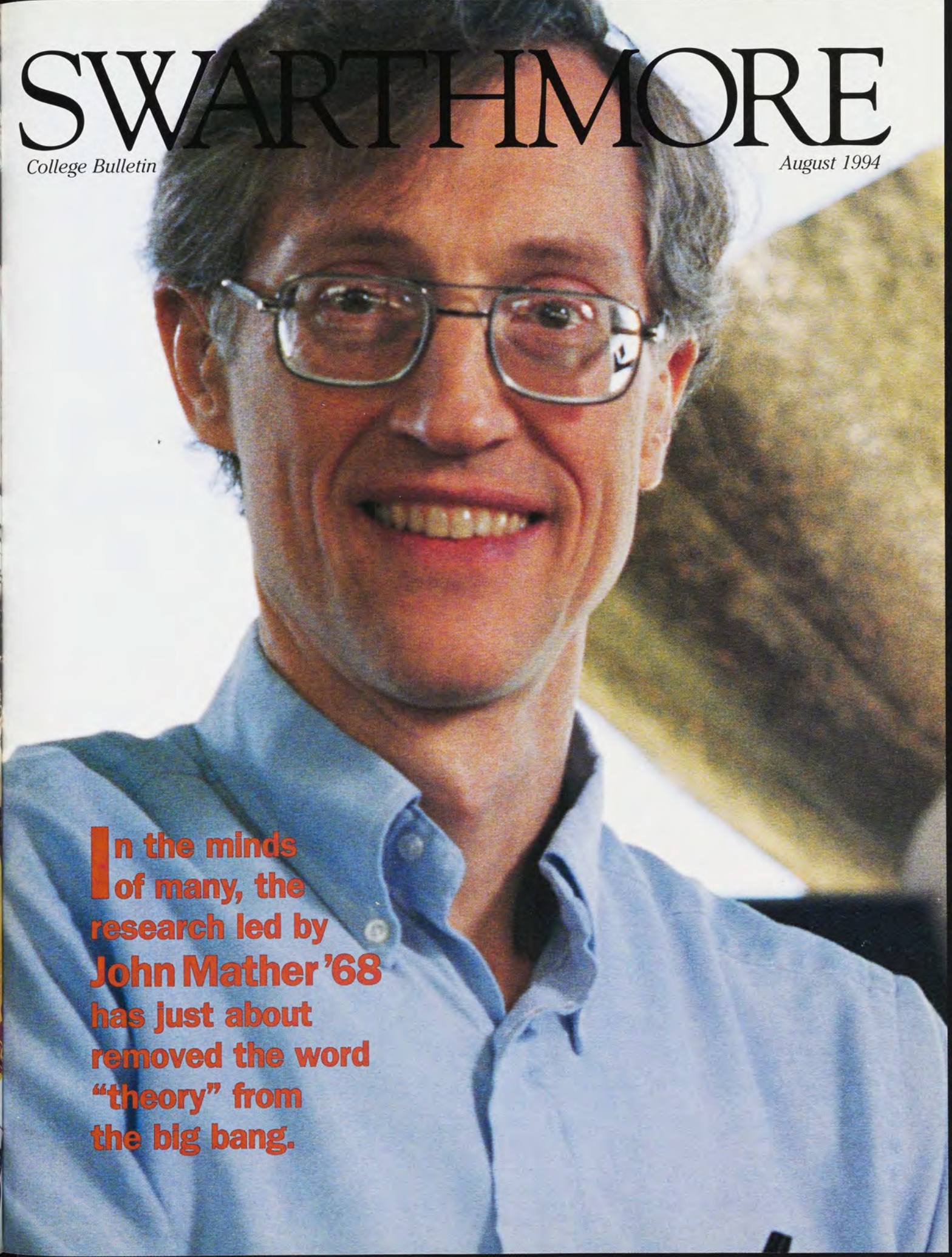
SWARTHMORE

College Bulletin *August 1994*



In the minds of many, the research led by John Mather '68 has just about removed the word "theory" from the big bang.

Marshaling in change ... After a tenure dating back roughly to the big bang, Paul C. Mangelsdorf Jr. '49, the Morris L. Clothier Professor Emeritus of Physics, hands over the staff of office as the College's marshal to Constance Cain Hungerford prior to Commencement in June. Hungerford, professor of art history, now takes on the duties of marshal, which include organizing and leading the processions and ceremonies for Commencement, Baccalaureate, and presidential inaugurations.

SWARTHMORE

COLLEGE BULLETIN • AUGUST 1994

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Cover: Cosmologist John Mather '68 has spent 20 years studying the origin of the universe. Story on page 4. Photograph by Bruce Reedy '68.

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PARLOR TALK

The last time we ran a story about scientific research on the origin of life on Earth ("Strewn From the Stars," August 1991) we got a long letter from Leonard Willinger '58 saying that we had missed the Biblical boat. For several months after we published his criticism, the Rev. Willinger and I conducted a lively personal correspondence about science and religion, ending in a philosophical impasse that each of us had to accept. We couldn't agree on The Beginning—or much of anything else—but the chance to sharpen and defend our views was a welcome challenge.

Cosmologist John Mather '68 is investigating the origin of the universe from a purely scientific perspective ("In the Beginning," page 4). He asserts that it is not the work of science to either prove or disprove the existence of God. Finding a spiritual force behind the big bang is "way beyond my capabilities," says Mather. Yet because his groundbreaking research encroaches on a realm of thought once exclusively occupied by religion, he is often asked the God question.

I wonder what might happen if scientists like John Mather were able to develop a perfectly understandable, absolutely irrefutable explanation of the origin of the universe. Would the weight of their evidence and the beauty of their logic convince us that some knowable physical or chemical process gave us the Earth, the stars, and our awareness of them? Will the human mind ever be able to discover the workings of a universe in which we are but specks of barely conscious dust?

Since Galileo's time, science has enlarged our knowledge and challenged our beliefs. The 20th century creation story known as the big bang is the latest in a long line of creation stories that stretch back to the dawn of human thought—except that it may turn out to be empirically "true." If it is accepted as such, cosmology itself could be elevated to the status of religion, with Copernicus, Galileo, Newton, Einstein, and Hubble as its saints—and scientists like John Mather as its reluctant priests.

Perhaps that's already happened. The legacy of 400 years of scientific thought has made me skeptical about anything that can't be supported by experiment or observation. I'm not a literalist about Genesis, but I constantly hedge. For me, the non-rationality of the Bible's creation story doesn't necessarily rule out a spiritual force behind the universe. Despite all the evidence, I can't think of my relationship to the stars as a strictly physical process. There are days when I often find more solace in myths than facts.

—*J.L.*

LET

What Fun! What Memories!

To the Editor:

With graduation gloriously behind us, I have had time to read cover to cover (a first for me as we get six different alumni magazines) the latest *Swarthmore College Bulletin*.

What fun! What memories! What a superb job you did in covering four very complicated years and turbulent times for all of us. The variety of articles was truly reflective of the many faces of Swarthmore's accomplished alumni.

As a member of Courtney Smith's family, I was deeply moved by the Stapletons' article ["The Challenge of Change"] and now look quite differently at this man I hardly knew. It touched some deep feelings I forgot were there, and I look forward to their book coming out soon.

Courtney's granddaughter Emily Smith ['94] and grandson Eliot Ingram ['94] looked wonderful walking out of the Scott Outdoor Auditorium on May 30 with diplomas in hand. I know he was watching.

PEGGY SMITH
(Mrs. Courtney Smith Jr.)
Philadelphia

Pressing Browne on Vietnam

To the Editor:

The four Chinese businessmen whose executions Malcolm Browne '52 witnessed ["Blood, Ink, and Tears," May 1994 *Bulletin*]—however guilty they themselves may have been of profiteering—were sacrificial lambs offered up by Air Vice Marshal Nguyen Cao Ky to divert attention from himself and the many other Saigon generals and government officials who were among the most corrupt and successful racketeers and profiteers in Vietnam, yet Browne's recounting of the executions makes no mention of this.

Moreover, "the street-corner execution" of the suspected Viet Cong guerrilla by Col. Nguyen Ngoc Loan took place in the midst of the Tet offensive of 1968 and had nothing whatever to do with Ky cracking the whip and wanting the world to know, as Browne asserts. Indeed, Loan was not Ky's police chief and interior minister, but rather General Nguyen Van Thieu's, Thieu having supplanted Ky as South Vietnam's

head of government in 1967.

And all this from the pen of a Pulitzer Prize–winning senior writer at *The New York Times*, the best of the best in his profession. The next time you pick up a paper or flip on the radio or watch the six o'clock news, you might ponder that.

WILLIAM D. EHRHART '73
Philadelphia

Malcolm Browne responds: "Loan was Ky's adjutant and police chief before Thieu became president, and he continued in that role. (I was myself once arrested by Loan during the Ky era.) Mr. Ehrhart seems to have little use for the American press. Neither did Loan, Ky, or Thieu."

MOVE a Cult, Not a Pressure Group

To the Editor:

I wonder if I might comment somewhat belatedly on the article "Fighting Words," describing Associate Professor Robin Wagner-Pacifici's book on the City of Philadelphia's handling of the MOVE crisis [February 1994 *Bulletin*]. Dr. Wagner-Pacifici apparently begins with the assumption that MOVE was a form of protest or pressure group. On the contrary, it was a cult. Its behavior, including the use of obscene language, foul odors, and blaring loudspeakers, was not intended to communicate but to offend, thereby enforcing cohesion within the group by arousing the hostility of those outside it.

The article quotes the actual (as opposed to the officially reported) message shouted into a bullhorn by the police commissioner when his force surrounded MOVE's headquarters: "Attention MOVE, this is America. You have to abide by the laws of the United States." In my view this message was admirably clear and correct. Unfortunately, it was delivered years too late. The impotence of the bureaucracy in enforcing health, sanitation, and other laws and regulations that exist for the common good had already passively validated MOVE's tactics.

Obviously, the assault on the house was a disaster in every respect. There was a monstrous fail-

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POSTINGS

Prehistoric humans had cave paintings, ancient Egyptians had tomb hieroglyphics, and this spring Swarthmore students had a wall of Pearson Hall to record their thoughts—uh well, make that graffiti.

Just weeks before the Franklin Mint Credit Union office in Pearson Hall was to undergo major renovations, teller Anna Feeny put out a basket of colored markers and encouraged students to write or draw their thoughts on the office walls before they were demolished. Someone labeled it "The Wall of Angst."

If College archivists were to preserve the wall, how would researchers decipher these glyphs in 1,000 years?

Sociologists would first delve into the deep thoughts expressed on the wall through famous quotations such as "Hacia La Victoria Siempre—'Che' Guevara." Or, juxtaposed directly below that, the thought-provoking, "Suckin' on chili dogs outside the Tastee Freeze—John 'Cougar' Mellencamp."

And lest one ever question Swarthmore's commitment to multiculturalism, one has only to translate messages in the script of Swahili ("I'll see you later"), Russian ("Good luck to good people—those who can read and cannot read this inscription. Anka"), German ("Always sing a song in your heart. Evil people don't have songs"), urban street lingo ("Nuff respec due tu yuh wall"), Greek ("Greek Islands and dry bread"), and French ("Swat: Embrassez mon derrière").

There's even graffiti for the mathematically inclined. OK, kids, put your thinking caps on:

$$\frac{13q + q + 2(3q)}{2} = ?$$

Math wizard Don Shimamoto, associate professor and chair of the Mathematics Dept., calculated the answer and chuckled for a good 20 seconds before declaring, "The answer is 10q. I think it's someone's way of saying 'Thank you.'"

Archaeologists might conclude that the student body has a flair for the poetic, such as in this sweet verse: "Share a joke/Hum a song/Pass some special joy along/And if someone should come your way/Who doesn't share your joy today/The hell with 'em."

And philosophical meanderings: "May those who love us, love us. And those who don't, may God turn their hearts. If he doesn't turn their hearts, may he turn their ankles, so we'll know them by their limping."

