with the rat genome in hand, "you can take the power of mouse genetics and the power of rat physiology and link them together," says Howard Jacob, a physiological geneticist at the Medical College of Wisconsin in Milwaukee.

NHLBI has supported rat genome work since 1995, although Jacob notes that "it's been a stealth project" that hasn't received wide notice. The project has generated sequencing tools, such as a physical map of the rat genome and a set of bacterial clones of rat DNA, but full-scale sequencing was on hold. In the past year, however, the big genome-sequencing centers have expanded their capacity so much that NHGRI director Francis Collins became convinced that they could tackle the rat genome as they were finishing the human genome and preparing the mouse draft. In May, the NHLBI advisory council agreed to put aside $32 million in 2001 and another $26 million in 2002 for the rat.

But NHGRI has advanced its troops even before the new year begins, shifting two groups, the Baylor College of Medicine in Houston and Genome Therapeutics Corp. (GTC) in Waltham, Massachusetts, into the rat effort. Baylor's Richard Gibbs will put the remaining $14 million from his mouse grant toward the rat, and GTC's Doug Smith will divert about $10 million from mouse and human sequencing for GTC's initial rat work. Together, they hope to sequence the entire rat genome once over within a year. The two centers are likely to be among those that receive the NHLBI contribution, which will be used to sequence the genome at least four times over to produce a rough draft.

If all goes well, the mouse and rat genomes will be available at the same time. Because the two rodents are separated by about 16 million years of evolution—while the human and mouse are separated by 80 million years—the rat and mouse genomes will share some DNA that is not obviously conserved between either rodent and the human genome. Thus, the rat genome should help to identify regulatory regions that might be missed in a mouse-human comparison.

NHGRI plans to push ahead on the mouse genome to produce a high-quality, complete version. So far, that's not in the cards for the rat. But that suits Jacob just fine, even though he works on the rat. He says: "I think it does not need to be finished at the current cost for finishing."

–ELIZABETH PENNISI

CREDITS: (TOP TO BOTTOM) LEE JAE-WON/AP; U.K. DEPARTMENT OF HEALTH

STEM CELL RESEARCH

U.K. Backs Use of Embryos, Sets Vote

LONDON—The U.K. government leaped into an ethical minefield last week, endorsing a report it had commissioned that calls for an expansion of research on human embryos. The report advocates tapping embryos for their stem cells, unspecialized cells that may ultimately serve as seed material for growing tissues to treat diseases. It also opens the door to cloning human embryos for research—an activity that has triggered sharp debate. Legislation implementing the recommendations will go to Parliament for a vote this fall.

If passed, the new U.K. regulations would likely be more permissive than guidelines expected out shortly from the U.S. National Institutes of Health. With Canada, Germany, and Japan also hammering out guidelines, says stem cell researcher John Gearhart of The Johns Hopkins University School of Medicine, "you'll soon see other players in the field."

Current U.K. rules allow research on human embryos only for studies aimed at improving infertility treatment, devising better contraceptives, and screening for genetic abnormalities before implantation. Nearly all embryos used in such studies are leftovers from in vitro fertilization clinics, and research is limited to embryos less than 2 weeks old, before neural development occurs.

But recent advances in stem cell research prompted the U.K. Department of Health to ask its chief medical officer, Liam Donaldson, to appoint an independent panel to review the science and ethics of human

POSSIBLE USES OF TISSUE DERIVED FROM STEM CELLS TO TREAT DISEASE

Cell type	Target disease
Neural (nerve) cells	Stroke, Parkinson's disease, Alzheimer's disease, spinal cord injury, multiple sclerosis
Heart muscle cells	Heart attacks, congestive heart failure
Insulin-producing cells	Diabetes
Cartilage cells	Osteoarthritis
Blood cells	Cancer, immunodeficiencies, inherited blood diseases, leukemia
Liver cells	Hepatitis, cirrhosis
Skin cells	Burns, wound healing
Bone cells	Osteoporosis
Retinal (eye) cells	Macular degeneration
Skeletal muscle cells	Muscular dystrophy

ScienceScope

DNA Across the DMZ The tears were real last week when members of 200 families torn asunder 50 years ago by the division of the Korean Peninsula were reunited briefly in Seoul and in Pyongyang. But many of the estimated 10,000 South Koreans with offspring in both countries may not live to see their long-lost North Korean children. A new initiative, however, could keep genealogies intact—and perhaps resolve inheritance disputes between North-South siblings.

On 1 September I.D. Gene, a Seoul-based paternity testing firm, plans to start taking saliva samples from any of the 10,000 South Korean parents who are willing. The sampling is free, but I.D. Gene will charge its usual fee (about $400) for typing the 10 nanograms or so of nuclear DNA in each sample. Efforts to get the government involved with the project have so far failed, says I.D. Gene CEO Yeon-Bo Chung, a Harvard-trained biologist. So a group of private benefactors, including the drug firm Korean Green Cross Inc., is bankrolling the estimated $80,000 sampling and storage costs.

Typing DNA from siblings alone may not cement a family connection, as siblings often have fewer DNA sequences in common with each other than with each of their parents. That's why preserving the older generation's DNA is crucial, says Chung. "Unless somebody collects the samples right now, they will not be available when they are desperately needed in the future."

Doubling Double Hit The campaign to double the budget of the National Institutes of Health (NIH) has won a pair of high-profile endorsements. Democratic presidential candidate Al Gore last week promised to "double the federal investment in medical research" in his nomination acceptance speech to the Democratic National Convention in Los Angeles. Not to be outdone, Republican rival George W. Bush's campaign said their candidate also backs the doubling push, begun 4 years ago by biomedical research advocates.

