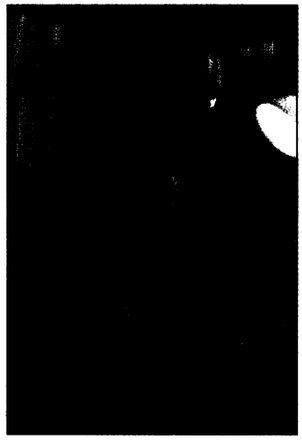
Downstream effects

If a buildup of sediment does choke waterways behind the dam, commerce on the river won't be all that will suffer. The discharge from upstream has contributed to the thriving delta region more than 1000 kilometers downstream, creating one of the country's most fertile farming areas. Although the annual outflow entering the sea is expected to remain unchanged after the dam is completed, some scientists worry about the effect on the river of an irregular discharge of the life-giving muck that disrupts natural patterns. A 1995 environmental impact statement, drawn up by scientists from CAS and the Research Institute for Protection of the Yangtze Water Resources, predicts that the reduced discharges in October and November "will make the saltwater intrusion appear earlier and its duration last longer, [and will] lead to variation in the process of deposition and erosion of the beaches in the estuary region."



JAMES ZENG-HUANG/CHINA FEATURES

Swirling debate. Lu Qinkan says planners understate the problem of sedimentation.

It is still too early to forecast the project's impacts on the estuary region and the entire lower and middle reaches, but many scientists fear the damage could be considerable. "The project's overall adverse impact on ecology and environment far overshadows its positive effects," says Chen Guojie, an ecological and environmental scientist with the CAS Mountainous Disaster and Environment Institute in Chengdu who has studied the issue. "We divided the systems of natural and social ecology and environment into subsystems and elements" ranging from terrestrial fauna to climatology, he explains. "We found only nine elements to have a positive effect, six to be unaffected, and 63 to suffer negative impacts."

Some scientists have also posited that creating a lake in the deep mountains will lead to increased fog in the region. Mixed with industrial pollution, they say, the fog could aggravate an already serious smog problem in Chongqing.

But other scientists have criticized that approach, saying it fails to account for the relative importance of the different elements. "The dam will save 50 million tons of coal [a year] and reduce the amount of carbon dioxide released by 100 million tons," says Li Zhennan, former chief engineer with the Changjiang (Yangtze) Water Resources Commission. "That can hardly be compared with such environmental problems as a slight drop in temperature or one or two more foggy days a year. The feasibility study concluded that the project will have both positive and negative environmental impacts," Li adds, "and that many adverse impacts can be solved through appropriate measures."

Some scientists have less faith in those remedies, however. Sun Honglie, a geoscientist and a former vice president of CAS, says that most of the 1.2 million people to be relocated will simply move higher up the mountain slopes around the reservoir region, putting additional strain on the already deteriorating environment. "The land in the region is already overused, and soil erosion on the mountain slopes by the reservoir is serious," says Sun, a consultant to the project's steering group in the 1980s.

With construction moving forward, there may be little time to accommodate the project's critics. But Three Gorges is not the last big dam on the drawing board. Work on two smaller dams located 500 kilometers upstream of Chongqing is scheduled to begin in 2003, and Zhang notes that their presence "will reduce the sedimentation [entering the Three Gorges Reservoir] by nearly half." Observers see his comment as belated recognition of the importance of some of the issues raised during the debate over the Three Gorges project.

–Xiong Lei

Xiong Lei writes for China Features *in Beijing.*

ESA

Industry Links Debated, Moon Shot Killed

Last summer, when Italian electrical engineer Antonio Rodotà took over as director-general of the European Space Agency—the first ESA head to come from industry—he promised to reinvigorate the faltering agency by forging new partnerships with Europe's rapidly growing aerospace industry (*Science*, 5 September 1997, p. 1426). Last week, delegates from ESA's 14 member states were given their first taste of Rodotà's new strategy at a meeting of ESA's Council at its Paris headquarters. While leaving ESA's science program untouched, Rodotà presented a "menu" of new initiatives that would all require the involvement of industry.