The wall contained various works of art, floral arrangements, vines, frogs, and even a Chinese dragon. A bald stick figure wearing a tulip shirt is pulling a string through its head and out each ear. Future art historians might decipher this as clearly indicating the wealth of brain mass of the campus natives. Another cartoon character with three strands of hair and big ears proclaims in a bubble near its head, "Wonder why I'm happy? I'll be done soon. Yeh right. I wish." There's also a magic marker scoreboard that scores a game between the Realists and Idealists. In each of the 10 innings, the Idealists receive zero points, while the Realists score anywhere from zero to four. The final score: Idealists–17; Realists–0. Go figure.

The wall contained some thoughts that even great paleontologists (let alone current administrators) would be hard pressed to figure out: "Oops! Sorry! My karma ran over your dogma"; "May Godspeed bless the feet of your holy camel"; "Peace, Love, and Hamsters."

Finally, there are numerous references to classes and exams being over. There are the counters: "17 more days and I'm outta here, Praise God," wrote a student high above a coat rack. "Only 5 more days and I'm done. I am envious of all the rest of you who are having fun." "Goodbye Swat: It's been four LONG years." And there are those who express a more laid-back attitude toward finals. "I am NOT stressed!" wrote one student, using a thick marker to stress the word not. "Welcome to thesis hell," wrote another. "Stress is a good thing ... really!" And this last calming thought: "Now the inmates are in charge of the asylum.—Finals '94."

—Audree Penner

IN THE BEGINNING

The Cosmic Background Explorer satellite made "the discovery of the century, if not of all time." And John Mather '68 gets a lot of the credit.

By Jeffrey Lott

Meeting John Mather '68, you'd never guess that his work has revolutionized our knowledge of the early universe. His unpretentious office at NASA's Goddard Space Flight Center in Greenbelt, Md., could be the lair of any busy professor. Books and papers cover every available shelf and surface. A blackboard lists upcoming writing projects—papers due, presentations, a book. Two computer screens glow on a government-issue desk, and the gray metal chairs look a mite uncomfortable, especially for the plainspoken 6-foot-5-inch physicist.

On the windowsill behind him sits a shiny foot-high model of the project that has been his life for the past 20 years, the Cosmic Background Explorer (COBE) satellite. In the scientific community, it's what sets John Mather apart from the crowd.

Cradling the model in his hands, Mather modestly refers to the pioneering spacecraft as "our experiment." Launched into Earth orbit in 1989, the COBE measured and mapped the faint microwave radiation left over from the origin of the universe. And though Mather will only say cautiously that "the COBE results are consistent with the theory of cosmic inflation," physicist Stephen Hawking has described the COBE findings as "the discovery of the century, if not of all time."

"All time" is a pretty big order, but in a way it's more than hyperbole. Because that's what John Mather and his colleagues are really exploring—all time, right back to the beginning.

It seems natural to assume that there was a beginning, a time when time began, that the physical universe has not always existed as we know it today. Human beings seem to have embraced this assumption all along. The Bible starts with a creation story, and religion and myth from nearly every culture have sought to explain the mysteries of the physical world.

In this century astronomers, physicists, and mathematicians have given us a different idea of the beginning—a scientific creation story based on their methods of theory, observation, and proof. These scientists, known collectively as cosmologists, have merged astronomical evidence and theoretical physics into the big bang theory, a creation story whose power is derived more from logic than mystery. Now, in the minds of many, the research led by John Mather has just about removed the word "theory" from the big bang.

Cosmologists ask how we got here from then. This conflation of space ("here") and time ("then") is not accidental. In the scientific creation story, space and time are inextricable. When we look out into space, we're looking back in time. We see the sun as it was about eight minutes ago, and light from the next nearest star is about four years old when it falls on our eyes. On a clear dark night, we can look back thousands of years, but that's nowhere near the beginning.

The oldest remnant of time doesn't glow like a galaxy; it just hums faintly like radio static in the cosmic distance.

With great telescopes we can see a lot farther. Instruments like the Hale at Mount Palomar and the Hubble Space Telescope were built to look to the very edge of visible time and space—some 15 billion light years away. Yet even they can't see back to the very beginning. That's because the oldest remnant of time doesn't glow like a galaxy; it just hums very faintly like radio static in the cosmic distance.

It's a signal first identified by Bell Laboratories researchers Arno Penzias and Robert Wilson in 1965, the year John Mather was a freshman physics major at Swarthmore. Cosmologists knew right away that this faint cosmic microwave background radiation (CMBR) could be the key to understanding—even proving—the big bang theory. In the nearly 30 years since Penzias and Wilson, there have been numerous attempts to study and measure it, but so far Mather's has clearly been the most successful.

The big bang story begins in the 1920s with the discovery by astronomer Edwin Hubble that the universe is expanding. Hubble found that the galaxies are rushing away from each other at terrific speed and that the farthest away (and thus the oldest) are receding the fastest.

One implication of Hubble's discovery was obvious: If the universe is expanding, it has to be expanding *from* something. If you pressed the Universe Rewind Button on your cosmic VCR, the galaxies would hurtle back toward each other. Space and time would shrink to a single point, to the beginning, and within this infinitesimal point would be found all of the matter in the universe. Hit Play and bang! here it comes again—or rather, here we come.

"At first it was very hard for many people to accept that this great expansion could have happened at all," says Mather. "But scientifically there are only a few choices. Either there was an origin at a particular time or there wasn't. And if there wasn't, then we would want to explain that too."

Even Albert Einstein was made uncomfortable by Hubble's discovery. Einstein's theories had favored a more stable universe, but it became apparent that cosmic equilibrium would require a balance of forces that could not be stable. Says Mather, "It would be like standing a pencil on end." And not on the eraser, either.

But how can we know that this explosion actually took place?

"Hot bodies like the Sun radiate most of their energy at very short wavelengths," explains Mather. "Something as hot as the big bang must have been filled with an enormous amount of radiation." In the 1940s Russian-born physicist George Gamow and his colleagues Ralph Alpher and Robert Herman had proposed that some of the radiation from the primeval explosion might still be out there.

"I think it might have been possible

Opposite: *A microwave map of the whole sky from the COBE satellite shows large-scale variations in the initial radiation from the big bang that are the "seeds" of the stars and galaxies of today.*

to find this radiation at that time," speculates Mather, "but no serious efforts were made." Nearly 20 years passed before Penzias and Wilson made their Nobel Prize–winning discovery. What they found (while trying to turn a primitive satellite communications antenna into a radio telescope) was a distinct microwave signal that seemed to come from everywhere. It bathed the universe in all directions and it seemed remarkably constant wherever subsequent researchers pointed their sensors.

By the time John Mather received a Ph.D. from Berkeley in 1974, the big bang theory was widely accepted. But there were some serious questions, like: Is the CMBR truly an artifact of the origin of the universe, or might this energy have come from something that happened later? The COBE instrument for which Mather was the principal investigator sought to answer this crucial question.

His idea since graduate school had been to compare the spectrum of the background radiation to what's called a "blackbody" spectrum—a theoretical benchmark for all cosmic radiation worked out by Max Planck in the last years of the 19th century. Mather's ingenious, liquid helium-cooled detector aboard the COBE made 10 months' worth of measurements and showed that the CMBR spectrum was exactly on the predicted curve. Though it didn't make headlines, the first public announcement of these findings in January 1990 caused an audience of more than 1,000 normally skeptical astronomers to burst into applause.

Interpreting these data, Mather is a bit less cautious: "We can now say that the big bang was completed in the first instant, that no other energy was released from other sources after the original event," he wrote. "We think that the universe really did expand from a hot and dense earlier condition."

Another crucial big bang question

Top: *A computer-generated map of one million galaxies shows how they are organized in huge strands. Cosmologists have now traced this structure to just 300,000 years after the big bang.*
Bottom: *John Mather, with a model of the COBE satellite in the background.*

was: How could billions of stars and galaxies have evolved from a primeval explosion that seemed to be unvarying in every direction?

If the radiation and matter from the early universe were exactly the same everywhere (isotropic is the word used by physicists), how could matter have begun to clump together to make stars and galaxies? The forces that pushed early atoms into huge galactic structures should be apparent in variations in the CMBR (anisotropy, it's called). Otherwise, the first atoms (mostly hydrogen and helium) would have just kept on expanding their separate ways forever. But the CMBR seemed to be perfectly smooth; no one had been able to find any lumps—until the COBE.

One of the satellite's crowning achievements was to find and map that anisotropy—the seeds of the universe. The announcement of these findings in April 1992 made worldwide headlines. The COBE showed that about 300,000 years after the big bang, the universe already showed enough variation in temperature to account for the formation of the huge clusters of galaxies that populate it today. (For more on the COBE experiments, see page 8.)

Considering the success of the COBE, it's ironic that John Mather once vowed never to try another cosmology experiment. He had tried to measure the CMBR as a graduate student, but by the time he left Berkeley, his complicated experiment involving detectors on a high-altitude balloon was still incomplete. Frustrated, he was moving on to a radio astronomy post in New York, saying that cosmology experiments were "too hard and give only a few numbers."

But he changed his mind when NASA called for satellite proposals in late 1974. He remembers the genesis of the COBE project in characteristically spare terms: "We pulled a little team together and wrote a little piece of paper that said, 'Here's our idea and we're pretty good at what we do, so why don't you talk to us?'" He says he never expected much to happen, but "after a couple of years, NASA said it was a good enough idea that we should study it some more."

In 1976 Mather moved to NASA/Goddard to head a group of six scientists charged with designing, building, and launching the COBE. In addition to Mather, the initial group included Sam Gulkis of the Jet Propulsion Lab, Michael Hauser of NASA, George Smoot of the University of California–Berkeley, Ray Weiss of MIT, and Dave Wilkinson of Princeton. (Coincidentally, Wilkinson, an early investigator of the CMBR, had been one of Mather's Honors examiners at Swarthmore in 1968.)

In 1982 NASA finally gave the go-ahead to build the 5-ton satellite, scheduling it for launch on the space shuttle. "It was almost built in 1986 when the Challenger exploded," says Mather, fidgeting a little at the memory. "We had to go back to the drawing board."

One of the COBE's crowning achievements was to find and map the seeds of the galactic universe.

The months after the Challenger disaster were probably the most intense of the entire project. Scientists and engineers at Goddard completely redesigned the COBE, cutting its weight in half in order to fit it into the nose cone of a Delta rocket, the only launch vehicle available after the shuttle was grounded.

"It hit us pretty hard," says Mather. "But always the job in front of us was how to get from here to the next step, and if something looked like it was going to stop us, well, it was just another thing to be overcome. With the COBE we were trying to do things a thousand times better than anyone had done before. There were a whole lot of things to learn along the way, and it's really tough, it takes a lot of effort."

Was he ever discouraged? "I can't say that I was. I tend to be the kind of person who just dives in and does something. When we started off, no one told us that it would take 15 years. I just said to myself, 'Well, this is fun every day. I'm not going to worry about whether it's going to take another day—I'm just going to do it."

Just doing it" appears to have been John Mather's style long before Nike shoes made it a national cliché. Mather knew as a high school student that he wanted to be a physicist. He was admitted to Harvard, MIT, and Swarthmore, choosing Swarthmore partly because of its size and setting. He had grown up on a dairy farm in New Jersey, where his father was an agricultural researcher, and "Swarthmore felt comfortable—safe and green and peaceful. Also, it had an integrated program. If you wanted to study physics, they made sure that you got all of the basics. It was a good place to sit down and study."

And study he did, moving into sophomore-level physics in the middle of his freshman year and graduating with Highest Honors. On receiving his second degree from the College this June—an honorary Doctor of Science—Mather told the 1994 graduates that "Swarthmore was the first place I could really become a professional scientist and like it." He also found that "the world was set up to reward people who were good at this. I could go ahead and follow my heart."

When he was a student, Mather explains, the Cold War was at its height and the United States had a deep inferiority complex about its science education. "We were so sure that the Russians were going to take over that we gave every kid who wanted to do science every possible advantage. It was actually very, very good for science, and for the country too, though the paranoia wasn't so good."

