Closing in on the Hubble Constant

In 1929, astronomer Edwin P. Hubble deduced that the universe is expanding. Ever since, astronomers have struggled to determine the exact rate of that expansion, now known as the Hubble constant. Given the separation between two bodies, the Hubble constant dictates that they will move away from each other at a rate proportional to their distance apart.

Researchers have now taken a key step toward pinning down the value of this much debated number, which plays a fundamental role in determining the age and size of the universe.

The new value, incorporating data from the Hubble Space Telescope, indicates that the universe is at least 15 billion years old — 3 billion to 5 billion years older than recent measurements of the constant suggested. While the numerical value of the constant remains a question, astronomers agree the finding represents important progress in determining how rapidly the universe has evolved since its explosive birth.

A team that includes Allan R. Sandage of the Observatories of the Carnegie Institution of Washington in Pasadena, Calif., and Abhijit Saha at the Space Telescope Science Institute in Baltimore described the new calculations this week at a workshop in Sardinia, Italy.

Measuring the Hubble constant requires two ingredients: the velocity with which one galaxy recedes from another and the distance between them. Astronomers can determine a galaxy's recession velocity relatively easily. Calculating distance has proved a challenge.

For years, astronomers have inferred the distance between certain galaxies by using a cosmic yardstick — the luminosity of a group of stars, called cepheid variables, located in those galaxies. By analyzing the rhythmic pulsation of cepheids, scientists can deduce their intrinsic brightness — how bright they would appear to an observer standing right in front of them. Knowing that the luminosity of any star appears to fall off in proportion to the square of its distance from Earth, researchers can in theory calculate the separation between any galaxy containing cepheids and our own.

Since telescopes can only resolve individual stars in relatively nearby galaxies, astronomers can't use cepheids to obtain direct measures of the distance of faraway bodies, which would offer a truer value for the expansion rate of the universe. But Sandage and his co-workers circumvented that limitation by using the Hubble telescope to measure the luminosity of 27 cepheids in a small galaxy known as IC 4182. That galaxy contains another, more luminous cosmic yardstick — a special type of supernova called 1A — that could help calculate the Hubble constant in galaxies many more millions of light-years away, Saha notes.

Astronomers believe that all type IA supernovas attain the same peak intrinsic brightness, but no one knows the magnitude of that brightness. For this reason, researchers have used the supernova yardstick only sparingly. But by using cepheids to calculate the distance to IC 4182, a galaxy in which researchers observed a 1A supernova in 1937, scientists can now determine the actual peak brightness of these stellar explosions, Saha says. Thus, the team has used one cosmic yardstick to calibrate another.

"This is an observation that has been needed for some 15 to 20 years," says George Jacoby of the Kitt Peak National Observatory in Tucson, Ariz. But he and others counsel caution about the new results. While the Sandage team calculates that IC 4182 lies about 16 million light-years from Earth, a team led by Kitt Peak's Michael J. Pierce, using a less reliable stellar standard, has come up with a far smaller distance — implying a smaller, younger universe. Pierce says his most recent calculations show that IC 4182 contains lots of dust, which could make the cepheids appear fainter and thus confound distance estimates for the galaxy. He adds that the space telescope's blurry optics might also have hampered efforts to measure the luminosity of the stars. Follow-up observations on the ground and with a repaired space telescope may resolve the discrepancies, he says. *— R. Cowen*

Age no barrier to aggressive therapies

Physicians often think of the elderly as too fragile to take the harsh treatments ordinarily prescribed to stop a heart attack or knock back advanced cancer. However, two new studies dispel that myth, suggesting instead that many elderly people respond to aggressive treatment as vigorously as younger people.

Previous studies have shown that investigators often exclude older people from clinical trials of cancer drugs, perhaps because physicians fear that chemotherapy would lead to lethal side effects. Researchers have found that even when elderly cancer patients do receive chemotherapy, they often get lower doses than their younger counterparts — a practice that may undermine treatment efficacy.

Kathy Christman of the Memorial-Sloan Kettering Cancer Institute in New York City and her colleagues at Wake Forest University in Winston-Salem, N.C., decided to take a hard look at the folklore surrounding treatment of metastatic breast cancer. They studied 170 women with advanced breast cancer who had been treated in five clinical trials between 1974 and 1989. The team compared patients age 70 and older with patients age 50 through 69 and with another group younger than 50.

A review of medical records showed that the three age groups barely differed from each other in terms of time to disease progression or length of survival. For example, women under 50 survived an average of 17.9 months after treatment, while those in the 70-plus group survived 14.2 months. There is no significant difference between those statistics, Christman says.

Furthermore, the toxic effects of chemotherapy were similar for all three age groups.

Rather than focus on age, oncologists should look at each patient's health status, the researchers suggest in the July 1 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION. For example, heart attack victims of all ages may do worse if given certain heart-damaging cancer drugs, Christman notes.

Cancer treatment is not the only area in which the elderly may face medical bias. Doctors know that rapid administration of a clot-busting drug such as streptokinase can save the life of a person in the throes of a heart attack. Yet a 1991 study revealed that heart attack victims under the age of 75 are six times more likely than older patients to receive such drugs.

An analysis in the July 2 NEW ENGLAND JOURNAL OF MEDICINE now shows that people age 75 and older who receive streptokinase for heart attacks gain a survival edge over those who receive no clot-dissolving therapy.

Treatment with streptokinase involves some risks, such as excessive bleeding. Yet Lee Goldman of Harvard Medical School in Boston and his colleagues conclude that for older heart attack victims, the benefits of streptokinase therapy greatly outweigh the risks.

Taken together, the new findings suggest that doctors should reexamine their assumptions about the elderly. "One should not exclude patients from standard therapy because of age alone," Christman says. *— K.A. Fackelmann*