The reaction of delegates was largely favorable, but there were calls for the scheduled June meeting of the Council at ministerial level—when major funding and strategic decisions are made—to be postponed while details are hammered out. And, in a separate action, the Council nixed plans to develop a European lunar project early in the next century.

The new suite of programs that Rodotà proposed to the Council last week included:

- a mainly French proposal for upgrading the Ariane 5 launcher, increasing its launch capacity and reducing its cost.
- the development of a small launcher, proposed by Italy, that can place 1-ton spacecraft into 700-kilometer polar orbits.
- an Earth observation program that would encompass both research-oriented "Earth Explorer" missions, wholly funded by ESA, and applications-based "Earth Watch" missions developed in collaboration with industry (*Science*, 16 January, p. 316).
- a satellite navigation program that would make Europe independent of both the U.S. Global Positioning System and the Russian GLONASS system.
- a program to develop multimedia satellite systems and mobile and personal satellite telecommunications.

ESA

New broom. ESA Director-General Antonio Rodotà.

Rodotà's vision of ESA as the technological standard bearer for Europe's space industry apparently got a mixed reception. Bartolomeo Pernice, who coordinates European cooperation at ASI, the Italian space agency, says the reaction of the majority of delegates was positive. Europe, he says, needs such industrial partnerships to compete with the United States, where "most [space] applications are supported by development funded by the Department of Defense. We don't have this huge expenditure of military activity in Europe." German delegate Walter Kröll, board chair of Germany's space agency DLR, agrees: "I completely agree with Rodotà that a reformed ESA has to try to go along the way which he outlined if ESA really wants to be a major player in space." But Gérard Brachet, director-general of the French space agency CNES, says the plan was received with "a mixture of sympathy and skepticism." Noting that ESA initiated the development of satellite communications in Europe, but was soon outrun by the industry consortium EUTELSAT, Brachet says, "ESA does not have very much experi-

ence in this field. ... It is industry that should play the principal role in the commercial applications of space."

Aside from the discussions of ESA's future role in nurturing industry, the Council also made two important decisions on future programs. It declined to back a project called Euromoon 2000, proposed by former ESA astronaut Wubbo Ockels, to send a small orbiter and lander to the moon in the early years of next century. Development work on the project had already begun at ESA's technology center ESTEC in the Netherlands. Brachet pointed to two reasons why the Council killed Euromoon: It had been developed without first gathering the support of the scientific community and ESA's Science Program Committee; and, although it would have been a scientific mission, Ockels was proposing to fund it through $135 million of industrial sponsorship in addition to $45 million from ESA. "Such a project goes counter to the aims of the agency, which is that the funding of [science missions] be by its own means," Brachet says. The ESTEC team was very disappointed by the decision, Ockels says: "We had only asked for approval of the first phase. ... Nobody expected that there would be a problem."

The second decision was to approve the creation of a single ESA astronaut corps. This will involve the dismantling of the separate astronaut programs currently run by France, Germany, and Italy, and their integration with the existing small ESA astronaut corps at a new astronaut center based in Cologne. "This is a very laudable decision. ... We are convinced that this will contribute to increased activity and an increased role for European astronauts, especially with the advent of the international space station," says Council member Jean-Pierre Ruder of the Swiss Federal Office for Education and Science. The ESA astronaut center will be based at DLR headquarters in Cologne and could be up and running by next year, reports Kröll. "DLR will carry out a number of training functions on behalf of ESA. ... This decision clearly reduces costs and is a concrete example of increasing efficiency," he says.

With much of Rodotà's reform program still in its early stages, several Council delegates called for the June meeting of the Council, at which government ministers will be present, to be postponed. Germany also wants a delay until after its general election later this year. "We should have a ministerial meeting which takes decisions sufficiently well prepared," says Kröll. The Belgian Minister for Science Policy, Yvan Ylieff, who will chair the meeting, will decide on its date later this month.

