reference for estimating the distance to those farther away. This leads to an estimate for the Hubble constant—the ratio of the recession speed of the galaxies to their distance from Earth—which, finally, constrains the age and fate of the universe.

"Because we still have a 10% uncertainty, we're not making a dent in the Hubble constant today," says Shrinivas Kulkarni, who supervised Lane's research. "The excitement is that the technique does work. As other optical interferometers come online, they will produce a dozen similar measurements with accuracy to a few percent. This is like an initial public offering." One new interferometer that will probably improve upon the accuracy of the PTI measurements is the Center for High Angular Resolution Astronomy, a 400-meter-wide array of six telescopes on California's Mount Wilson, which will be dedicated on 4 October and is expected to start operations by the end of the year.

–DANA MACKENZIE

Dana Mackenzie is a writer in Santa Cruz, California.

PRESIDENTIAL APPOINTMENTS

Panel Cites Barriers to Government Service

Why don't more scientists want to work as top officials in Washington?

The answer, according to a panel of veteran government policy-makers, is a lack of attention to science by incoming Administrations, a slow appointment process, and outdated rules to prevent conflicts of interest. The problem is particularly acute among high-tech industry executives, according to a new report from the National Academies of Sciences and Engineering and the Institute of Medicine, which urges the next president to give industry a bigger place at the policy table. "We don't want to lower the standards," says Mary Good, dean of engineering at the University of Arkansas and chair of the panel. "But we think that it's fair to ask if the world has changed so much that the rules need to change, too."

Industry officials don't disagree that recruitment is a serious issue. But many say that considerations such as salary levels and career prospects are bigger disincentives to government service, and that it's also possible to serve the government without working in Washington full-time. "It's not a career path for most people in Silicon Valley," says Tim Newell, an aide to science adviser Jack Gibbons during Clinton's first term and currently managing director at E*Offering, an Internet investment banking firm in San Francisco. "The last few years have seen huge growth and unprecedented economic opportunities," he adds. "Those tremendous opportunities, plus the barriers mentioned in the report, make it harder to attract quality people to Washington."

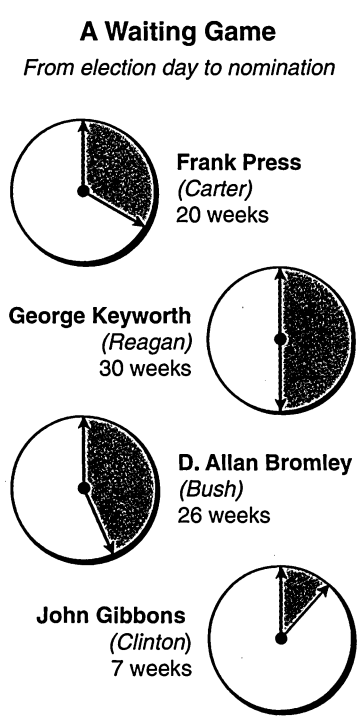
The eight-page report (www.nationalacademies.org) is a follow-up to a 1992 study by the academies and similar exercises by others carried out during an election year. It urges the incoming Administration to include scientists on its transition team and to appoint a presidential science adviser early enough to play a role in screening for other top positions. For example, President Reagan's decision to wait until May 1981 to appoint his first science adviser, George Keyworth, "was a big problem at the start," notes panelist John McTague, a retired Ford Motor Co. executive and acting presidential science adviser during Reagan's second term. "His first two science budgets were woefully inadequate, not out of malice but out of ignorance."

The science adviser is one of 50 science and technology slots, from the director of the National Institutes of Health to the undersecretary for technology in the Commerce Department, that the panel labeled as "most urgent" of rapid appointment. The panel was also concerned that the Clinton Administration included fewer people from industry in its first batch of nominees for top science jobs than did the Reagan and Bush presidencies. (The report did not tally appointments made after the second year in office.) It blames the decline, from 27% in 1982 to 12% in 1994, in large part on the screening process, which it says has grown so cumbersome that it deters potential hires. Indeed, several executives noted that the long delay between initial consideration and confirmation—data from the panel show that a majority of people now wait more than 4 months—is a big disincentive for industrial leaders, who must put their enterprises on hold while awaiting resolution of their job status.