Another of Mather's remarks to the Class of 1994 brought the only spontaneous applause of the Commencement exercises: "Cooperation works better than competition when you are trying to get something done. There's no point in trying to be first if you're all riding in one canoe." (See page 23 for a longer excerpt from Mather's talk.)

Whenever Mather talks about the COBE project, he uses the word "we." (He even attributes the canoe

metaphor to a co-worker, Marty Donohoe.) The initial team of six scientists eventually became 20, and they in turn worked with hundreds of engineers, technicians, and project managers—even NASA lawyers—to get the satellite built. "If you count everybody who worked on the COBE," says Mather, "there are about 1,500 people."

"The canoe can be as big as you want it to be," Mather explains. "The boundaries are artificial. We can draw little circles and say, 'Well, this person's in this group and they're working on this problem,' but that's all descriptive. In the largest sense, all living things on this planet are in one canoe."

Yet the advancement of science has traditionally depended on friendly competition between scientists. "You need the competitive part to assure that the best ideas actually surface,"

Asked if he thinks there was spiritual force behind the big bang, Mather is concise: "That's way beyond my capabilities."

says Mather. "It really makes people's creative thoughts work a lot better. But when you have a big group like the COBE team, you have to cooperate with each other. It doesn't always mean being polite and nice. If the other guy is wrong, you ought to tell him because we're all in this together and we're all going to be wrong together. There's a duty for people to tell the truth as best they know it."

Big teams answering big questions—it's called Big Science and is often criticized for its need for Big Money.

Mather unashamedly defends the $300 million cost of the COBE project: "It's a uniquely human opportunity for us. I certainly don't want to live in a world where everyone says, 'Well, it's just too expensive to have an adventure, so we're all just going to sit home.' Try to picture an ideal world where everyone is clothed and fed, where no one is poor or suffering. What would we want to do then? Well, we'd want to do what we're doing now. It seems to me if we pretend we have to wait until some other problem is solved first, then we're never going to get anywhere. We have to take on the challenges we see when we see them."

NASA scientists admit that there is no practical application for the COBE research. "But," says Mather, "for what we got, it seems like a bargain. You can say, 'Well, that answer itself was worth that amount of money,' but there is no absolute scale for that. Or you could look at how hard it is to get that answer in some other way. There were well over 100 CMBR experiments done before the COBE, and not all of them were cheap. The predecessor experiments showed that we needed this kind of project to get where we got."

How much is it really worth to find out about The Beginning? And if it became possible for science to fully explain the origin of the universe, would that be enough to satisfy the human spirit?

George Smoot of the COBE team got a lot of attention at an April 1992 press conference when he said of the CMBR anisotropy map, "If you're religious, it's like looking at God." Some thought Smoot was taking a cheap publicity shot, but Mather calls it "a more or less spontaneous thought. He was just trying to make it seem interesting and important."

Nevertheless, the use of God metaphors to describe the COBE findings bothers Mather. "Within science we don't have a study of God," he says. "It's not our territory. If you really want to know how people feel and think, cosmologists aren't the right people to ask. A lot of people want us to tell them that our measurements agree with their Biblical theory of religion. But many others have moved beyond worrying about detailed comparisons [of scientific discoveries] to physical features described in religious literature. I think that the real

Please turn to page 62

A slightl

The Cosmic Background Explorer (COBE, rhymes with Moby) satellite was the platform for three separate experiments. It was launched into polar orbit by a Delta rocket in December 1989. With its solar panels deployed, it measured 19 feet by 26 feet and weighed 5,000 pounds at launch. Its primary objective was to investigate two radiative remnants of the early universe: the cosmic microwave and infrared background radiations (CMBR and CIBR). Four years of observations were completed in December 1993, and analysis of the data is continuing.

The most widely publicized experiment aboard the COBE proved that the CMBR is anisotropic—not the same in every direction. Previous measurements had been unable to find anisotropy, which is theoretically vital to the agglomeration of matter into stars and galaxies. George Smoot of the University of California–Berkeley was principal investigator for the differential microwave radiometer (DMR) that made the first detailed maps of the variations in the CMBR.

To understand the importance of this discovery, one has to delve into the theoretical physics of the early universe.

Atoms are the building blocks of matter, but atoms themselves are composed of protons, neutrons, and electrons, which in turn are made from more fundamental particles. Current theory holds that for about one second after the big bang, the universe was so hot—an estimated 10^{13} degrees Kelvin—that all of these subatomic particles were separated from each other.

After a few minutes, some protons and neutrons were able to join to make helium nuclei, but electrons and photons (particles of light) remained blissfully free, banging into each other at a furious rate like adolescents dancing at a rave, with each collision changing the wavelength of the photons. (In the meantime, antimatter annihilated most of the matter, but that's a problem for another day.)

After about a thousand years (the

more technical explanation of what the COBE did

blink of an eye in cosmic time), the temperature dropped enough that the wavelengths of the photons were no longer being changed by their electron encounters, fixing forever the total number of photons in the background radiation. This is the radiation that we see today.

Even then, complete atoms were still unformed. The young and restless electrons were too energetic to settle down in quantum marriages with the heavy, dull nuclei of hydrogen and its cousin helium. Their nuclear courtship lasted another half million years while the universe cooled, and finally atoms came together, forming vast clouds that were the precursors to the galactic universe we see today.

The DMR maps represent the gravitational potential in the universe about 300,000 years after the big bang and thus show the largest and oldest structures that may ever be detected by science.

In a second experiment, the far infrared absolute spectrophotometer (FIRAS) used sensitive detectors to compare the radiation from space to a known "blackbody" calibrator that was periodically flipped in front of the cone-shaped antenna like a mute on the bell of a trumpet. John Mather was the principal investigator for this experiment. The goal was to prove that the early universe had reached what it called "thermal equilibrium" and thus had no further input of energy after the big bang.

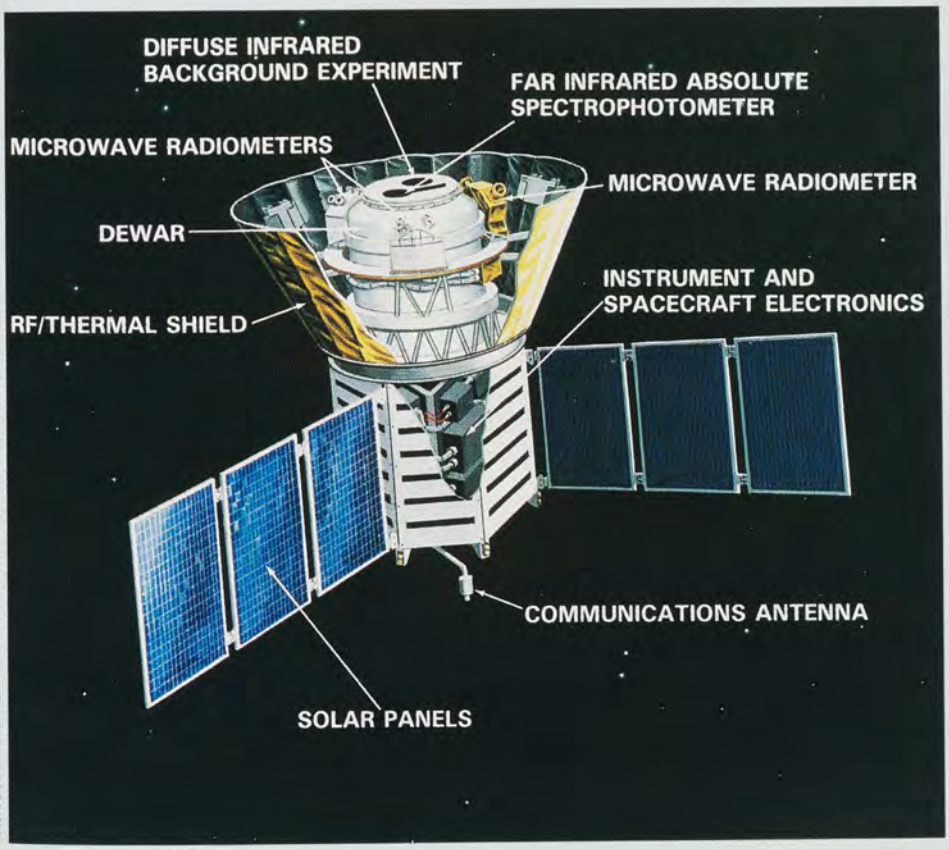
A blackbody is an ideal body or surface that completely absorbs all radiant energy falling upon it and itself radiates at a spectral energy distribution first worked out by mathematician Max Planck in the 1890s. He showed that the relation of brightness and wavelength of a blackbody were dependent on absolute temperature—or thermal equilibrium.

Considering that the big bang was so hot, it's hard to believe that the early universe reached any sort of equilibrium, but for a time the energy levels of the particles in the cauldron must have reached a constant state throughout the pre-atomic soup. As they bumped into each other in the chaos following the explosion, subatomic particles scattered and absorbed energy in the same manner as a blackbody. Thus, for the temperature of the CMBR (2.726 degrees above absolute zero), a certain energy/wavelength curve should result—as it would for any blackbody.

The curve that came from the FIRAS data matched the Planck curve point for point to an accuracy of 0.03 percent—about 1,000 times better than any previous observation. It showed that at least 99.97 percent of the energy in the cosmic microwave background radiation (CMBR) was released by the end of the first year after the big bang, confirming that the universe had in fact passed through a state of thermal equilibrium in its early evolution. This finding all but rules out competing theories of creation like the steady state theory and the "cold" big bang.

The data from the third COBE experiment are still under study. NASA's Michael Hauser is principal investigator for the diffuse infrared background experiment (DIRBE), an instrument designed to measure the infrared light left over from the formation of the earliest luminous objects. The above-described universe of subatomic particles would have been a "dark age," and the measurement of infrared background radiation would provide insight into the evolution of galaxies and the nature of the pregalactic universe. The interpretation of the DIRBE data is made difficult by the presence of so many bright infrared energy sources in the cosmos, but the instrument was designed to measure the collective glow from millions of objects rather than these point sources. It is hoped that a faint and uniform residual signal will remain after computer analysis has subtracted the foreground sources.

—*J.L.*



NASA/GODDARD SPACE FLIGHT CENTER: COBE SCIENCE WORKING GROUP

The COBE carried three separate experiments into orbit.

Wild Beasts with Wonderful Tales

Photographs by Deng-Jeng Lee

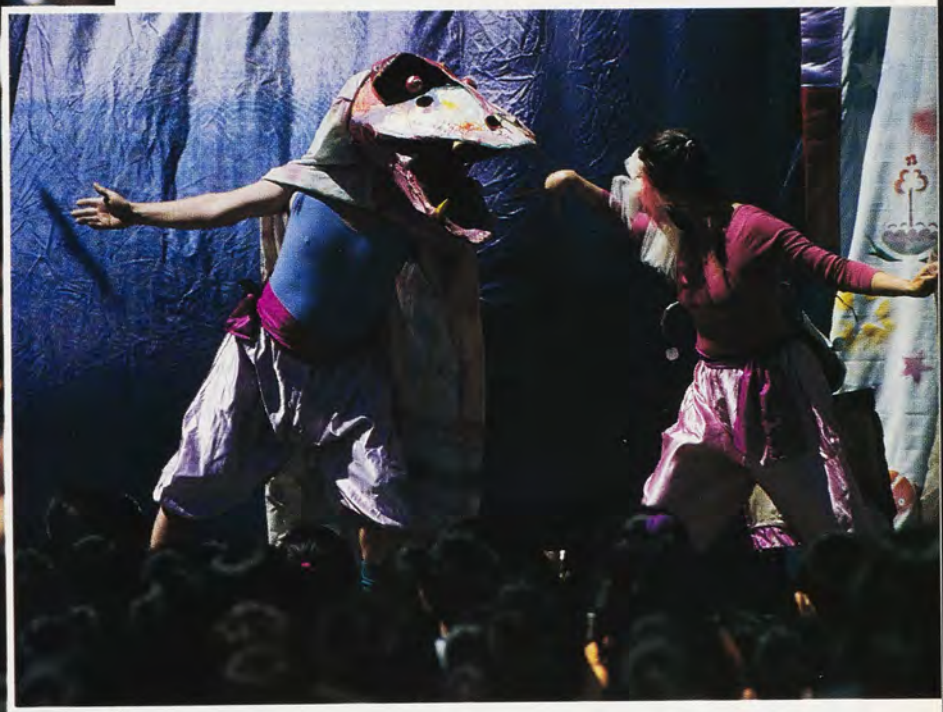
Text by Rebecca Alm

It's a cloudless June day in Columbus Park in New York's Chinatown, the kind of day when children can't sit still, when shouts and skirmishes seem to break out spontaneously. Four hundred and fifty children straggle onto a playing field, reined in by their teachers, and sit cross-legged on the hard surface. Their wandering attention is caught by a makeshift stage set up in the corner of the field. Behind the flimsy blue curtain, magic is being made.