–Alexander Hellemans

Alexander Hellemans is a science writer in Naples.

MICROBIOLOGY

New Hunt for the Roots of Resistance

As bacteria worldwide acquire resistance to the drugs meant to kill them, public health experts have stepped up surveillance of antibiotic resistance in human pathogens. Now a grassroots network of scientists is taking aim at what they see as the root of the problem: resistance genes in harmless bacteria that live in humans, animals, plants, even soil and water. By keeping tabs on when and where specific antibiotic-resistance genes appear, the group hopes to predict—and one day help block—the spread of resistance.

Efforts to track resistance in clinical pathogens have "too narrow a focus," argues Abigail Salyers, a microbiologist at the University of Illinois, Urbana-Champaign, who helped organize a meeting in Boston last week to plot the new strategy. She explains that antibiotic resistance can hide undetected in harmless bacteria well before it shows up in patients. "Clinical isolates are the tip of the iceberg compared to what's out there in the environment," agrees microbiologist Stuart Levy of Tufts University School of Medicine, who is president-elect of the American Society for Microbiology (ASM) and president of the Alliance for the Prudent Use of Antibiotics (APUA), an international group that hosted the Boston meeting.

Seemingly harmless bugs are worth watching, Levy says, because widespread dosing of both humans and animals with antibiotics selects for drug resistance in benign bacteria that normally thrive in such places as the large intestine. The resistance genes can then jump species lines into disease-causing bacteria. When that happens, the genes from harmless bugs are anything but. For example, ampicillin has lost its potency against infections caused by *Haemophilus influenzae* because the bacterium picked up an ampicillin-resistance gene from *Escherichia coli* in the 1970s. The ASM estimates that drug-resistant pathogens cost more than $4 billion per year in extra medical costs in the United States alone.

By using sequence similarities in resistance genes from different bacteria as an indicator, scientists have already identified a handful of such trans-species leaps, although they can't prove which way the genes jumped (see table).

To provide early warnings of such gene transfers, the new network will catalog resistance gene sequences and data on specific strains in a searchable Internet database. The 19-member working group hopes to enlist scientists, physicians, and public health workers worldwide, reaching them through the existing networks of the 7000-member APUA and the 40,000-member ASM, as well as with editorials in scientific journals. Funded by a $100,000 National Institutes of Health grant, the group will also launch two pilot studies. One study will compare drug resistance in harmless gut bacteria from rural Mexican children, who have not been exposed to antibiotics, with bacteria from children in Mexican cities, where antibiotics are sold over the counter. The other study will compare resistance in gut bacteria from antibiotic-fed cattle with those from antibiotic-free bison.

Not everyone agrees that these efforts are on the right track. The link between resistance in harmless bacteria in animals and in human pathogens is "pretty tenuous," says Richard Carnevale, director of regulatory affairs at the Animal Health Institute, a group that represents producers of animal antibiotics. "I'm not sure it's worth doing." But other experts support the undertaking. "Their approach is the correct one," says microbiologist Mark E. Jones of MRL Reference Laboratories, who directs resistance surveillance efforts in Europe.

As drug-resistant pathogens continue to emerge from the shadows, researchers are eager to start their hunt. Says Salyers: "We need the answers yesterday."

–Dan Ferber

Dan Ferber is a science writer in Urbana, Illinois.

SUSPECTED RESISTANCE GENE TRANSFERS

Drug resistance	Benign Bacteria	Location	Disease-Causing Bacteria	Disease
Tetracycline	*Enterococcus* species	Human intestine	*Streptococcus pneumoniae* *Neisseria gonorrhoeae*	Pneumonia Gonorrhea
Erythromycin	*Bacillus sphaericus*	Soil	*Bacteroides fragilis*	Blood infections
Tetracycline	*Prevotella ruminicola*	Pig, sheep intestine	*Bacteroides fragilis*	Blood infections
Tetracycline	*Lactococcus lactis*	Cheese	*Listeria monocytogenes*	Food poisoning

SOURCE: A. SALYERS