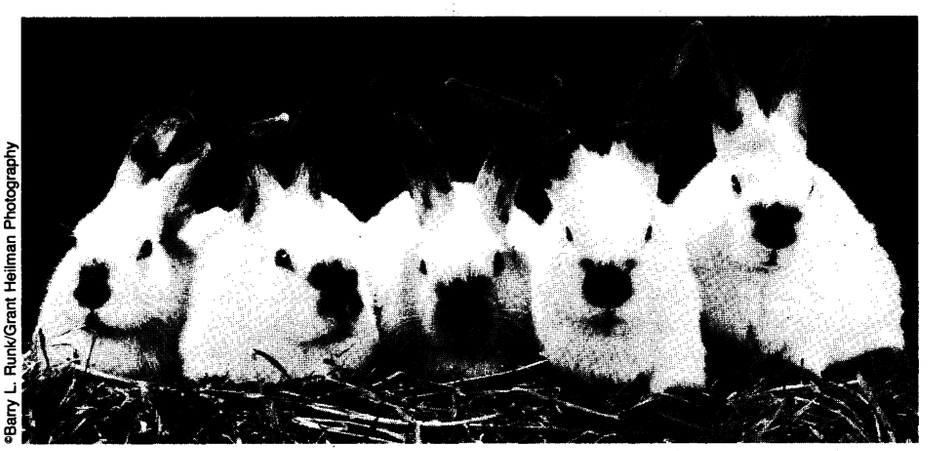
A multitude of in vitro alternatives involving cell, tissue, and organ systems are now under investigation. For example:

- Chorioallantoic membranes, the membranes covering live chick embryos, which can register tissue injury, cell toxicity, and inflammatory and immune responses. There have been problems correlating the results with the Draize test because they do not take alkalinity into account.
- Whole eyes from mice, rabbits, or cows. These are of limited use since inflammatory and healing responses cannot be triggered.
- Corneal cells from mice and rabbits to detect cell injury. Some cells are destroyed and their ability to grow back indicates whether healing will take place.
- Various tests with mammalian skin cells where uptake and release of certain chemicals indicate cell toxicity.
- Assay using a multicellular aquatic organism, tetrahymena (also used to assay teratogenicity), which registers an inflammatory response.

The biggest problem is the validation of alternative tests. "It will not be possible any time soon to validate new tests," said Keith Booman of the detergent association. New data will be needed that can be compared with the existing database, so new tests "will have to be supplemented by animal test results." Booman added there is no possibility of establishing a "gold standard" in the form of a material that can be tested across the board. The job is so large, he said, that if use of the Draize test were to be foreclosed, the period required to validate tests would be extended by years. Much cooperation between various laboratories will be needed to assess the variability of new tests.

As for possible regulatory obstacles to the adoption of new tests, the three federal agencies involved—the FDA, the Environmental Protection Agency (EPA), and the Consumer Product Safety Commission (CPSC)—have shown some willingness to be flexible about the kinds of tests used to provide safety data. The CPSC has said that if the *p*H factor of a new product is over 5, it will assume that the product is an irritant for which labeling is required and will not require corroborative testing. The Federal Insecticide, Fungicide and Rodenticide Act, administered by EPA, requires in vivo testing to get a new product registered, but the act allows much discretion on waiving data requirements. The EPA also announced recently that it will accept guidelines recently put out by Organization for Economic Cooperation and Development which permit the use of only three animals in Draize tests. It appears that no change in federal laws would be required. "There are really no legal barriers to the implementation of alternatives—just scientific ones," said Washington lawyer James C. Lamb.

There has been a good deal of cooperation among the various parties, much of it owing to the tireless efforts of New York activist Henry Spira, who launched the Coalition to End the Draize Test in 1978. Flamm of the FDA said he was "impressed with the increased intensity of commitment" on the part of industry. Speakers agreed on the need to establish time frames for various phases of test development, and the need for "harmonization" of test data so they can be shared among industries. There was general agreement that government, industry and academia will have to cooperate on the development and validation of alternative tests. Said Spira, "This is almost like a Manhattan Project." ■ CONSTANCE HOLDEN



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California bunnies. *Advances in toxicity testing and reduced use of the Draize test by the cosmetics industry means that fewer rabbits are used in research.*

CBO Cautions Congress on SSC

The Superconducting Super Collider could cost far more than what the Department of Energy (DOE) has estimated, warns the Congressional Budget Office (CBO) in a report scheduled to be delivered to the Senate Budget Committee later this month.

The report, requested by retiring committee chairman Lawton Chiles (D–FL), is generally positive about the potential contribution the SSC could make to high energy physics. It stresses, however, that while project costs have not escalated significantly to date, recent experience with accelerators suggest that outlays could be higher than the $4.4-billion (constant 1988 dollars) estimate provided to Congress.

The statement is based on a simple analysis of cost increases three of four accelerator projects built in the 1980s. The report's author, analyst Philip Webre, observes in *Risks and Benefits of Building the Superconducting Super Collider* that the "unweighted average cost increase in constant dollar terms was 46%." If this were to happen with the SSC, CBO estimates that the cost could rise to $6.3 billion.

The report cites several areas where the higher costs could be incurred:

- Difficulties in developing detectors could boost their costs by $200 to $400 million, CBO says. DOE has said the detectors can be built for around $719 million.
- Superconducting magnets could cost $270 million more than the $1.4 billion allotted, if economies of scale from mass production are not achieved.

The draft report also observes that the SSC would account for a substantial fraction of the federal basic research budget while it is under construction. As a result, funding growth in other basic research programs could be limited. The author also seems to question whether other science disciplines are being treated equitably, noting that in 1988 high energy physics received 6.6% of all federal basic research money even though physicists account for about 2% of "active scientists."

Despite these cost factors, the report's author also states that the SSC appears to be the most scientifically sound machine for the United States to pursue at this time. Cheaper options, he says, such as participating in Europe's Large Hadron Collider or building an advanced electron-positron linear collider, may not be as rewarding. What Congress must decide, notes Webre, is how fast it wants high energy physics to advance. ■ MARK CRAWFORD