The Mystic Paper Beasts, Dan Potter and Marya Ursin '71, pull strange masks and costumes out of their large trunk, lining them up against the chainlink fence that surrounds the park. Marya is a dancer, writer, mime, yoga teacher, and massage therapist. Dan is a performer, sculptor, potter, architect, and maskmaker. Together, with that chest full of cardboard, old curtains, vacuum tubing, and other "found" materials, they create the Mystic Paper Beasts.

From behind the curtain, a swan glides up to a group of children in the front row, who fall suddenly

The Mystic Paper Beasts (Dan Potter and Marya Ursin '71) perform tales for all ages. This show for children is about the search for a princess who has disappeared with a dragon (bottom far right). Among those anxious for her is the queen mother (right). Other Beasts works, aimed at both children and adults, include *Ganesha*, the story of the Hindu elephant god, and *Tayo*, about a Native American healer.



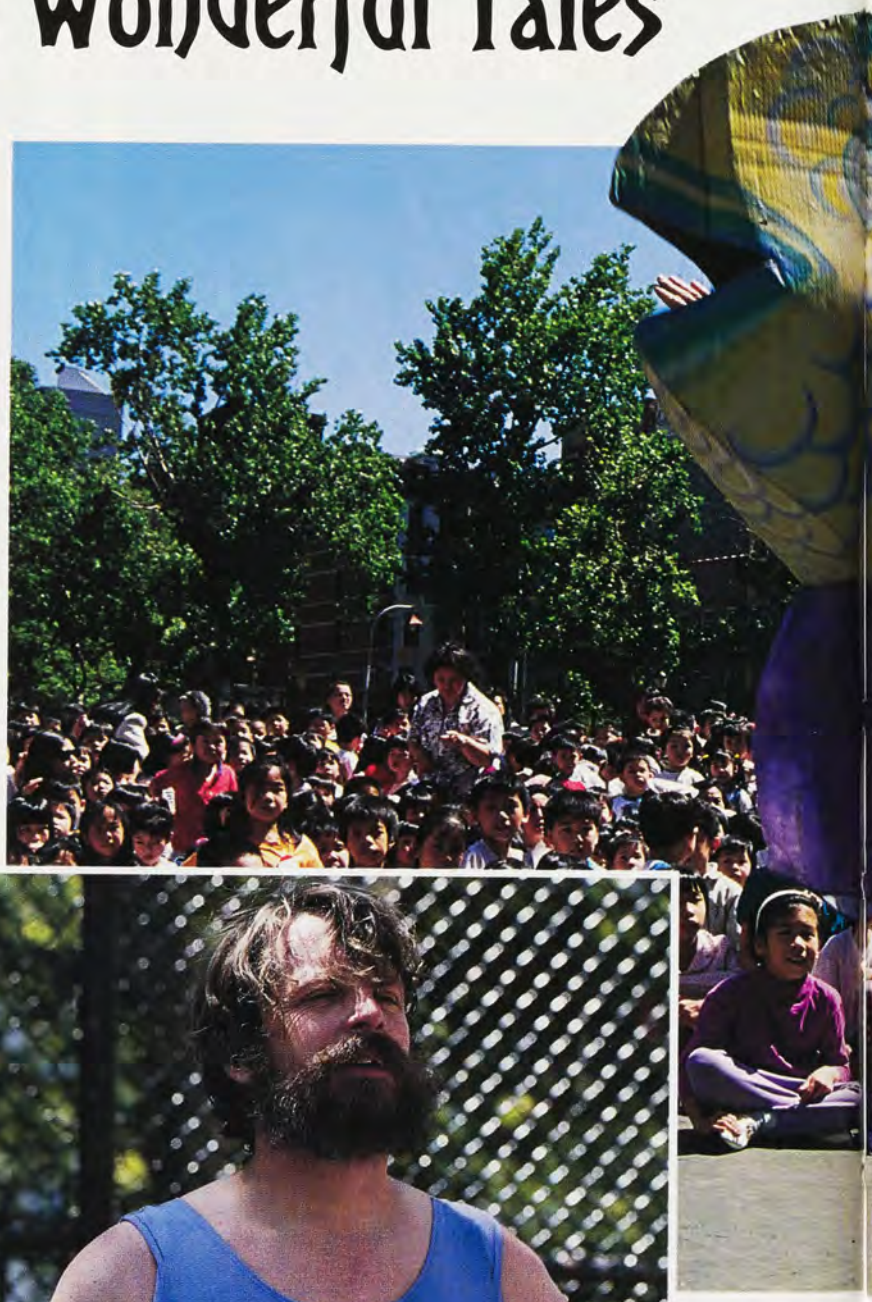
Wild Beasts with Wonderful Tales

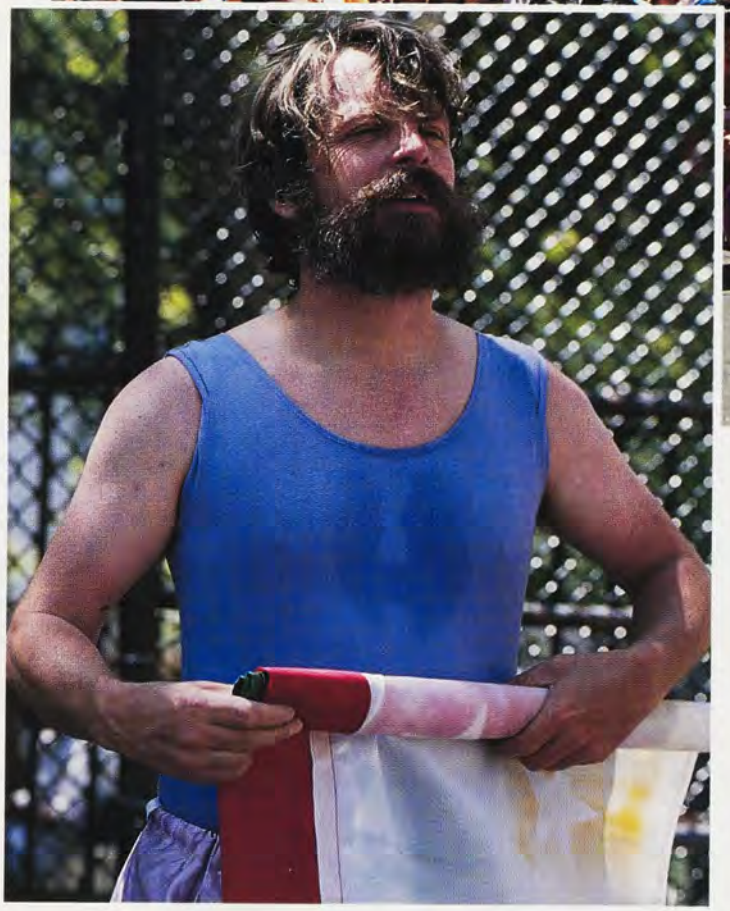
quiet. Her long neck bends gracefully as she nibbles on children's hands and nametags, much to their delight. Some stand back, looking on with serious eyes, and as the swan comes closer to them, she lifts the gauzy white drapery that serves as her body to reveal Marya underneath, smiling and demonstrating how the transformation takes place. The costume, made primarily of paper and fabric, is beautiful and unusual, and Marya's movements bring it to life, the essence of swan-ness.

Then the story begins. A princess disappears with a dragon on her birthday and is found after great searching over land, water, and air. In his search, her father meets with such beasts as a cat, several fish, a fly trying to escape from a fly swatter, an ostrich, and a pair of mynah birds. She's finally found to be living well with the dragon, and she comes back to enjoy her birthday cake.

The stories they do are "new tales for old myths," Dan and Marya say. This one was adapted by Marya especially for these children.

When the tale is told, pandemonium breaks out behind the blue curtain. Shouts and skirmishes erupt again as children try on masks with bulging eyes, shake bouquets of hearts, grab fabric out of the large trunk, pull the levers, turn the knobs, and pretend to be beasts large and small. Pure magic.■





Dan Potter (left) founded the Mystic Paper Beasts in 1976 for a performance in Mystic, Conn. Since then, the Beasts have traveled internationally in various forms: family circus, solo with audience participation, and now a duet. In 1989 Marya Ursin (top right) joined the Beasts, now based in Stonington, Conn. Marya writes and directs and Dan engineers the masks, with both painting, decorating, and performing.

And in the Center Mickey Herbert!

In the hometown of P.T. Barnum, big business meets the big top.

Now that's what I'd really like to wear," Michael "Mickey" Herbert '67 says, gazing reverently at the glass case.

The case encloses a black, somewhat beat-up top hat that has frayed around the brim. Affixed to the front of the hat is a gaudy splash of colored sequins. Beside it, coiled about like an arabesque, is a metal whistle on a black string.

A card explains that the hat and whistle were donated to Bridgeport's P.T. Barnum Museum by a former ringmaster of the Ringling Brothers and Barnum & Bailey Circus.

Herbert, the founder and president of Physicians Health Services, one of America's first HMOs and the largest in Connecticut, has already worn a ringmaster's hat. At 49 he sports a wide, easy smile and ruddy good looks. But today, at least, his attire has Barnum all over it.

Literally. The lapels of his blindingly bright, fire-engine red jacket are festooned with circus pins and patches. Brown and green elephants cavort on his necktie. He mentions that he was considering wearing his red sneakers, with the flashing lightbulbs in the heels, but left them at home with his ringmaster's hat in nearby Trumbull at the last minute.

That hat is a souvenir from Herbert's stint as 1993 Barnum Festival ringmaster. To appear now in a top hat would be, in Herbert's opinion, a bit much. Though Herbert is chairman of the Barnum Museum and so can still indulge in outrageousness as he sees fit, this is, after all, 1994. In an hour Herbert is going to have to restrain his emotions as he relinquishes his ringmaster's whip, whistle, and pocket watch to the new ringmaster, the vice president of a local bank, at the Barnum Festival's annual Whip, Whistle, and Watch Luncheon.

"All good things come to an end," he sighs. "You can do a lot of things in life, but you're only a Barnum Festival ringmaster once."

Parting with such a past is indeed sweet sorrow. Festival rules specify that former ringmasters may appear in public (in and around Bridgeport, at least) in bright red jackets, but the jackets can't have tails.

"And I can't wear the white jodhpurs and riding boots with it," Herbert says. "As for going around with a whip, well, I'm not exactly that kind of guy."

By Bill Kent

The festival, a Bridgeport tradition since 1949, honors the memory, achievements, and personality of the city's most famous resident, Phineas Taylor Barnum: promoter, showman, politician, author, three-ring circus impresario, and all-around master of hyperbole and humbug.

"Who *did not* say 'There's a sucker born every minute,'" Herbert adds. "When I became involved here, the first thing I did was read up on Barnum. Many things Barnum did were hoaxes, but he did them with aplomb. He never took advantage of people. When he had his museum in New York City, it was a bigger tourist attraction than the Metropolitan Museum of Art. He knew that people enjoy being fooled, as long as they can share the joke."

Herbert stops in front of another case. A card identifies what looks like a cross between a dead monkey and the tail of a shark as the "Feejee Mermaid." It's an obvious fake that Barnum displayed more than a century ago in his Manhattan menagerie.

