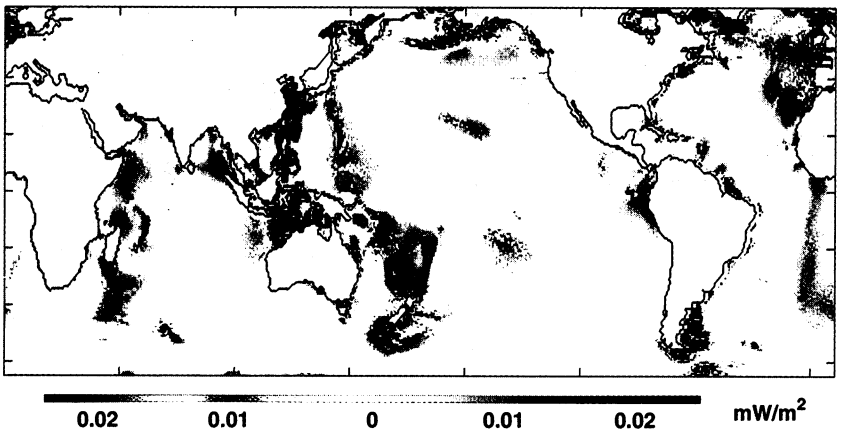


Deep mixing. Stirring (red) occurs in the deep sea where tidal currents cross rugged sea floor.

CREDIT: (TOP) G. EGBERT AND R. RAY/*NATURE*

shore, although by only a few tens of centimeters in the open ocean. Where the water is shallow enough, thinking went, tidally induced currents drag on the bottom and stir the shallow seas and waters of the continental shelves. Thus, through the tides, the moon's orbital energy slowly trickles into stirring the shallow ocean.

But although tidal mixing seemed to be solved, some loose ends remained. It wasn't clear to everyone that the shallow ocean could account for the dissipation of all the tidal energy the moon imparts. And oceanographers had trouble with what they call the conveyor belt, which carries heat from the tropics to the poles. Dense, cold water sinks into the deep sea near the poles, travels to the tropics, and rises to the surface. To do so, it must mix with warmer, more buoyant waters along the way. Oceanographers have discovered one or two places where tidal currents flowing across a rough sea floor greatly enhance mixing (*Science*, 10 January 1997, p. 160). But they have found only a tenth of the mixing required to lift deep waters.

Oceanographers needed a global tide gauge, which they found in the TOPEX/POSEIDON satellite. Every 10 days for 7 years, it has measured the height of the tides over the world ocean to an accuracy of about 1 centimeter. In this week's issue of *Nature*, geophysicists Gary Egbert of Oregon State University in Corvallis and Richard Ray of NASA's Goddard Space Flight Center in Greenbelt, Maryland, report how they used TOPEX/POSEIDON altimeter data to map tidal currents, tidal energy, and finally where tidal energy was being dissipated and mixing the ocean. Shelves and shallow seas such as the Yellow Sea off Asia show up clearly as areas of strong tidal dissipation, but some deep-sea, rough-bottomed areas show considerable mixing as well—the ridge joining the Hawaiian Islands, the Mid-Atlantic Ridge, and ridges of the southwest Pacific, among others. All told, open-ocean tidal mixing seems to account for enough energy dissipation to keep the conveyor belt running.

"That's supportive of deep tidal mixing," says Wunsch. "The answer is interesting." It reaffirms the theoretical inference that "mixing is the driving force" behind the conveyor belt, says Schmitt. If not for tidal mixing in the deep sea, he notes, the ocean would fill to near the top with cold water and the conveyor would shut down. Because deep-sea tidal mixing determines the rate at which the conveyor runs, changes in the way tidal currents interact with the bottom could have changed the way the climate system worked in the past, Wunsch notes. The rearrangement of the continents and sea-floor ridges in plate tectonics may have altered tidal mixing, for example. And the uniform mixing of climate model oceans—in contrast to the actual patchy mixing—could skew model forecasts of ocean behavior and therefore greenhouse warming. Those are far-reaching conclusions to draw from imperceptible tidal bulges on the open sea. **–RICHARD A. KERR**

CLINICAL TRIALS

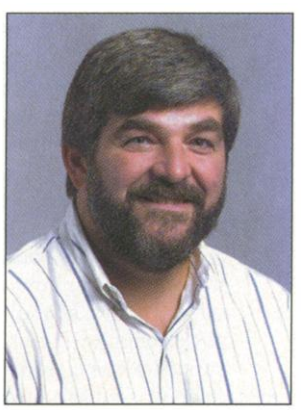
Harvard's Koski to Lead Human Subjects Office

As Congress steps up oversight of human clinical trials, the Administration is getting a high-level manager of its own to watch out for the interests of volunteers in U.S.-financed research. As expected, Secretary of Health and Human Services (HHS) Donna Shalala last week named anesthesiologist E. Greg Koski, 50, to run a new HHS Office for Human Research Protections (*Science*, 26 May, p. 1315).

One of Koski's first jobs when he takes over in September will be to conclude more than 170 pending investigations into alleged infractions of regulations governing human experimentation. Koski may also be swept into a debate on the adequacy of those regulations. Last week a bill, H.R. 4605, was introduced by Representatives Diana DeGette (D–CO), Henry Waxman (D–CA), and John Mica (R–FL) that would extend HHS's authority over patients in federally funded studies and certain private studies that are not now subject to federal monitoring. Arguing for a "comprehensive reform," the sponsors propose to bring all human research under a single standard, "independent of setting and funding source." They also would like to create a "nonprofit entity" to accredit the local Institutional Review Boards that examine and approve clinical trials.

Koski, an M.D.-Ph.D. associate professor at Harvard Medical School in Boston, has spent 30 years in the Harvard community, most recently as director of human research affairs for Partners HealthCare System Inc., which oversees the Massachusetts General Hospital in Boston and other Harvard-affiliated hospitals. As chief U.S. protector of research subjects, Koski will report directly to the assistant secretary of health, Surgeon General David Satcher. An agency reorganization that created his job at HHS also created a 12-person advisory panel—not yet named—that will give outsiders a chance to drive policy from the back seat.

Koski could not be reached for comment, but scientific leaders say they welcome him to Washington. Jordan Cohen, president of the Association of American Medical Colleges, said last week that Koski "is highly respected within the academic medical community and brings to the new office a strong track record in the area of human subject protections." The administration, he added, "is to be applauded for attracting a person of Dr. Koski's caliber." Cohen also supports H.R. 4605.



Clinical czar. Greg Koski will oversee federal efforts to protect patients.

But Vera Hassner Sharav, a leader of one of the patient advocacy groups that has faulted the government for weak enforcement of regulations, Citizens for Responsible Care and Research in New York City, offers a more wary endorsement of HHS's new scheme. Sharav says she is concerned that a boost in the status of the human subjects office, formerly headed by Gary Ellis, does not necessarily confer independence. "The new office," she says, "should be judged on its actions—on how vigorously and expeditiously it investigates allegations of research violations."

–ELIOT MARSHALL