ising to defeat cancer in a decade—the kind of pledge that typified the original war on cancer—Armitage thinks NCI may become "more productive ... less affected by political issues and less vulnerable to disease-of-the-day [lobbying]."

The NCI's most visible planning effort under Klausner has been the preparation of a strategic plan—normally anathema to biomedical scientists. When former NIH director Bernadine Healy tried to write one for NIH in the early 1990s, she met with scorn from researchers who complained that biomedical research can't be planned like a NASA mission. But Klausner says he felt he had to take on the "paradoxical challenge of planning for science." Over several months in late 1995 and early 1996, he consulted a select group of scientists and NCI leaders to set specific goals and timetables for the next 5 years. The result is a rewrite of what has come to be called the "bypass budget," a document mandated by the 1971 National Cancer Act, which asks NCI to jump over departmental bosses and submit its funding recommendations straight to the president. It had become NCI's wish list, a 5-centimeter-thick "phonebook" describing everything in progress or in prospect that might be done to fight cancer. The old version gave little sign of what should take precedence. Klausner's version is not so reticent.

Released in May, the new bypass budget lays out in a slick, 80-page booklet a 5-year road map for the institute. Replete with glossy photos and anecdotes of families coping with cancer, it gives a terse account of ongoing programs, then launches into the core of Klausner's strategy. It has some explicit goals, such as: "Identify within 5 years every major human gene predisposing to cancer." Its theme reflects Klausner's view that cancer is "a disease of genetic instability," and it indicates that he intends to push NCI to the forefront of gene-based diagnostics and medicine.

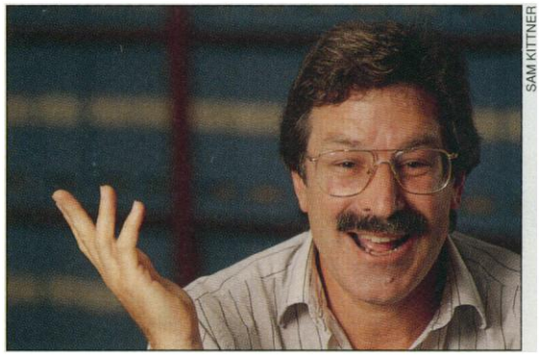
Klausner's operating style is evident in the way he is implementing this strategic plan. He has established five new "mini–think tanks," including both intramural and extramural scientists, to develop detailed strategies. At least two of them will focus on genetics. One group—led by geneticists Alfred Knudson, an NCI adviser formerly at the Fox Chase Cancer Center in Philadelphia, and Barbara Weber of the University of Pennsylvania—is considering how to create a "cancer genetics network." Klausner describes this embryonic network as a group of expert centers that will share a common protocol and the use of an electronic network and database. The aim, he says, is to build an infrastructure and accumulate data that will

(continued on page 1331)

SCIENCE INTERVIEW

NCI: A Lab Scientist's View, From the Director's Office

A year after he was appointed director of the National Cancer Institute (NCI), Richard Klausner met with Science *editors and reporters for a broad-ranging discussion of the cancer program. The following is a transcript of the meeting, edited by* Science *for brevity.*



SAM KITTNER

Q: When you took over NCI, did you think about where you wanted to go with NCI in 4 or 5 years and stage the changes?

A: Well, yes and no. I'm actually a fairly impatient person. I felt I've worked very hard the first year to try to transform the place as quickly as possible. And there was a reason for that. ... I really felt that it was time for a cultural change, a change of spirit, a change of approach. I did not think that there was a need to phase in a set of principles. I thought those principles needed to be articulated immediately—day one—and acted on immediately. And so we restructured quite profoundly—one of the largest restructurings in the department's history. Those restructurings were built ... [on a fundamental test]: Is it furthering science?

Q: Could you give an example of how the culture of NCI has changed?