"Barnum's idea of humbugging peo-

Ring...

ple was to pull their leg in such a way that everybody knew he was pulling their leg. He was a character who had a lot of fun and liked to share it."

As does Herbert, who admits that he was somewhat unprepared for some of the ringmaster's skills. "I had to learn how to crack that whip, which is something they didn't teach at Swarthmore."

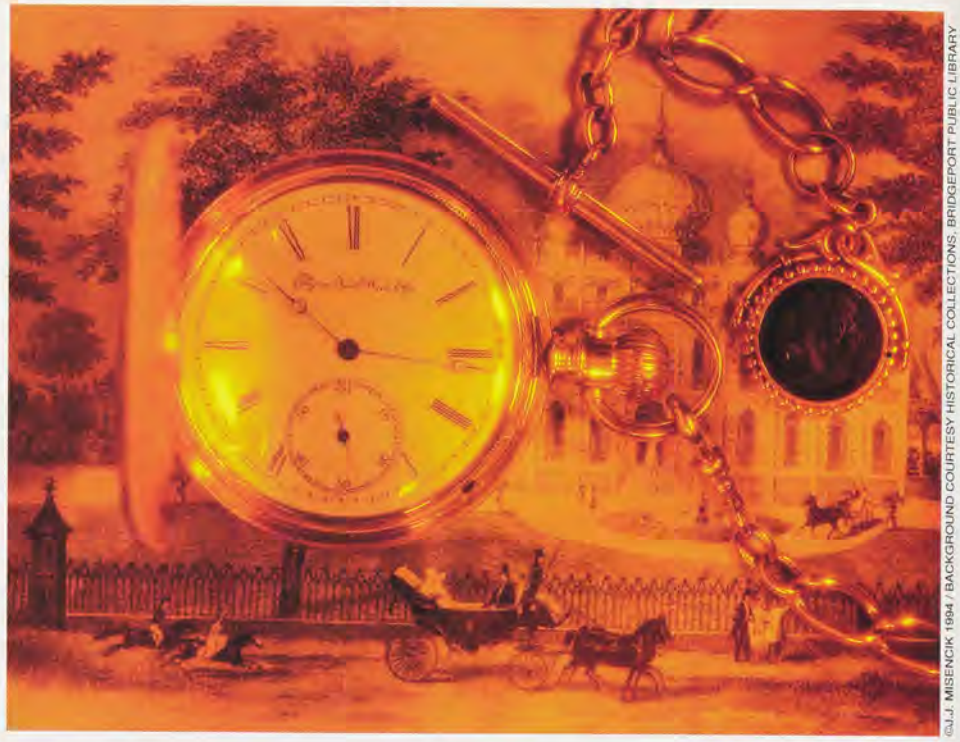
Last year, from the beginning of June to mid-July, Herbert cracked a whip and blew a whistle, appearing in full ringmaster regalia at corporate meetings, charity bazaars, public schools, civic organizations, church groups. His goal was to raise money for the festival events culminating in a triumphant parade on July 4.

As ringmaster Herbert's job was not merely to raise enough money to cover the Kid's Wing Ding, Barnum Pops Concert, Barnum Art Show, Circus Murder Mystery, Clown-Around, banana boat ride, Jenny Lind singing competition (in honor of a singer Barnum promoted), parade, and other events. He attended all preparatory meetings, organized the program, and arranged for the largest fireworks display ever seen in Connecticut. The events brought an estimated 200,000 people into downtown Bridgeport—150,000 for the parade alone.

"From May to the end of July, I think I had about two hours in the day when I could go back and find out what was happening to my company. Fortunately, there weren't any crises we couldn't handle, and we ended up getting so many businesses involved that if you're in a Bridgeport area company and you're *not* involved in the Barnum Festival, you stick out like a sore thumb."

Herbert just had to make his year as ringmaster a bang-up time because the year 1993 was the centennial of the Barnum Museum (a delightful Renaissance rococo building constructed with money donated to the city by P.T. Barnum), as well as the bicentennial of the circus in America (the first recorded circus performance in the new nation took place in Philadelphia in 1793).

Herbert also felt a need to bring together as many Bridgeport businesses as possible "to show the people of this city how important we all are to each other. It's not that Bridgeport doesn't have enough civic and business organizations—it does, and they do a lot of good. But the Barnum Festival crosses all barriers, all dividing lines, all walks of life. We have millionaires involved, we have city public school kids involved, kids from the suburbs, people of every walk of life. The Barnum Festival isn't so much about solving the problems of the city as it is about raising the spirit of the city. The idea is simply to have the most fun we can, and share it with everybody. I can assure you, if somebody told me, back when I was in Swarthmore, that I'd be blowing my whistle about anything like this, well, I wouldn't've believed it."



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With a Barnumesque flourish, he withdraws a highly polished, flamboyantly engraved gold pocket watch, holding it like a piece of the true cross.

He takes a bauble-encrusted brass whistle out of his jacket.

"The whistle is just a whistle. I won't shed any tears to pass that on. But this is going to be tough to part with."

With a Barnumesque flourish, he withdraws a highly polished, flamboyantly engraved gold pocket watch. The watch actually belonged to P.T. Barnum, and Herbert holds it like a medieval pilgrim clutching a piece of the true cross.

"This," he says, piling on the bravado, "is absolutely amazing."

Mickey Herbert's fascination with P.T. Barnum is actually only three years old. He was asked to get involved in 1991 "and I got totally swept up in it," he says as he drives his modest Chrysler Eagle to the Whip, Whistle, and Watch Luncheon at the Bridgeport Holiday Inn.

Until he became Barnumized, if you asked Herbert how he'd describe himself, he would say, first and foremost, a softball fanatic.

Born in Washington, D.C., he was an early avid baseball fan and sandlot player. He picked Swarthmore because he wanted a "good school that

was close to home, where I could play a lot of baseball."

Indeed, Herbert was captain of the baseball team, coached by Gomer Davies, and also played varsity soccer for Coach Bill Stetson. At a time when the country was gripped by student protest and counterculture rebellion, Herbert was inspired to be a businessman by Professor of Economics Clair Wilcox.

"He said to us, 'To be in business, you have to remember two things,'" Herbert remembers, leaving his car in the hotel lot and walking rapidly toward the entrance. "'The first is don't trust anybody over 30.' With all the protests happening around the country, that got a laugh. But then he said, 'Don't trust anybody under 30.' That didn't get the same laugh, but it made a lot of sense to me."

Herbert figured that despite the issues that motivated his generation's unrest, business would still be business. He got an M.B.A. from the Harvard Business School and joined a prestigious New York business consulting firm just in time to have his job, and the firm, disappear in the recession of 1970.

In the fall of 1970, Herbert answered a "help wanted" ad in *The Washington Post* for an administrative assistant in Minneapolis. The ad had been placed by Dr. Paul Elwood, a Minnesota physician who was trying to persuade the Nixon administration to encourage the growth of a new kind of consumer-oriented medical service. Elwood had kicked around several names for this service until he settled on "health maintenance organization."

Mickey Herbert became Elwood's right-hand man. He found himself spending more time in his hometown of Washington, D.C., attending high-level meetings with congressmen and members of the Department of Health, Education and Welfare, than in Minneapolis. Thanks to their efforts, Congress passed the HMO Act in 1973, and Herbert found himself back in Minneapolis, helping Elwood set up the nation's first official HMO.

The experience made Herbert want to go off and set up his own. In 1976 he had narrowed his choices to three locations: Los Angeles, Chicago, and somewhere on the East Coast outside of New York City.

He settled on Bridgeport because the neighboring town of Stratford had the defending national fast-pitch softball championship team. For eight years Herbert played the outfield on the Stratford team, which won the championship again in 1983. Between games, in Trumbull, a suburb of Bridgeport where he made his home, Herbert founded Physicians Health Services Inc.

"We were clearly ahead of our time and struggled miserably for years," he says as he breezes into the Holiday Inn. "If I didn't have softball to get my mind off things, I don't know what would have happened. It wasn't until 1982 that we broke even, and we've gotten bigger every year since."

In 1992 Herbert was named one of *Inc. Magazine*'s Entrepreneurs of the Year. In 1993 Physicians Health Services became a publicly traded company, now grossing some $300 million a year, with 4,000 participating physicians and 170,000 members in Connecticut and New York state.

Herbert is also chairman of the American Managed Care and Review Association, the HMO industry's trade group, and has been spending quite a bit of time in his hometown again, addressing the issue of national health care with some of the same congressmen he met 25 years ago.

"Without any effort on the part of government, the entire health care industry is converting to managed care," Herbert says. "My concern is that the government will try to fix this and screw it up."

As soon as Herbert strolls into the Holiday Inn's lobby, big business becomes the big top. He can't walk far without someone in a red jacket (signifying a former ringmaster) or a business suit saying hello, shaking his hand, posing for a picture as if he were a world-renowned celebrity.

One person isn't overwhelmed. His daughter Eleni, the eldest of his five children, is a hostess at the hotel's restaurant. She waves her hand and says, "Hiya Dad."

Herbert waves back, asks her how she's doing, and finds himself swept into the hotel's banquet hall, where his wife, Jackie, is waiting, as the Whip, Whistle, and Watch Luncheon begins.

The 270 people in the banquet room represent the elite of nearly every major business, civic, religious, professional, trade union, and political group in the area. The room would resemble a typical Rotary, Lions, or Kiwanis luncheon if not for a few rather odd details. Every table has at least one former ringmaster, or the widow of a ringmaster, attending (1985 ringmaster Victor Kiam, Remington shaver TV huckster, is noticeably absent). Colored balloons rise toward the ceiling from black plastic top hat centerpieces, surrounded by boxes of Barnum's Animal Crackers.

Politicians, the rich, the famous, and the infamous are happily roasted by a local radio personality. Herbert isn't called to the rostrum to relinquish his ringmaster accessories—he's passed them on to Bridgeport's Mayor Jim Gamin and Connecticut Congressman Chris Shays, who present them to Paul DelFino, a vice president of the Bridgeport-based Shawmut Bank, 1994 Barnum Festival ringmaster.

The buzz around the room is developer and casino owner Donald Trump's recent proposal to build a theme park at Pleasure Beach, a portion of the city fronting the Long Island Sound.

Because Mickey Herbert is also a member of the Bridgeport Regional Business Council, his opinion is requested by just about everyone who approaches his table. To one and all, Herbert is cautiously positive.

"I'm for anything that will bring Bridgeport out of the recession," he says. "The city's been hurt badly and it's still hurting."

But he adds that people shouldn't put their hopes in one basket. "What's going to bring Bridgeport back is Bridgeport itself. There's a lot that needs to be done and a lot of time that needs to be spent on the problem. But if you're looking for the people who can do it, they're all in this room, and they can't wait to make it happen."■

As a student at Oberlin College, freelance writer Bill Kent briefly studied clowning with performance artist Bill Irwin.