Part of the problem are rules that require divestiture of stock, stock options, and other financial stakes that could be seen as a potential conflict of interest. To try to avoid these problems, the panel calls for the creation of a bipartisan panel, involving the White House and Congress, that would examine ways "to reduce unreasonable financial and professional losses" for nominees.

However, industry officials say a more important barrier than the ethics rules is the fact that a job in Washington may not look as good on the résumé of a rising executive as it might on the CV of a university administrator.The economy also plays a role in determining the pool of applicants, say industry officials. And good times don't last forever, Newell notes. "Just wait until the next recession," he says. "That could change things in a hurry."

–JEFFREY MERVIS



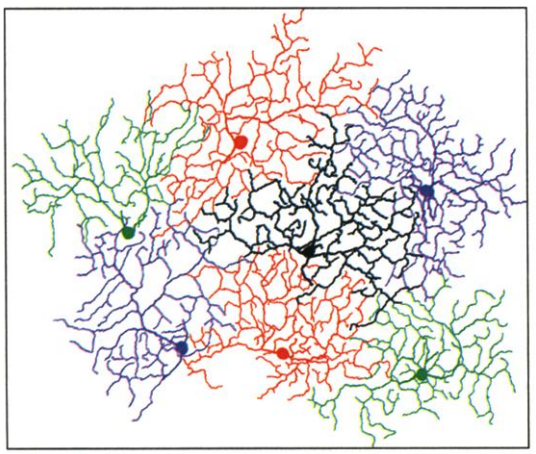
Timely hires. Clinton was the speediest of recent U.S. presidents to name his first science adviser.

NEUROSCIENCE

A New Look at How Neurons Compute

The eyes, considered windows to the soul, may offer views of the brain as well. Researchers seeking a simple system in which to study how neurons perform computations—such as tallying the myriad of incoming signals they receive and concluding whether or not to fire—have for decades focused on the retina, which contains neurons that fire only in response to objects moving in certain directions. By studying how those neurons calculate the direction of movement, they hoped to learn general lessons about how brain neurons compute. But the studies were handicapped because no one knew which retinal neurons do the math. Now, on page 2347, a team led by W. Rowland Taylor of Australian National University in Canberra and David Vaney of the University of Queensland in Brisbane, Australia, reports evidence that the directional computations take place in retinal neurons called ganglion cells.

"This is really important work," says Alexander Borst, a neuroscientist at the University of California, Berkeley—especially because it offers researchers a welcome chance to explore how neurons compute in a well-defined system. The Australian work might not be the last word, however. Another group has evidence that the site of computation lies elsewhere—a discrepancy that is likely to spark a flurry



Calculators? Retinal ganglion cells like these may compute when to fire by summing up the excitatory and inhibitory signals they receive.

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of additional studies.

The first sign that retinal ganglion cells do computations came in 1965 when Horace Barlow of the University of Cambridge in the U.K. and William Levick, a co-author on the current paper, showed that some of the cells respond only to objects moving in a certain direction. The ganglion cells are third or fourth in a chain of neurons triggered when light strikes the retina. Barlow and Levick proposed that neurons somewhere in this path calculate movement direction from the timed interplay of excitatory and inhibitory neural impulses.

In their scenario, when an object moved in the neuron's preferred direction, excitatory impulses would reach the target neuron first, triggering positively charged sodium ions to flow into the cell—an excitatory current. But when the object moved in the opposite direction, inhibitory and excitatory signals would arrive together. The inhibitory signal would cause chloride ions to enter the cell, their negative charge effectively canceling the excitatory effect. A decade later, Nigel Daw's team at Washington University in St. Louis confirmed that inhibitory impulses are required for directional selectivity, but a key question remained. Do the inhibitory and excitatory impulses converge on the ganglion cells or on earlier cells in the pathway?

To answer that question, Taylor used a method called patch clamping, which enables researchers to detect electrical changes in a single cell—in this case, ganglion cells in cultured rabbit retinas. Taylor and postdoc Shigang He found, as expected, that movement in a cell's preferred direction caused a greater excitatory current to enter the cells' dendrites, the structures that receive incoming signals. But that didn't pinpoint the site of computation; cells earlier in the pathway might be analyzing motion and delivering a larger excitatory signal to the ganglion cells in response to movement in the preferred direction.

