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Animals in the Laboratory

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## Hubble Space Telescope Operations System

We are concerned that readers of M. Mitchell Waldrop's article of 17 March (Research News, p. 1437) may be left with an inaccurate impression of the current status of the operations system for the Hubble Space Telescope (HST). Although the article presents an excellent analysis of the troubled history of the Science Operations Ground System (SOGS), it is misleading to say that "critical operations software is still a mess." End-to-end ground system tests have already demonstrated that SOGS can support basic HST operations. The continuing "bug fixes" and augmentations will improve the operations and science efficiency of the observatory. We at the Space Telescope Science Institute are convinced that we are ready to operate the HST and are looking forward to launch later this year.

We agree that the early history of SOGS provides a textbook example of the weakness of the old-time approach to carrying out a large software project. However, augmentations and fixes to SOGS carried out at the institute, with the support of staff of the TRW Corporation and NASA, have indeed been "beating the system into shape," as Waldrop states. The success of this effort has been due in large part to the fact that the operators of the system are also at the institute and participate in the design of the fixes. Furthermore, SOGS itself is by now only a portion of the institute's operations system. The Spike system referred to in the article, as well as several other software systems that augment SOGS, were built according to the rapid prototyping methodology; they started out with user guides rather than detailed requirements, continuing on to develop working software that was turned over to operations staff for evaluation and feedback. Whatever the formal methodology, user involvement is key.

The result of all the work during the past few years on the part of the institute, NASA, and TRW is that we have a ground system capable of operating the observatory. In a succession of ground system tests, we have used SOGS to command the actual HST science instruments and have received and processed data coming from the instruments. Furthermore, we have shown that we can keep up with the throughput requirements. Although new bugs appear, they are no longer the "showstoppers" that prevent operation. We are continuing to improve the system and will continue to do so even

after launch to make the best possible use of the observatory.

As for whether SOGS is the "last example of the old system," only time will tell. NASA has indeed taken steps to avoid repeating the HST experience in some future projects. Thus, for example, with AXAF, the Advanced X-ray Astrophysics Facility, which has just been approved for a new start, NASA has decided that a single center will be responsible for both development and operations. Furthermore, there is intent to get a science support center established early in the program to supply the early and continuing strong user input that was so sorely lacking in the early days of the HST program.

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## Animals in the Laboratory

John Hoyt, president of the Humane Society of the United States (HSUS), in discussing the accusation that that body has "gotten radicalized" about animal rights issues, states the following (Letters, 17 Mar., p. 1419):

Our policy on animal research has remained essentially the same for over a decade. The HSUS is not an antivivisection society. We accept as inevitable some laboratory use of animals, given science's historical reliance on animals and its current state of knowledge.

He goes on to say that the HSUS advocates alternatives to animal research.

I quote from that same society's policy statement (1):

Refinement and reduction are interim steps toward the ultimate goal of complete replacement of animals in biomedical research and product testing.

I believe there is a discrepancy here!

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## REFERENCES

1. "Animals in biomedical research and testing" (Humane Society of the United States, Washington, DC, 1987), pp. 5-6.

Daniel E. Koshland Jr.'s editorial, "Animal rights and animal wrongs" (10 Mar., p. 1253) does not give a complete or balanced view of this issue and is yet another polemic. What of the nonutilitarian ethic that ques-

tions all forms of violence, animal experimentation being one? What of the increasing concerns of biomedical scientists and animal protectionists who feel that further animal experimentation is a waste of limited resources (and minds) considering the global environmental, socioeconomic, and public health ills of humanity that no amount of animal research is going to prevent? To continue to uncritically endorse animal research may be symptomatic of a world view that is pathogenic in itself, and responsible for many of the ills that humanity faces today. A vaccine to protect cattle in Africa against rinderpest seems like progress from this point of view. But what of the environmental impact and the future of Africa's wildlife?

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I disagree with Koshland's editorial, especially his arguments in favor of animal research as long as it is designed to be beneficial.

The fact that some human in some hospital has had a certain procedure does not make that procedure right for animal research. Are the methods and goals of both procedures the same? Seldom, I submit.

That the Humane Society and veterinary hospitals must resort to cages, usually because of the lack of inexpensive land to create runs and housing, is not ground for research laboratories to always cage animals (usually alone, often cramped). Healthy animals need room to exercise and play, and they need social companionship.

That pounds kill a hundred stray dogs and cats for every one "sacrificed" in research proves nothing.

The argument that some important diseases like cancer may be cured more quickly with animal research may be true. But I for one, with a sometimes debilitating, life-threatening brain disorder, would choose no cure over sacrificing more animals to find a cure. My belief is that there are other approaches to curing most or all of these diseases. It will take some tough creative thinking on the part of the nation's scientific community, but it can be done.

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*Erratum:* The first sentence of reference 15 in the report "Single-chain antigen-binding proteins" by Robert E. Bird *et al.* (21 Oct., p. 423) should have read, "The majority of experiments have produced  $K_a$ 's within a factor of 2 of these values; therefore,  $\log K_a$ 's for the 4-4-20 IgG, Fab, and 4-4-20/202' single-chain protein are 10.2, 9.9, and  $9.0 \pm 0.3$ , respectively.