Both Bush and Gore, however, have yet to endorse the more ambitious agenda of Gore's running mate, Senator Joe Leiberman (D–CT). Leiberman is a major backer of bipartisan legislation that recommends doubling the government's entire $35 billion nondefense, nonbiomedical research portfolio by 2010. Many lobbyists say that NIH's rapid growth in the past 2 years has skewed the federal portfolio and that other agencies need to catch up.

ENDANGERED SPECIES

Migrating Otters Push Law to the Limit

Fourteen years ago, Congress declared the Southern California coast an otter-free zone—but the unwitting creatures aren't cooperating. That's no surprise to federal biologists, who this summer issued a report concluding that the otter-free zone harms the already-endangered population. Federal officials are now trying to come up with a better plan, but it's likely to draw from politics as well as science.

Hearings last week in Santa Barbara and Monterey showcased a decades-long tussle over the range of the southern sea otter, which was hunted nearly to extinction during the 19th century. The few dozen animals that remained in 1911 expanded along California's central coast, but by the late 1970s the colony still numbered fewer than 2000, earning it a place on the endangered species list. Worried that an oil spill or other catastrophe could wipe out the entire population, officials from the U.S. Fish and Wildlife Service (FWS) proposed an ambitious relocation plan in the early 1980s to transport more than 100 otters to San Nicolas Island, 100 km west of Los Angeles.

Moving south. California sea otters have migrated into the official no-otter zone, threatening fisheries.

The fishers in the region were furious about this plan to establish a second colony. Although sea otters are undeniably cute, their voracious appetites are far from endearing. Lacking blubber, the animals keep warm with a racing metabolism that drives them to eat a quarter of their 30-kilogram body weight each day—mostly invertebrates such as clams, sea urchins, and abalone. "We have size limits, but otters don't," says commercial sea urchin diver Bruce Steele, who is based in Santa Barbara. "They do an awful lot of damage really quickly."

In 1986, Congress struck a compromise that declared the waters south of Point Conception to be a no-otter zone—except for the experimental colony on San Nicolas Island. FWS was required to round up any otters that strayed into the divers' zone and cart them back to San Nicolas or north of Point Conception—a task that proved exceedingly difficult.

For some reason, few otters were content to stay at San Nicolas. Although FWS relocated 140 animals, fewer than 25 live on the island today. FWS spent several years rounding up stray otters, but in 1993 the agency quietly stopped transporting animals to San Nicolas and also stopped enforcing the no-otter zone.

The implicit decision to abandon the policy might have remained in place had not an adventurous troop of some 100 animals decided to migrate south in early 1998. "They knocked down our harvest resources by 80% or 90% in 2 years," says Steele, explaining why he and other commercial divers filed suit in May to force FWS to maintain the no-otter zone.

FWS has defended its biological ground in a report issued last month. The agency says that the animals are still imperiled—their numbers fell from a 1995 high of 2377 to 2090 in 1999 before an increase this spring. And the exclusion zone is not helping. Not only do some animals die during capture or in transit, but introducing stray animals into existing colonies in the north can disrupt the current inhabitants and threaten their health. FWS biologists conclude that "continuing the containment program would jeopardize the existence of the species," says Greg Sanders of FWS. The move south "likely represents a natural range expansion" vital to the population's health, he says.

FWS is now considering several options. One is to declare the original relocation plan a failure because the colony at San Nicolas is too small for its original purpose: to rescue the species if the mainland population were wiped out. That admission would mean moving the remaining San Nicolas otters to the mainland and abolishing the no-otter zone.

Sea otter advocates prefer a second option, which would leave the San Nicolas colony in place and abandon the no-otter zone. The animals at San Nicolas are reproducing, they note, and otters born there might be more likely to stay. To that end, FWS is devising a supplemental environmental impact statement that will compare

CREDIT (LEFT TO RIGHT): J. MCDONALD/VISUALS UNLIMITED; SIRTF/NASA/JPL

ScienceScope

Protein Rush The race to understand the proteins assembled by human genes is powering up. Within a few weeks, Celera Genomics of Rockville, Maryland, expects to get a prototype of a sophisticated mass spectrometer which it claims will increase by a factor of 10—and, ultimately, by as much as 100—the number of proteins researchers can analyze at one time.

Currently, scientists can sequence about 300 proteins per hour on a good day. But Celera chief J. Craig Venter "soon" foresees decoding 30,000 an hour, and eventually up to a million a day. Identifying proteins is considered a key to designing new drugs.

Celera has ordered 20 of the new devices, which are being built by Applied Biosystems of Foster City, California, a sister company of Celera, Venter told pharmaceutical and biotech executives last week at a meeting in Boston. He also laid out a typically ambitious plan for his company in the burgeoning field of proteomics, but he admitted that Celera is unlikely to hold the kind of sway that it did in the gene-sequencing world. Indeed, the competition promises to be fierce, as other companies are pouring money into other technologies and research strategies (*Science*, 24 March, p. 2136).

Given the complexities of unraveling protein structure and function, Venter says, there is room for everyone. The field, he says, has "an open-ended horizon."

Delayed NASA's massive Space Infrared Telescope Facility—the last of the space agency's planned great observatories which began with Hubble—was scheduled for a December 2001 launch. But agency officials quietly told researchers last week that the $53 million mission, which will chart cooler objects such as dust clouds and asteroids, faces delays. One NASA manager says that a programming problem with the control system for the satellite's camera will force a 4- to 6-month launch delay. Fixing the glitch in the system, which is the responsibility of the Goddard Space Flight Center in Greenbelt, Maryland, will cost about $2 million. Keeping the 1-ton spacecraft on the ground longer, however, will add $30 million to $50 million to the program's cost, NASA officials say.

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