ences, says the new report "seems to have achieved a pretty reasonable balance." And pathologist Jonathan Tait of the University of Washington, Seattle, after a quick reading, said he identified some vague spots, but thinks the report "doesn't have severe problems."

Today, an investigator often makes biological samples anonymous by stripping off names and other identifiers and replacing them with a code. Because these coded samples are considered to be exempt from normal consent requirements, researchers often share them with colleagues as though they were anonymous, without obtaining new consent from donors. Nor do researchers necessarily seek approval from local panels that monitor the use of human subjects—known as institutional review boards (IRBs)—to conduct research on such samples. But this could change.

To protect against loss of privacy, NBAC is proposing that unidentified samples be coded not by the investigator but by a third party, such as "an encryption service." This would make it almost impossible for any researcher to identify the source. But if a researcher cannot or doesn't want to make tissues truly anonymous in this way, NBAC says, the research should be approved by an IRB, which might also ask the researcher to obtain specific consent from the donors.

If a study might pose more than a minimal risk of harm to the donors, NBAC says, IRBs should take care to see that the risks are clearly described to donors before consent is sought. This is particularly important for "sensitive" projects such as research on behavioral genetics or for "studies differentiating traits among ethnic or racial groups, or research on stigmatizing characteristics such as addictive behavior." If the IRB determines that donors of stored tissue samples were not adequately informed in the past, researchers might be required to go back to the donors seek a new consent. In addition, donors at this point would be given a chance to ask that their tissues not be used in this or any future research project.

Even if the IRB finds no need for this kind of renewed consent procedure in a particular study, NBAC recommends that tissue donors should be given a chance to opt out of any research they "might find objectionable on moral or other grounds." NBAC doesn't explain how: It just says that institutions "should consider the option of making a good faith effort to contact subjects to allow them to 'opt out. . . .'"

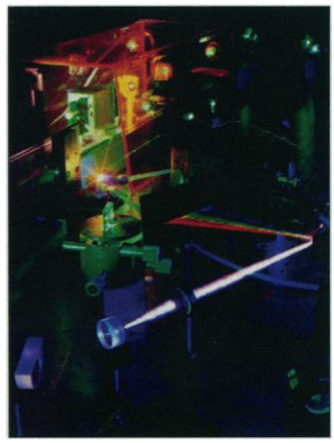
Some of these tough requirements were included in earlier drafts. But NBAC is taking a softer line on some issues. For example, it is not including a recommendation that researchers obtain "community consent" for genetic studies that might embarrass a particular ethnic group. Instead, the new draft says researchers should "be mindful" that their research might harm a genetically linked group of people, and minimize the risk. NBAC also suggests—to reduce paperwork—that the requirement for consent be waived when research on identifiable tissues poses a minimal risk of harm.

Many critics of NBAC's earlier draft are likely to agree with pathologist Jeffrey Cossman of Georgetown University, who says, "I think there's been a major advance" in the report's quality, "but this document isn't ready for prime time." It needs more polishing and another round of editing, he says. But time is running short. NBAC has set a deadline for all public comment of 17 January, and the panel could vote on a final report early next year. **–ELIOT MARSHALL**

LASER PHYSICS

Powerful Pulses Color Thomson Scattering

Not long after identifying the electron in 1897, British physicist J. J. Thomson watched it dance. He showed in 1906 that powerful pulses of light could make electrons oscillate up and down and reemit light at the same frequency in all directions, a phenomenon later dubbed Thomson scattering. Now, almost 100 years later, researchers have applied much stronger light to electrons and coaxed them into performing a more complex dance step, tracing out figure-8 shapes and reemitting the light in rainbow colors.



Pulse power. The University of Michigan laser used to demonstrate relativistic Thomson scattering.

CREDIT: WILLIAM PELLETIER

Researchers predicted the effect, called relativistic Thomson scattering, as early as the 1930s, but the intensity of light required to observe it was impracticably high. Now, with the help of laser pulses compressed into split-second bursts of staggering power, a team of physicists at the University of Michigan in Ann Arbor has seen the phenomenon's colorful signature. "We now have enough power to study nonlinear relativistic Thomson scattering," says team leader Donald Umstadter, whose group reports the result in this week's *Nature*.