A: [Researchers brought in from the extramural community] sit weekly on the governing board that makes decisions about things like setting the pay line [the percentage of extramural grant applications that get funded, which rose from 15% to 23% this year]. ... To have those voices in the room ... forces us to be able to act on what we said we believed. And in fact that's why we were able to so dramatically change the pay line. There were two reasons. One, we got a good budget. But, in fact, even before we had that budget, we had been able to raise the pay line significantly. ... We looked at everything we were doing: the intramural program, contracts, everything. We went through them and asked tough questions. ... Everything was put on the table. ... The message it sends to the community is ... that staying in this enterprise is worth doing. It's not suicide. That had to be our first priority. We could have articulated that, but having at the decision-making table people like [Edward] Harlow and [David] Livingston and [Martin] Abeloff and [Alfred] Knudson just kept us honest.

Q: Congress is now considering $250 million in special appropriations for breast and prostate cancer research that would go to the Pentagon and not the Cancer Institute. What do you think about that?

A: That's fine. ... It's good if the money will be spent well, and I don't see any reason that the Department of Defense cannot engage in peer review just as well. The breast cancer money [appropriated to Defense in the past] has been spent through a peer-review process, and that peer-review process is going to be reviewed. I happen to think from what I've seen that it looks excellent. In fact, I think there are aspects of it that we can learn from. I don't feel proprietary about where the money comes from. ... I think it's fantastic.

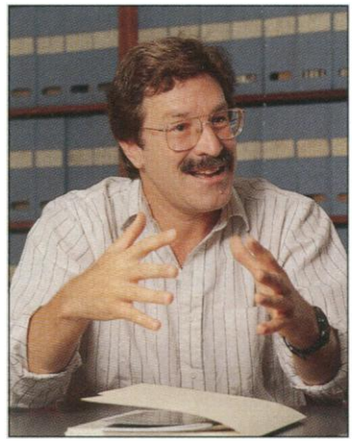
Q: NCI was criticized for using AIDS money for research that really didn't have much to do with AIDS. What changes have you made?

A: I sat down last August [with other National Institutes of Health (NIH) leaders] to work out what we thought was an intellectually useable, useful, and defensible [definition] for AIDS and AIDS-related work. ... We have an obligation to make sure the monies are spent in a way that we believe and we can defend as contributing to the AIDS program. We did not shut down research. ... [But] we have reduced the intramural AIDS funding from about $102 million to about $66 million. We did that in a number of ways. We cut down programs, because at the same time, we were doing very intensive reviews. ... The majority of intramural labs had their budgets reduced just by establishing cost-management principles. When those reductions were in AIDS money, we took it and we put it into the extramural pool. ... We now have a working group that is advising us on priorities in AIDS malignancies, and we have already established

several programs that we have and will be funding based upon the community coming together [and making recommendations]. So I feel right now extremely comfortable, meaning that I don't mind opening up *Science* and seeing them describe how we spend our AIDS money. ... I think we've really corrected some maldistributions.

Q: Does NCI have a responsibility to see that genetic tests for cancer susceptibility are not misused?

A: We're not a regulatory agency, and we shouldn't be a regulatory agency. ... Our responsibility is not to get trapped in lots of these fake arguments [that pit clinical use of genetic tests against research]. ... What you do is you try to make sure that we have more and more sites, centers, and individuals that are expert in genetics, cancer genetics, testing, and counseling. ... That's one of the reasons that we have proposed the creation of a national cancer genetics network, to create an electronic infrastructure where we link together sites of expertise to attempt to work together and articulate standards for decision algorithms, standards for counseling, standards for tests, and to couple that into an anonymized information base. ... We are working now on a [funding proposal] to create the informatics structure that we will then ask people to apply for to join together into an interactive network. ... It's going to have to grow slowly, but that's okay. I mean, this isn't necessarily the avalanche crisis that is often portrayed.



SAM KITTNER

Q: Will this cancer genetics network be a big new clinical investment?

A: I think it's going to have to be a big new investment in discovery, informatics, and a clinical investment. We are hoping that we will have the resources to do that. We will begin it and then we will scale it to the extent that, one, we're ready to do it well and what resources we have. And that's why we have tried to put out a budget that describes cancer genetics and what sort of investment we think the nation needs to make.

Q: Isn't the genome center developing the new genetic technologies?