MIRACLE

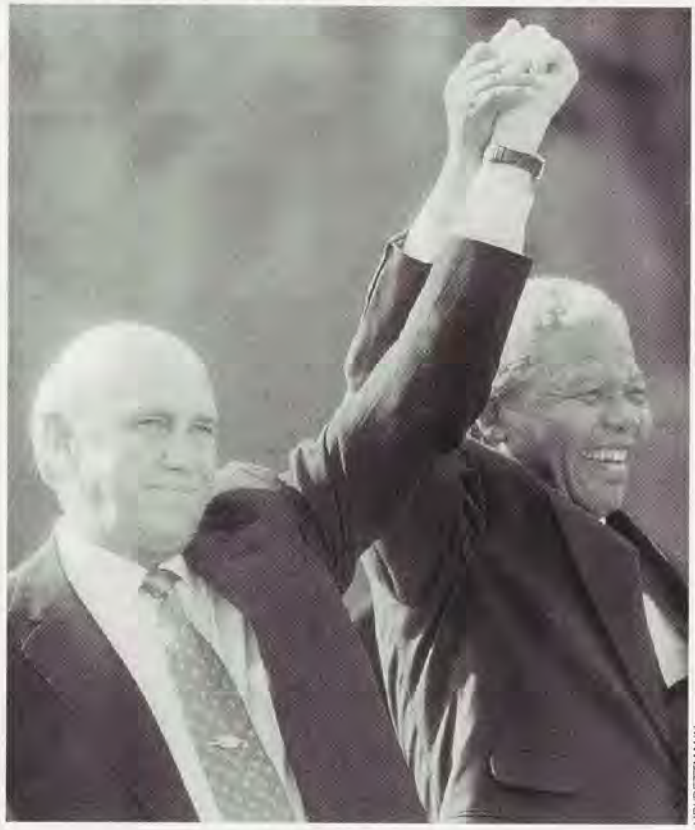
May 2, 1994. In Alexandra, the scene is a surreal tableau right out of Dante's *Inferno*. Some 300,000 people live in this squalid township just across the freeway from Sandton, one of Johannesburg's wealthiest suburbs. They are packed into the squatters' shacks, small brick homes, apartments, and prisonlike hostels. Indoor toilets are a luxury and raw sewage flows in the streets, while dogs, goats, and an occasional cow roam about, scavenging for food. There are no street lights and the night is blacker than black.

But tonight the thick smoke of coal fires clogs the air and the heavy blackness is illuminated by bonfires dotting the landscape. Garbage and trash blaze in metal oil drums or are just piled in the dirt streets and ignited. Around some of these fires, people have gathered to party through the night. Some drink beer, others smoke marijuana as they sing songs of liberation and dance for joy.

I stop to see what is going on and am immediately surrounded and swept up by the joyous tumult of the crowd. It is as if people had been waiting for someone to come and record their ecstasy, to share their hope.

When I had prepared to leave Washington for Johannesburg in March, I had my doubts that such a celebration would ever take place. It was with some trepidation that I had volunteered to produce National Public Radio's coverage of South Africa's first all-race elections. Political violence there was running rampant. Members of the Inkatha Freedom Party and the African National Congress had been slaughtering each other for years, and since ANC leader Nelson Mandela was released from prison in 1990, an estimated 12,000 had been killed. As the April election drew nearer, South Africa had all of the appearance of a country on the brink of civil war. There was speculation that the violence might force the vote to be postponed or even canceled. Little did I suspect that I was going to witness a modern-day miracle—the peaceful birth of a new nation.

My regular job as an editor on NPR's national desk normally keeps me out of harm's way. But as an African American, the prospect of bearing some small witness to the end of white-minority rule in South Africa proved irresistible. Besides, I had been there once before and I loved the country and its people.



UPI/BETTMANN

South Africa pulled back from the brink of civil war to a triumph of democracy.

By Michael Fields '69

In 1991, about six months after the National Party had repealed the Grand Apartheid laws, I had been sent to produce stories from an African American perspective about the "New South Africa." The New South Africa was the catch phrase coined by the image-makers of the regime to distinguish the multiracial, multicultural future from the white-dominated past. On that trip it was pretty clear that apartheid was not going to die an easy death.

This time I got a sample of the multiracial face of the New South Africa while waiting for my South Africa Airways flight to leave New York. The safety film on the 747 jetliner featured a multiracial cabin crew—white, colored, and black. As the film progressed, I noticed that it was white crew members who gave the instructions in Afrikaans, while the colored crew member had the English lines. The black didn't have any lines at all. In the film none of the passengers appeared to be interacting with each other across the various color lines, although one white crew member did adjust the seat belt of a black passenger, a little girl.

For many whites like Eric Barry and his wife, farmers from Natal who talked with me during the flight, violence meant crime, not political violence. Political violence was a problem for blacks, not whites, and for Barry it was the result of tribalism. The elections, he said, were stirring up the tribal nature of the Africans.

The Barry family has raised maize, wheat, and row crops for three generations on a farm about two hours northwest of Durban in Natal, home to most of South Africa's nearly eight million Zulus, the nation's single largest ethnic group.

Barry said they live among the Zulus, know them well, and respect them tremendously. "The Zulus are a proud people," said Mrs. Barry. "We

speak their language, but they can't speak ours." Eric Barry described the Zulus as the Prussians of Africa—a martial, well-disciplined, hard-working people who are loyal to their leaders. The Zulus are a patriarchal people, he went on. They will never allow themselves to be governed by the Xhosas, who are a matriarchal people, or the ANC, which is predominately Xhosa.

"The real problems facing South Africa are economic, not racial," Eric Barry concluded. Whoever wins the election will have to generate jobs, he went on. "When you send a boy to school," he said, "you're going to have to have something for him to do when he comes out."

This was the first but by no means the last analysis based on tribal traits and stereotypes offered to me by white South Africans to explain the political situation.

Blacks seldom offered tribalism as an explanation for the nation's problems. Under apartheid the government attempted to encourage tribal divisions as part of its strategy of "divide and rule." The ANC's strategy was to build a unified mass movement by minimizing South Africa's myriad racial and ethnic distinctions. In fact, polls before the election reported that more Zulus supported the ANC than supported the Zulu-based Inkatha Freedom Party—the reason, many observers concluded, that the Zulu leader, Mangosuthu Buthelezi, was so intent on disrupting the elections.

On March 28, the day after I arrive in South Africa, the Inkatha Freedom Party brings the war home. A march and rally called by Inkatha for downtown Johannesburg turns deadly when marchers proceed to the ANC's Shell House headquarters. Shooting breaks out, and before the day is over at least 30 people are gunned down in the heart of the city. It isn't clear who really started the shooting. Many see it as Buthelezi's latest, most desperate effort to force postponement of the election, and people wonder what's coming next. One thing is clear: the violence drives a dagger of fear straight into the heart of South Africa's financial capital.

South Africa is numbed to the daily death toll. It's not something that directly affects whites, and for blacks it's just another hazard in an already precarious life. But the March 28 killings seem to demonstrate how far Inkatha is prepared to go to stop the election—and what price everyone might have to pay to hold it. People are shaken and depressed.

"The violence has made everything uncertain," says Judy Sandison, the news director of Natal Broadcasting Services in Durban. She sees the social order slowly eroding. Service workers are refusing to go to work because they fear for their lives. Telephone repairmen have been attacked.

F.W. de Klerk and Nelson Mandela led the celebrations after South Africa's first all-race election. Violence between supporters of the African National Congress and the Inkatha Freedom Party nearly scuttled the historic vote.

TOP: UPI/BETTMANN BOTTOM: AP/WIDE WORLD PHOTOS

AP/WIDE WORLD PHOTOS

Nelson Mandela shakes hands with Zulu King Goodwill Zwelithini after Inkatha leaders agreed to participate in the vote. A few weeks later, thousands lined up in Soweto to cast their first-ever ballots.

Cars belonging to health care workers have been hijacked. "It's become impossible to plan. People don't know what's happening; they feel like they're losing control of their lives." Sandison observes that this is a major problem in a society where order was everything: "You may not have liked the old South Africa, but at least everything had its place."

The next day Sunni Khalid, NPR's reporter covering Natal, and I head north with David Alcock, our translator. Our destination is Esikhiwini, a dusty little town about two and half hours from Durban. The drive takes us along the Indian Ocean, past beaches world famous for their surfing, then through rolling hills covered with acres and acres of sugar cane.

In Esikhiwini it's not easy finding people who will talk. Talking to strangers, especially foreign reporters, can be fatal. We pay a visit to the local *induna*, the equivalent of the village chief. He's not home, and a member of his family tells us that if we want to stay healthy, we should get out of town. We park on a road heading out of town to give the appearance that we've stopped to ask for directions. Many passersby are reluctant to talk, but a few say that they would like to vote, especially since it is the first chance they've ever had. They probably will, they say, despite the intimidation being brought to bear by Inkatha. We don't ask whom they're going to vote for.

As we're leaving town, we spot an official from the local taxi association who has stopped to monitor the day's business. He won't tell us his name, saying he's fed up with the violence because it's bad for business. He is afraid that if the Zulu king, Goodwill Zwelithini, does not get the proper respect from the government, Zulus will be called upon to take up arms and fight.

KwaZulu, a homeland within Natal with some degree of self-rule in the old South Africa, is scheduled to be absorbed as a province under the new centralized government. The king has been asking for a recognition of Zulu sovereignty that carries some real power, but the ANC is only offering a budget and ceremonial trappings. The taxi official says he would not fight for a politician like Buthelezi, but if the king asks him to fight, he will fight.

The next few weeks pass in a blur. I spend 12 to 16 hours a day working with our reporters, Ann Cooper, Sunni Khalid, and Michael Skolar, helping them with logistics, juggling assignments, conducting interviews, and dealing with bureaucrats at the

South African Broadcasting Corporation. At the beginning of April, the governent declares a state of emergency in Natal and sends in troops. Nonetheless, the killing continues, including the decapitation and mutilation of eight voter-education workers who were distributing nonpartisan election material in a village about 50 miles north of Durban. More and more people wonder how a "free" election can be held in an area that is under military supervision.

Meanwhile, everyone is keeping an anxious eye on efforts to bring Inkatha into the election. A summit meeting between Mandela, then-president F.W. de Klerk, Buthelezi, and King Zwelithini comes to nothing. A team of volunteer mediators headed by Henry Kissinger comes and goes, virtually in the blink of an eye, accomplishing nothing.

Despite a police ban, the Inkatha Party's youth brigade calls for another march in downtown Johannesburg. Everyone is afraid that the March 28 bloodbath will be repeated. My colleagues and I are not looking forward to the prospect of covering this march. However, with the possibility of violence, our presence is mandatory. The recent death of a well-known and well-liked South African photographer casts a pall over the entire press corps.

The day before the march, I go to pick up a bulletproof vest. They come in white or sky blue, and the Ballistic Body Armour Company assures me that the two ceramic plates covering my vital organs front and back are impervious to anything up to and including rounds from an AK-47. If it's returned undamaged, the company will buy the vest back at a steep discount. This is not even a small consolation.

On Monday Johannesburg breathes a momentary sigh of relief when the march is postponed. The nation's leaders meet yet again, trying to end Inkatha's election boycott. No one is very optimistic, because de Klerk, Mandela, and Buthelezi have been meeting off and on for months with nothing that resembles progress. The voting is scheduled to begin in just over a week and no new proposals have surfaced. This appears as one last attempt to bring peace before the country slips off into a violent abyss.

Then the miracle begins. Buthelezi settles. With eight days left, the guardian of Zulu nationalism agrees to end his boycott and bring Inkatha into the election. No one quite understands why, since Buthelezi could have gotten a better deal anytime before. There is much speculation. Since it was clear that the elections were going to be held on schedule, some speculate he realized he faced political marginalization by refusing to participate. Others argue that he was about to lose the support of the king.

The next day election posters featuring Buthelezi's picture over the IFP's colorful green, yellow, black, and red logo join those of the National Party, the African National Congress, and the 23 other parties on power poles and walls around Johannesburg.

Outside the polling place, the disabled clog the narrow street. Voters hobble in on crutches, and one arrives carried in a wheelbarrow. This is a day many thought they would never live to see.

The Johannesburg stock market climbs, and the rand strengthens against the dollar. For the next few days, there is a dramatic lull in political violence, and the police report that crime too seems to have fallen off, at least momentarily.

Yet Inkatha is not even on the ballot, creating a logistical nightmare for election officials. Within one week stickers that bear the likeness of Buthelezi and the Inkatha symbol must be attached to the bottoms of 80 million ballots, just below the line for the ruling National Party. (For weeks the National Party had been telling voters to vote for the last party on the ballot. Now, at the 11th hour, they are no longer last.)

Forty-eight hours before the voting, South Africa goes through one final violent convulsion. Terrorist bombs start going off around the country as white extremists make a final bid to derail the elections. Nine are killed in downtown Johannesburg, including a white ANC candidate for parliament, when a car bomb explodes near the ANC's regional headquarters. The next day, a bomb kills 10 people at a taxi stand in Germiston, a predominately black area just east of Johannesburg. A right-wing extremist group claims responsibility for the Germiston explosion and threatens more unless whites are given their own homeland so they will not be forced to submit to black-majority rule.