Light can get an electron to dance because it is accompanied by an electric field vibrating across the direction of the beam. If the light is bright enough, the oscillating field grabs the charged electron and shakes it up and down. An oscillating electron naturally emits more electromagnetic radiation, and because these electrons are moving at the same frequency as the incoming light, the emitted light has the same frequency. But light also has an oscillating magnetic field, perpendicular to both the beam and the electric field. A magnetic field also exerts a force on a moving electron, known as the Lorentz force, which is so weak that its effect is not normally observable. The Lorentz force is, however, related to the speed of the electron, so if the incoming light is very strong and it oscillates the electron very fast, the Lorentz force should kick in, broadening the electron's normally linear motion into a figure 8.

To bathe the electrons in sufficiently bright light, team member Anatoly Maksimchuk built a tabletop neodymium-glass laser and squeezed its billionth-of-a-second pulses by a factor of about 1000, boosting their power to 4 trillion watts. Although more powerful lasers exist, Maksimchuk says it's beam quality that counts. "Essential for this experiment is a high quality of the beam, very short pulse duration, and good focusability," he says.

Aimed at a jet of helium gas in a vacuum, these pulses ionized the gas and simultaneously caused the freed electrons to oscillate. A charge-coupled device camera recorded the light emitted by the electrons from all angles around the apparatus. Just as predicted by theory, Umstadter and his colleagues saw light at the laser frequency as well as at multiples of that frequency, known as harmonics, each one emitted in a different direction. Umstadter notes that this is a definite signature of an electron moving in a figure-8 path and emitting light.

"It is the first time that we have been able to directly observe the instantaneous motion of electrons in the combined field [electric and magnetic] of the laser," says Umstadter. Doing so was no mean feat, says Antoine Rousse of the Applied Optics Laboratory at the Ecole Polytechnique in Palaiseau, France. "It is very difficult ... to extract the signal from background noise," he says. "You need ingenuity to eliminate all the extraneous sources."

"It really opens up a new subfield of physics—the study of the behavior of electrons at these extreme light intensities will give rise to many new interesting theoretical questions," says Nicolaas Bloembergen, a pioneer of laser science at Harvard Universi-

ty. For example, says Rousse, at such high speeds, close to that of light, the mass of the electron increases, changing completely the interaction between light and matter. "It will be very interesting to see what happens if we can increase the energy of the laser even further," he adds.

Umstadter believes that the feat will also lead to new laboratory x-ray sources. If the pump laser is powerful enough, the electrons should reemit most strongly in the x-ray region of the spectrum, he explains, "so we presumably will be able to convert 1 micrometer [infrared] light into 1 angstrom x-rays." The dance of electrons might ultimately lead to a tabletop laser producing very short x-ray pulses, useful for snagging a glimpse of other quick moves such as the molecular choreography of photosynthesis.

–ALEXANDER HELLEMANS

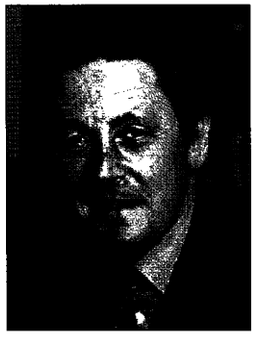
Alexander Hellemans is a writer in Naples, Italy.

BIOETHICS

Britain Urged to Expand Embryo Studies

Biologists in Britain who want to use human stem cells to develop new medical therapies say the chances for government support are looking brighter. They're encouraged by an opinion issued in London by a senior advisory panel urging the U.K. government to enact a new law to ban "reproductive cloning" of humans while permitting a limited type of cloning for research on new methods of treating disease.

The recommendations, written by a joint working group of the two agencies that regulate the use of human reproductive technology in the country—the Human Genetics Advisory Commission (HGAC) and the Human Fertilisation and Embryology Authority (HFEA)—are expected to carry substantial weight in the U.K. The report could also become a model for other countries, say U.S. researchers, including developmental geneticist John Gearhart of Johns Hopkins University in Baltimore, who has cultivated human stem cells from fetal tissue.



Limited approval. Advisory committee chair Sir Colin Campbell.