A: No, actually, they're not. [The technologies] have been stimulated by the genome project, but in fact, for most of them, there's very little money in the genome project. Francis Collins sits on the steering committee [of the cancer genetics network]. We're doing this together. We are collaborating. ... I'm not saying that no one's thought about these things [before]. In fact, we're bringing the groups of people together who are making the chips and making the arrays, and they are telling us where they're having trouble. ... [However], there's not a good articulation of how they're going to be used or how they're going to be connected to a clinical trial system, how they're going to be connected to clinical research. And that's what we're trying to do. Take my word for it, we are not trying to reinvent the wheel.

Q: Is it unusual for an NIH institute to move this far into technology development?

A: Yes, I actually think it is. ... NIH needs to pay more attention to technology. And that's what I like about this process. We're not sitting there blindly trying to say, "Gee, wouldn't it be nice to have technology?" We're asking the [biotech] community to come in and say what they would need to enhance discovery. And this is what the community is telling us. And I think we're going to hear very similar things ... [about the need for] intellectual infrastructure for animal genetics, for repositories for multiple strains, perhaps of unichromosome strains, for developing available statistical genetics.

Q: How do you handle proprietary conflicts?

A: I don't see that there's going to be conflict on proprietary issues; I mean ... whoever makes discoveries of technologies has the opportunity to patent them. If they are discovered within the government, then they are patented by the government. If they are discovered in private industry, they are patented there. I think that will work fine.

Q: NCI researcher Steven Rosenberg wrote a provocative piece last year about proprietary conflicts [in clinical research]. Do you share his concerns?

A: I certainly do share the concerns. That said, the data are quite anecdotal. ... There are [also] lots of anecdotes of terrific interactions and open interactions between industry and the academic community. So I must say that I really agree that it's an important issue, [but] ... knowing the magnitude of the actual problem, as opposed to anecdotes, is less clear to me.

Q: Is biomedical research threatened by a brain drain as young people go into biotech start-ups or become advisers to corporations?

A: I don't see that as a threat. I think that biotechnology as an outlet for academic creativity is really good. I mean, I've been involved in it. It's really attractive. It's often a different way of attempting to turn discovery into application ... that brings in, I think, more voices, more creativity into that process. Again, I'm not sure that I see that these things represent societal conflicts. I think that these are all different ways that enrich the enterprise.

Q: Have you invited advocacy groups to become more involved at NCI?

A: Absolutely, and it's been fantastic. ... One of the great things about this job is the ability to speak to a lot of communities, including the public, about science. I really enjoy it. You really do feel that you're participating in very real human and societal issues. ... Wherever I can speak about the values of science, and people want to hear about it. People are incredibly interested in science. ... I think it's important that not only are scientists real and accessible to people, but that people feel connected to the scientific process because it ... provides the hope that people want about disease. ... I really enjoy that. But I didn't realize how large the audience is and how many people would like to have the opportunity to hear that, and I want to be able to respond to that. So I'm spending a lot of time doing this.

Q: Several NIH leaders, like you, have continued to run their labs while serving as administrators. Why try to do both?

A: I can't imagine running the Cancer Institute the way I would like to run it if I were not an active scientist. ... So it's not just a recruitment bonus. ... Basically, I don't think this job is well done as a manipulator of mechanisms and numbers. I think it ought to be science leadership. I need to speak about science. I need to talk to scientists.

Q: But could you theoretically have given up your lab the day you walked in the door?

A: Well, maybe theoretically I could have done that, but I would have felt terrible. ... Each of us probably does things to feel intellectually sharp and alive, and I think that helps us, whether it's reading fiction or listening to music or whatever it is. And for me it's very important that I'm looking at data and thinking about experiments and excited about a result. Now I'm spending much, much, much less time in my lab. ... My group is smaller, but I do speak to people in the lab most days, and I have group meetings once a week. ... There's no question: It's not the same. I can't turn off the institute so that I'm clear to really think in the way I would like to think. So what my lab will actually look like in terms of productivity, in terms of creativity, I worry about. But for now I'm going to keep trying to do it. I hope I can. We'll see.