To find out, the researchers shifted the voltage across the dendrite membrane of individual ganglion cells in a way that would favor inhibitory currents over excitatory ones. They found increased inhibitory currents in response to movement in the nonpreferred (null) direction, suggesting that inhibitory inputs play a role in the ganglion cell's response. Next they flooded the interior of the dendrites with chloride to block the inhibitory inward flow of chloride ions; that change abolished directional selectivity. These results provide "strong evidence" that the computation is going on in the ganglion cell dendrites, says Borst.

What's more, indirect evidence suggests that ganglion cells are capable of something called shunting inhibition, a phenomenon in which chloride channels are opened by inhibitory signals, but there is no net flow of chloride through them unless an excitatory signal comes along at the same time and drops the voltage across the membrane. This voltage change drives chloride through the open channels into the dendrite, where their negative charge electrically nullifies that incoming excitatory signal. In neighboring dendrites the calculation may be different; excitations arriving without inhibition could add up to help make the neuron fire. This model provides a much more complex vision of neuronal computation than does the view in which a neuron simply sums up all the excitatory and inhibitory signals it receives.

Shunting inhibition has been found in brain neurons, but the computations they perform are not known. Assuming that retinal ganglion cells do in fact calculate direction, researchers can investigate whether shunting inhibition occurs in these cells and, if so, how it contributes to computation, something many have been eager to do in neurons of well understood function, says California Institute of Technology neuroscientist Christof Koch.

But Lyle Borg-Graham, a neuroscientist at the French research agency CNRS in Gif-sur-Yvette, is not convinced that retinal ganglion cells have computational powers. He reported last July at a meeting in Brugge, Belgium, that his team has evidence that the critical direction-selective computation in turtle retinas occurs earlier in the signaling pathway. "I doubt that the different interpretations may be ascribed to using the turtle as opposed to the rabbit," says Borg-Graham.

The reason for the discrepancy is not clear. But when it is resolved, both camps agree, this particular window into the brain may provide quite an exciting view.

–MARCIA BARINAGA

ANTHROPOLOGY

Bones Decision Rattles Researchers

The Interior Department has decided to turn over the 9300-year-old remains of Kennewick Man to the five Indian tribes that have laid claim to them. But scientists suing to study the remains, found 4 years ago on the banks of Washington's Columbia River, say they will continue to pursue their case.

Last March, federal Judge John Jelderks gave the government until September to try to get some DNA out of the bones before deciding whether to allow academic anthropologists to study them (*Science*, 17 March, p. 1901). Three labs have since failed to obtain any DNA and, thus, suggest a link to a particular people or culture. This week, however, Interior Secretary Bruce Babbitt said the bones have been studied enough and that they should go to the Indians under the controversial Native American Graves Protection and Repatriation Act (NAGPRA).

NAGPRA applies to remains that are "native American" and "culturally affiliated" with existing groups. But many scientists say the Kennewick skull bears a greater resemblance to early Pacific rim inhabitants than to modern native Americans. And there is no cultural evidence connecting him to existing tribes: The only artifact accompanying the bones was a projectile point in Kennewick's pelvis. Nonetheless, in a letter to the Army Corps of Engineers, Babbitt said reports by four scientists have persuaded him that "the geographic and oral tradition evidence establishes a reasonable link between these remains and the present-day Indian tribe claimants." He referred to the "continuity of human occupation" in the area for more than 10,000 years and the fact that oral traditions support a very long residency for the tribes.

Looking for a home. A court may decide the final destination of Kennewick Man.

Scientists who want to study the bones aren't happy with Babbitt's decision. It is "absolutely absurd" and "cannot be supported either scientifically or from a legal standpoint," says Alan Schneider, a Portland, Oregon, lawyer for the scientists. Anthropologist Richard Jantz of the University of Tennessee, Knoxville, one of the plaintiffs, says "I can't imagine how the government can defend its decision in court." No trial date has been set.

–CONSTANCE HOLDEN