It is soon clear, however, that neither blacks nor whites will be deterred from voting. The bombings seem to bring the nation together in grim determination to go forward with the elections. The government promises to deploy more than 100,000 troops to protect the polling places, and when the voting finally starts on Tuesday, April 26, even a "cynical" American journalist gets swept up in the emotion. It is impossible not to get teary-eyed witnessing this expression of faith in democracy. Hope is everywhere.

The first day of voting is set aside for pensioners, invalids, and people in hospitals. It's mid-afternoon before I can get to the Sankopano Community Center, a polling place in Alexandra township. Outside, cars and taxis filled with elderly men and women and the disabled clog the narrow street. Some voters hobble in on crutches. One women is carried in a wheelbarrow. Another woman, very overweight, her bleeding, swollen feet wrapped in rags, stops every few steps, gasping and wheezing to catch her breath. She says she has asthma, and I wonder if she'll make it downstairs to vote without collapsing.

The courtyard inside is packed. Some people stand in a long line snaking up to a single door at the entrance to the voting booths. Others sit in chairs and benches, more or less

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THE COLLEGE

"Accomplished and empowered," Class of '94 leaves Swarthmore

Urging new graduates to use their leadership roles to help others become "as accomplished and as empowered" as they are, President Alfred H. Bloom presided over the College's 122nd Commencement, awarding 321 bachelor of arts degrees, 22 bachelor of science degrees, and three honorary degrees.

"What I would like to ask you today is that as you meet the demands of leadership positions you assume, you draw not only on the intellectual skills and on the ethical intelligence you have developed at Swarthmore but that you draw also on your first-hand experience with that special Swarthmore relationship between teacher and student. Remember how accomplished and how empowered that relationship has led you to become. Lead in a way that enables others to be as accomplished and as empowered."

Honorary degree recipients included David Bamberger '62, director of the Cleveland Opera, who received the Doctor of Humane Letters; Seamus Heaney, internationally renowned poet, who received the Doctor of Humane Letters; and John Mather '68, a physicist with NASA, who was awarded the Doctor of Science.

In related Commencement activities, Nadinne Cruz, senior associate for the Higher Education Consortium for Urban Affairs, delivered the Baccalaureate address. Amy-Jill Levine, the Sara Lawrence Lightfoot Associate Professor of Religion, spoke at Last Collection. Following are excerpts from honorary degree recipients' charges to the seniors.

David Bamberger '62 *is director of the Cleveland Opera, which has received national recognition for its outreach to schools.*

"I would ask you all as the parents you will become or the parents you already are, as the leaders you will become or the leaders you already are, to remember that the reason we need arts in the schools is not so that children will remember when Mozart lived or died, although any form of knowledge is valuable. The reason we do all this is for the children to find themselves. We talk a lot these days about wonderful catch words—self-esteem and self-knowledge and belief in self-worth—as if these were new things that had to be invented. In fact they are old things that need to be restored by putting the arts and particularly the performing arts back in the schools. So I would urge you whenever you see the chance to fight for that.

"Here you have all studied some of the arts and learned to become quite sophisticated about them. But you have certainly not gotten to study all the arts because the time did not permit it. And so there are a lot of arts about which you may feel very unknowledgeable and very unsophisticated. But I'd just like to remind you that those of us who have been crazy enough to go into this business are in it not in order to provide deep themes for research papers, but in the hope that when we do things right, when that ... curtain goes up, there will be magic behind it for you."

STEVEN GOLDBLATT '67

David Bamberger '62

Seamus Heaney, *whose term as professor of poetry at Oxford University is coming to an end, is the author of* Death of a Naturalist *and many other award-winning works.*

"My first visit to Philadelphia was in 1971, when I read poems to the students of an inner-city high school. The teacher in charge of that event had hidden me away in a kind of book closet while he herded mini-stampedes of teenagers

STEVEN GOLDBLATT '67

Seamus Heaney

down the corridors and tried to pen them in as an audience in another, much less distinguished library. And as I skulked there, like some latter-day apostle in his upper room, I heard a voice from the corridor like the voice of God asking a simple question. It cried out, in ringing American and impatient tones, 'Who is this poet anyhow? Is he any good?'

"Today, of course, you, the Class of 1994, are hearing that question, 'Is she any good; is he any good?' in a particularly keen way. Because from today, you must begin to live in a more exposed way as yourselves. And you will only begin to live truly, I would suggest, when you have conceived standards by which you can fail. These are the standards you test yourselves against if you want to attain that ideal which Socrates once called 'the examined life.' They are the standards representative of the highest possibility, that ultimate possibility, to which an artist

like Cézanne or a poet like Emily Dickinson or a hero like Nelson Mandela sacrifices himself or herself.

"So you, the Class of '94, now stand in some book closet deep within yourselves and hear a voice calling upon you to imagine those standards, if *you* are to be any good."

John C. Mather '68, *a physicist with NASA, originated the concept of the Cosmic Background Explorer (COBE) satellite to study microwave radiation in space (see page 4).*

"When I gathered the team to propose the COBE satellite, I had no idea how to make it happen. What we all did together was to solve the problems as they came along. I found out I had to learn about many things I never expected, everything from balancing budgets to running meetings to learning how to type and writing memos all day long. I found out I didn't know how to be the kind of leader that I wanted to be, and I had to ask for help about that too.

"I also found out that cooperation works better than competition when you are trying to get something done. There's no point in trying to be first if you're all riding in one canoe. I try to work with people so that we all get to our goal together, and then we let our creative juices flow. I think that's important because through most of my life in school, I saw people worrying about being better or worse than their fellow students and losing sight of their larger goals. I wish I could get people to stop worrying about comparing themselves with other people and just go after what they really care about. Competition gets our adrenalin flowing, but our competitors are not really our friends and neighbors. Our competitors are the cockroaches who will inherit the earth all too soon if we don't pay attention to what we're doing and help each other along.

"If I could leave you with any parting words, it is the reminder to take the time to imagine what you really would like to do, really think about it, and then go after it with all your heart. You'll be too busy to know if you're better or worse than somebody else or whether you're happy or not, but you can be proud to be yourself."

STEVEN GOLDBLATT '67

John Mather '68

Gabriel Quinn Bauriedel '94, senior class speaker

"Today of all days, let us celebrate and let us dance. And what better spot to celebrate than in this amphitheater under the shade of *Liriodendron tulipifera* looking out on *Acer negundo* and *Quercus rubra.* I've studied the nameplates for four years. I wanted the Scott Arboretum staff to know that their hard work has not been overlooked.

STEVEN GOLDBLATT '67

Gabriel Quinn Bauriedel '94

Today, if you listen closely, you might hear, or even see, Swarthmore's new mascot (we're ditching garnet because it doesn't sing and dance). Today I announce the new mascot: Puck, our spritely, Crum-dwelling, elfish twin. Puck should be our mascot here at Swarthmore, for he embodies the three personalities that represent us as students.

"First, we have the Hobgoblin 'devilish' Puck: the April Fools' jokers, the part of us that tries to outsmart our professors just for the challenge. Next we have Robin Goodfellow Puck: a public servant, a problem solver, a close friend who mends our angst, someone who cares about us. Then there is the headstrong Harlequin Puck, the leader, director, and innovator. This component wrote our essays to get us into Swarthmore and ensured that we received the diploma today. Harlequin actively participates on campus, fueling change and progress in organizations, the community, social life, and political life. These three personalities of Puck have lived through not just a midsummer night's dream, oh no, but four years—give or take a semester or two—of fall, winter, and spring night and mid-morning dreams. And just as in the play, our dream has not always been a satisfying, successful, or especially restful dream. In fact, it has been a long, long, sometimes nightmarish, but ultimately fulfilling dream."

Honors Program revised by faculty

After a year and a half of intense dialogue, much of it concentrated in the last weeks of the spring semester, the faculty has approved a revision designed to reinvigorate the External Examination (Honors) Program. The revised program will go into effect for either the Class of 1997 or the Class of 1998, depending on the recommendation of the provost and the faculty's Curriculum Committee in December.

Discussions were led by the Council on Educational Policy (CEP) task force on curriculum, made up of the members of CEP, including the president and the provost, plus three faculty members added to ensure representation across the divisions. The task force presented its first proposal to the faculty in March, and the faculty passed the final version of the proposal with a large majority on May 23.

"I believe that the new plan responds to each of the factors that placed the old Honors system in jeopardy while retaining the program's intellectual rigor, pedagogical impact, and external distinctiveness," said President Alfred H. Bloom.

The revised program departs from the current

one in several important ways. Instead of taking six seminars, Honors candidates will take four "preparations," three in a major and one in a minor, or four in a special or interdisciplinary major. Each preparation will be based on two or more units of academic credit. The word "preparations" was chosen rather than "seminars" to make it clear that there will be various ways beyond the traditional seminar to prepare for external examination.

In their senior year, most often in the spring semester, Honors candidates will enroll for at least one credit of Senior Honors Study, designed to provide an opportunity to review, extend, and, when appropriate, integrate the work that has been done in preparation for external exams. "This is what many alumni who have been through Honors point to as the most important part of the program," says Provost Jennie Keith, "so we want to formalize that, give it credit, and give students the time to devote to it." Senior Honors Study could take place in a variety of formats, ranging from independent study of an additional reading list to a colloquium for all Honors candidates in a department on a particular topic. Students could also make their own proposals for this additional work.

External examiners will examine students on their four preparations plus their Senior Honors Study. Departments will have the opportunity to give examiners a broader picture of what a student has done by sending them information about all the student's Honors preparations. Some departments may set up panels of examiners rather than having each student be examined four times.

For the first time, Swarthmore instructors will grade all work taken for credit at Swarthmore and used as a preparation for Honors. Exceptions will be Senior Honors Study and theses or other original work, such as laboratory research or projects in performing or studio arts. External examiners will be responsible for awarding the level of honors. Finally, when the revised Honors Program is implemented, the honorific Distinction in Course will no longer be given.

The revisions are intended to reinvigorate the program and to give faculty members and students more flexibility to create ways to do excellent work. President Frank Aydelotte's Honors Program "put Swarthmore on the map," says Philip Weinstein, the Alexander Griswold Cummins Professor of English Literature and chair of the CEP task force on curriculum. "That's our legacy. But the legacy has been ailing."

For 30 years the number of students applying for and being accepted into the Honors Program has been declining, with only 10 percent of the Class of 1995 participating in the program. Only four students in the Natural Sciences Division completed Honors last May.

One major reason for the decline in student participation in the program is that over the years students have increasingly wanted to participate in educational experiences that have not been easy to accommodate within the program. Students who have wanted to do such things as foreign study, independent research in the sciences, and interdisciplinary concentrations have often found the program too rigid and have opted not to apply.

The revision addresses this problem by making the program more hospitable to a broader range of educational experiences. Departments will have more flexibility in defining what kind of work will be required or accepted as a "preparation." In addition to traditional seminars, some students may use such things as sequences of courses, performances, field work, and combinations of seminars with foreign study to prepare for Honors. Shifting the number of required preparations from six to four will also give students more flexibility in planning their course of study.

Added flexibility will also aid departments, some of which have almost dropped out of the program because its structure did not seem compatible with teaching their students in the best possible way. "Each department should be able to participate in the way that makes the most sense," says Philip Weinstein. The task force worked to create a program that would allow departments to set as the standard for Honors the kind of work they believe their best students should be doing, whatever form that work might take.

Lack of grades has also been a big problem for students who are planning to

DENG-JENG LEE

***For a while this summer**, it appeared that the north campus was invaded by an army of gigantic demented ants. Piles of dirt were everywhere as workers labored to relocate underground utility lines to prepare for construction of a new academic building north of Parrish Hall next month. The relocation involved phone, data communication, electric, steam heating, water, and sewer lines that ran through Parrish Annex, which is expected to be torn down later this month. Offices formerly housed in the Annex have been moved to temporary quarters in a refurbished Pearson Hall. When the new building is opened in the winter of 1995–96, activity will turn to Trotter Hall. A total renovation within its exterior stone walls will create new classrooms, seminar rooms, and offices for the departments of Classics, History, and Political Science.*

attend graduate or professional schools, which in recent years have more heavily relied on grades for admission. It has always been thought that not giving grades was important to the seminar, putting the instructor in the position of coach or colleague rather than evaluator. But faculty members have been grading Course students in seminars since 1987, and several said in faculty discussion that they were surprised to find that giving grades had not made any difference in the relationship between students and instructors.