CREDIT: UNIVERSITY OF NOTTINGHAM

The joint HGAC and HFEA working group, headed by the Reverend Dr. John Polkinghorne—an Anglican minister and mathematical physicist—began reviewing U.K. policy last January at a time when the press was full of speculation that humans might soon be cloned. The working group drew up a summary of key issues and sought public comment. On cloning for reproductive purposes, the outcome was "conclusive," says legal philosopher Sir Colin Campbell, HGAC's chair and vice chancellor of the University of Nottingham: "86% of the people who commented supported a ban on human reproductive cloning." The working group also endorsed a total ban.

But a fraction of respondents also favored limited research that involves DNA transfer into oocytes, the process that produced the sheep Dolly. Besides offering a way to copy an organism, cloning might enable researchers to transfer DNA from a defective to a healthy embryo, and it might also allow them to create new tissue for transplants. The working group, says Campbell, supports research in these two areas.

In the first, aimed at studying diseases rooted in the mitochondria—the cells' energy-producing organelles—DNA might be transferred from a cell with deficient mitochondria into a healthy oocyte, creating an embryo that could develop into a healthy child. The goal of the second line of research would be to clone a patient's DNA in stem cells derived from an embryo and coax those cells to develop into tissues that would be accepted by the patient's immune system. "The eventual clinical use of such [transplantation] procedures," the report notes, "would be to provide immunologically compatible tissues for the treatment of degenerative diseases of, for example, the heart, liver, kidneys, and cerebral tissue, or repair damage to skin or bone." The potential medical value, it adds, is "enormous." The report recommends that research licenses be granted for these areas of research.

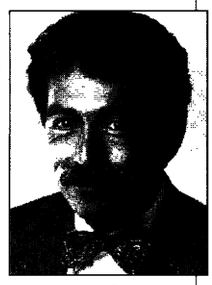
"This seems like a very positive signal that may open the door to research" on new methods of human cell therapies, says developmental biologist Austin Smith of Edinburgh University in Scotland. Existing U.K. guidelines allow researchers to obtain a license for research on human embryos up to the 14th day of development, but only for narrow applications such as improving fertilization methods. (At present, Britain has licensed 24 such projects at 18 centers.) Under the proposed new rules, however, these early embryos could be used for broader purposes, such as developing stem cells that can grow into a full range of specialized tissues—one of Smith's goals.

The HGAC-HFEA report lets agencies know that they should now give serious consideration to grant requests in these areas, says Smith. In the past, he says, restrictive legal policies have made it difficult to obtain funding even for research that would lay the

ScienceScope

SCIENCE EDITOR-IN-CHIEF TO STEP DOWN

Science is looking for a new editor. Editor-in-Chief Floyd Bloom (below) last week told the board of directors of the American Association for the Advancement of Science (AAAS), which publishes *Science*, that he will not seek a second 5-year term when his current appointment expires in May 2000. He said he wants to spend more time doing research at The Scripps Research Institute in La Jolla, California, where he is chairman of the Department of Neuropharmacology.



During Bloom's tenure, *Science* regularly published research reports that ranked among the most cited papers of the year. The journal also underwent a major redesign and made the leap onto the World Wide Web. Bloom "brought the vision, energy, and focus necessary to make it happen," says *Science* Publisher Richard Nicholson. The AAAS board plans to appoint a search committee within a few weeks, with hopes of naming Bloom's successor sometime next year.

NOT-SO-CRITICAL TECHNOLOGIES

Japan's industrial might in the 1980s created a bull market for studies assessing whether U.S. industry was falling behind in the race to master so-called "critical technologies" such as x-ray lithography. But a new White House report suggests that the once-hot topic has become cold, thanks to a healthy U.S. economy and Asia's financial crisis.

The report, based on interviews with 39 industrial titans from the likes of Merck, Motorola, and Lockheed Martin, is largely an exercise in chest-pounding. "Most speakers expressed their belief that the U.S. has regained its edge," the authors note. At the same time, the industrialists register grave concern with the state of U.S. public school education, a finding that the authors admit seems far removed from anyone's definition of a critical technology.

Perhaps the best gauge of how far techno-fears have ebbed is the affiliation of the authors. The report is from a federally funded think tank called the Science and Technology Policy Institute. Until recently, Washington insiders knew it by another name: the Critical Technologies Institute.

Contributors: Eliot Marshall, Michael Baker, David Malakoff, and Jeffrey Mervis