Says one MP biologist who requested anonymity: "You can't go on funding research with little coming out at the end."

On the other side, supporters of the status quo say it promotes harmony. "At the moment, the pie is divided rather equitably," says Ken Holmes, a director at the MPI for Medical Research in Heidelberg. "I prefer this to the kind of feuding that would come with [a more formal review system]. It won't save enough money to make it worthwhile." Others argue that freedom from competition for funds allows directors to start risky projects without being under pressure to publish.

Small is beautiful

Perhaps the thorniest issue for the MPS is the tradition of powerful directors building up research groups that can reach the size of a typical university department. Several physicists interviewed by *Science* argued that big groups are crucial for some large-scale projects. But many biologists felt that institutes with lots of independent groups using different systems are more in tune with the times. "People want independent colleagues, not lots of junior groups dependent on you," says Nüsslein-Volhard.

And at present there are few chances for young people to be formally independent. "[The MPS] can be very stifling to up-and-coming scientists," says biochemist Walter Hill of the University of Montana, an adviser to Berlin's MPI for Molecular Genetics. "It throws a blanket over other people ... [and] encourages them to become puppets of the director." Of the MPS's 2800 scientists below director level, only 30 are officially independent group leaders with their own resources.

Working under a director has been fine for some. Take Hartmut Michel, now a director at the MPI for Biophysics in Frankfurt. Michel was working in Dieter Oesterhelt's group in the early 1980s when he took on a project other scientists thought was impossible: crystallizing a protein from the cell membrane. His work on the photosynthesis reaction center won him and two MPS collaborators the 1988 Nobel in chemistry. Michel says that continuous funding and topnotch facilities were "absolutely decisive" to his success. "[The MPS] makes your life as easy as possible," he says. Similarly, neither Bert Sakmann nor Erwin Neher were formally independent when they developed a technique for measuring the flow of ions through single nerve channels—research that earned them the 1991 Nobel Prize in medicine.

But for the less lucky ones, life at an MPI can be frustrating or—in extreme cases—disruptive to their careers. When a director retires or dies, says one MPS researcher who requested anonymity, "the leftover people all scramble for a foothold." And, although there are many such "leftover" staff—some 20%, according to several estimates—they have no real place in the system. In fact, some say the institutes often try to push them out, regardless of the quality of their work. "I don't expect a free lunch," says one researcher. "What I object to is getting kicked in the butt."

Some MPS leaders dismiss criticism of these harsh realities. "The director has a lot of freedom to structure his department," says Vice President Trautner. "This is entirely adequate to encourage young people." To avoid leftovers, he favors drastically reducing the number of permanent positions for non-directors. Others see a solution in creating a tenure-track, middle level of independent researchers. Besides nurturing young talent, says Nüsslein-Volhard, it would allow institutes to cover more areas. And it would prepare more women for top posts in the MPS, she says, where they are abysmally underrepresented—a problem common throughout German research.

With change in the air, it is perhaps the perfect moment for a man like Markl to take over: someone not steeped in MPS traditions, yet a formidable intellect and a skillful politician. What's more, says Nüsslein-Volhard, "he might not assume we're all geniuses."

–Patricia Kahn

With reporting from Robert Koenig.

PLANETARY SCIENCE

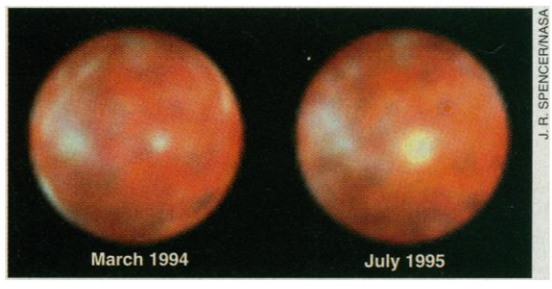
Galileo Lives With Balky Tape Recorder

Sooner or later, it happens to everyone who has a tape recorder. You push the button on your machine and nothing happens. A moment later, you try again, and it works. Engineers operating the Galileo spacecraft that is nearing Jupiter know the feeling. On 11 October, they found that the recorder that is supposed to store data for eventual transmission to Earth was stuck. Just like frustrated audiophiles, they backed off and tried their tape recorder again. Now it seems to be working—to the engineers' great relief.

"We have a good idea of what the problem is and good ideas of how to work around it" to keep the tape recorder rolling smoothly, says manager William O'Neil of the Jet Propulsion Laboratory (JPL) in Pasadena, California. If he's right, Galileo will once again have dodged a technical obstacle threatening the $1.3 billion mission.

The balky tape recorder is central to plans for making up for the failure of Galileo's main communications antenna to open fully (*Science*, 5 February 1993, p. 759). Using the latest data compression techniques to compensate for the reduced transmission rate, Galileo will be able to return about 70% of the data that mission planners had hoped for. But that will only be possible if some of the big data loads can be stored for long enough to allow the crippled communications system to catch up.

By late last week, engineers had concluded that the tape recorder probably malfunctioned because its moving parts had stiffened up, says O'Neil: "One of the problems could be that we have used this tape recorder so infrequently." Besides a sticky mechanism, the machine also suffered from the mechanical disadvantage of a nearly empty reel pulling on a full one when controllers sent the order to rewind. Last Friday, when engineers commanded it simply to play back—the easy direction to drive the tape—it worked fine. So engineers plan to limber up the mechanism by working it through a series of exercises; to be safe, they will also avoid recording or playing near the end of the tape, says O'Neil.



Out of sight? Without a tape recorder, Galileo could not image this new volcanic spot *(right)* on Jupiter's moon Io.

If that regimen doesn't work, says project scientist Torrence Johnson of JPL, the mission would lose another 20% of the data it was originally expected to gather, with imaging of Jupiter and its satellites suffering the brunt of the losses. The losses would be even greater, says Johnson, if not for the new data compression techniques and a contingency plan to use the on-board computer for data storage.

Still, engineers would be resting easier if Galileo carried a spare tape recorder. But Johnson explains that when the Galileo mission was being planned, its managers "couldn't sell the necessary extra mass and expense. ... Every bit of incremental growth in Galileo was regarded as a dire threat to its existence." And that leaves the Galileo team with nothing to fall back on but innovation. Claims O'Neil: "We've demonstrated we're the most resilient planetary mission ever flown."

–Richard A. Kerr