Finally, the existence of two routes to honorifics at Swarthmore, the Honors Program and Distinction in Course, has put the College in a kind of "intellectual dishonesty," says Philip Weinstein. "We've been speaking with two tongues. We've said that the Honors and the Course programs are separate but equal, and we've also said that the Honors Program is the honorific program."

After this latest revision, Course and Honors no longer need to be thought of as two separate tracks, says Jennie Keith. "Conceptually, we now have much more the sense that everybody goes through the same educational program. The students who wish to take what we see as the ultimate step, which is to go beyond their relationship to their teachers here and to use what they've learned in an encounter with people outside, will want to enroll in the Honors Program. As we move away from a two-track kind of program, it makes sense to have only one definition of what we think is the very best that our students can get out of Swarthmore."

STEVEN GOLDBLATT '67

Time to say goodbye—Commencement 1994.

The elimination of Distinction in Course was among several aspects of the revision that were hotly debated by the faculty. Also controversial was the creation of the Senior Honors Study, with some faculty members feeling that independent study for all Honors students was not the best use of either the students' or the faculty's time. On the other hand, many faculty members thought that this time for reflection and integration was the most important part of the program for students' intellectual development.

Some faculty members questioned whether the program should continue to include external examinations, pointing to the cost of these exams and the difficulty some departments have in getting examiners. But Barry Schwartz, professor of psychology and a member of the CEP task force, explains the reasoning of the group: "It is important for students to see that they are not engaged in a private conversation with their teachers, that what they have learned is actually communicable to other people." He adds that the presence of external examiners also helps keep the faculty in touch with the rest of the academic world.

This fall each department and concentration will be working to define more specifically the formats for preparations and for Senior Honors Study. Depending on the progress the departments have made, in December the Curriculum Committee will decide whether the revised program will be ready to go into effect for the Class of 1997 or 1998. After four years of operation, the program will undergo formal review.

The Board of Managers is enthusiastic about the revision, says Dulany Ogden Bennett '66, chair of the Board's Instruction and Libraries Committee. Her committee was kept informed of the work of the CEP task force throughout the process, and the task force "solicited discussion, comments, and questions" from the Board, she says. "There was a real frank, energetic, and positive interchange between the faculty and the Board committee, with each understanding its proper role. We wanted to be sure that the faculty was giving the question of Honors the central importance for the ethos of the College that it deserved, but we understood that the particulars of the new program were entirely in the faculty domain. It was very heartening to be convinced of the seriousness of the faculty about the revision and their conviction that it will work."

Members of the College's faculty and administration are also enthusiastic. "I am deeply excited about the steps the College has taken to return the Honors Program to its status as the signature program of the College," said President Bloom. Thomas Blackburn, the Centennial Professor of English Literature, former dean, and a member of the CEP task force on curriculum, echoes the president, looking forward to the opportunity to create new possibilities for the College's best students: "Next fall could be a very exciting time."

Staff positions filled for student services

Two important staff positions in student services—director of Psychological Services and director of the Black Cultural Center—were filled recently.

David E. Ramirez, formerly director of clinical training for Haverford College's Psychological Services, began his duties as director of Psychological Services on July 1. He replaces Leighton Whitaker '54, who resigned to pursue other professional opportunities.

Prior to his position at Haverford, Ramirez was a staff psychologist at the University of Pennsylvania. His bachelor's, master's, and doctorate degrees are from the University of Texas at Austin.

Maxine A. Proctor, previously a member of the dean's staff at the University of Chicago, was named assistant dean and director of the Black Cultural Center, effective Aug. 1. She replaces Joan Eldridge, who served as acting director for the past year.

At Chicago Proctor was an academic adviser as well as the adviser for the Minority Student Enrichment Program. She holds a bachelor's degree from Chicago State University

Maxine Proctor

MARSHA MULLAN

David Ramirez

and a master's degree in inner-city studies from Northeastern Illinois University.

Avery, Krugovoy retire; both become emeriti

Two members of the faculty in Modern Languages and Literatures—George Avery and George Krugovoy—retired at the end of the spring semester. Both have been named emeriti.

Avery, professor emeritus of German, joined the Swarthmore faculty in 1959 as a lecturer. From 1975 to 1980, he served as chair of the Department of Modern Languages and Literatures.

Born in the U.S.S.R., Krugovoy, professor emeritus of Russian, received his graduate degrees in Austria. He came to Swarthmore in 1968 as an associate professor in the areas of Russian literature, philosophy, and folklore.

New dates for October break

Please note that the dates for October break for 1994 have been changed to Oct. 7 (end of last class or seminar) to Oct. 17 (8:30 a.m.).

The change is to coincide with the fall vacations of Bryn Mawr and Haverford colleges and the University of Pennsylvania.

College adopts new judicial system and student code

A revised student judicial system and code of conduct have been adopted and will be in place for the 1994–95 academic year.

The new judicial system does away with three former disciplinary committees and replaces them with a single College Judicial Committee that will adjudicate all major violations of College regulations. Composed of two faculty members, two students, and one administrator who is not a dean, it will normally be convened by Dean of the College Ngina Lythcott. Minor infractions—those where a finding of guilt would result in a sanction less severe than suspension—will be handled by Dean Lythcott or members of her staff.

The new "Statement of Student Rights, Responsibilities, and Code of Conduct" details the College's standards concerning academic honesty, computing ethics, personal conduct, sexual conduct, alcohol and drugs, and respect for College property.

Lythcott said she had concerns about "whether the old code reflected the real values of Swarthmore and whether it gave students a fair chance to know and understand them." The process of revising the code of conduct was already under way when Lythcott joined the College two years ago, but her arrival spurred an even more comprehensive overhaul. It was studied and rewritten by a committee composed of students, faculty members, and members of the dean's staff, then presented to the student body and the faculty for approval this spring.

Included are more explicit definitions of sexual assault and harassment and the statement that "students have the responsibility to ensure that any sexual interaction occurs only with mutual consent." Dean Lythcott explained, "In the past the code said in essence, 'You have to read my mind,' and now it says, 'It's my obligation to let you know what I do or do not want to happen.'" The code emphasizes the counseling and support available on campus and refers to specific rights of complainants and accused persons in matters of sexual misconduct.

Praising the work of the students and faculty members who revised the code, Lythcott stated: "It is important for students to know the values of the community that they are choosing to live, work, and play in. I think this new statement makes those values clear."

Admissions deadlines change

The Admissions Office has changed its Regular Decision application deadline from Feb. 1 to Jan. 1. This brings Swarthmore's date into line with other highly selective colleges and universities and will allow the deans more time to read applications carefully.

Admissions has also merged its two Early Decision plans (formerly Fall Early Decision and Winter Early Decision) into one Early Decision option with a deadline of Nov. 15.

At the same time, the College's application fee has been raised from $45 to $50.

Women's lacrosse earns national ranking

Guided by second-year head coach Karen Yohannon Borbee, the **women's lacrosse** team had its most successful season in the history of the school, compiling an overall record of 12-4. The women were also recognized on the national level for the first time, being ranked 13th in the nation in the final Brine/IWLCA coaches' poll of the season. Julie Noyes '95 led the Garnet with 107 goals and 18 assists, establishing both national and College records for the most goals scored in one season. She was named a first-team national All-American by Brine/IWLCA and the United States Women's Lacrosse Association. Lia Ernst '97 received honorable mention Pennsylvania regional All-American status, while Noyes and defender Madeline Fraser '95 were first-team All-Centennial selections. Ernst and defender Heather Maloney '95 were second-team All-Centennial selections. Borbee was honored as the Pennsylvania Region Coach of the Year.

The **women's outdoor track and field** team finished fourth at the Centennial Conference Championships this spring. Kate Dempsey '95 qualified for the NCAA National Championships in the 800-meter with her time of 2:15.88, which also set a new College record. Another highlight of the season was the 1,600-meter relay team's performance at the Penn Relays. In the 12 years that women's track and field has been a varsity sport, no Swarthmore woman had ever won a medal at this prestigious event. This year, at the 100th anniversary of the meet, the relay team of Dempsey, Megan Cunningham '95, Tina Shepardson '94, and Jill Wildonger '97 took home silver medals in the MAC race. Shepardson was also the conference champion in the triple jump, in which she broke her own College record several times.

The **men's outdoor track and field** team came in sixth at the Centennial Conference Championships. Scott Reents '96 came within three seconds of the College record in the 5,000-meter when he ran a 15:03 against Haverford. His time was good enough to earn him a spot in the Penn Relays in the college 5,000-meter. Mike Turner '96 had four first-place finishes at the conference meet, winning the 100- and 200-meter races and helping to solidify victories for the 400- and 1,600-meter relay teams. Eric Pakurar '97 had a successful rookie year, taking second place in the 400-meter hurdles at the conference meet and also having participated in the 400- and 1,600-meter relays and the triple jump throughout the season.

A long-standing Swarthmore streak was broken this spring when the **men's tennis** team did not qualify to send a team to the NCAA Division III Tournament for the first time in 19 years. The men ended the year with a record of 6-10 and finished the season ranked fourth in the Northeast region of the NCAA and 18th in the nation. Including matches played in the fall, Barry Mook '96 accumulated a record of 8-15 at No. 1 singles, and George Khalaf '96 posted a record of 13-12 at No. 2 singles. In the No. 1 doubles spot, the duo of Brandt Lincoln '95 and Vijay Toke '96 had an overall record of 5-12.

The **baseball** team finished up the year with a record of 5-28. However, after winning only three of the first 30 games of the season, the men pulled things together and won two of their last three games. Pitcher Chuck Hudson '96 came on strong as the season progressed, picking up the save in the Garnet's final win against Dickinson. After losing 12 seniors (and eight starters) to graduation in 1993, the team lost only four seniors to graduation this year.

Kate Dempsey '95 qualified for the NCAA nationals in track.

Under the direction of new head coach Dan Sears, the **women's tennis** team finished the season with a record of 3-13. Becky Katz '95, at No. 1 singles, compiled a record of 6-8. The team was forced to make do without Kim Crusey '95 this spring. Crusey, who played in the No. 1 slot during her first two years, spent the semester studying in Spain.

Zack Colburn took over the reins as head **men's lacrosse** coach this year, after serving as an assistant coach in 1993. Even with Colburn at the helm, the team struggled this season, finishing with a record of 2-14. Brian Dougherty '95 (19 goals, 13 assists) and Ben Seigel '96 (19 goals, seven assists) led the team in scoring.

The **softball** team finished the season with a record of 2-23 and a conference record of 1-13. The one conference win was against Washington, whom they beat 5-3. The women also won a third game against Haverford, which currently plays softball at the club level only. Margy Pierce '95 led the team in batting with an average of .371, and outfielder Lena Loewenthal '97 received honorable mention All-Centennial honors.

Due to wet weather conditions, the **golf** team got a late start to the season. At the Centennial Conference Championships, Swarthmore finished eighth of the eight teams that participated. Swarthmore's top competitor was Andres Zuluaga '94, who shot a 226. Shawn Bundy '97 played at number one for the Garnet throughout the season and finished at the championships with a score of 247. Peter Yoho '97 shot a 233.

Haverford captured the **Hood Trophy** this year by a score of 9-6 in head-to-head competition. This spring the Fords swept the Garnet in baseball, while also winning in women's tennis and men's lacrosse. Swarthmore defeated Haverford in women's lacrosse.

LETTERS Continued from page 3

ure of communication on the part of the authorities handling the stakeout. However, I seriously doubt that any meaningful negotiation with MOVE was possible at this point. The "hybridized form of discourse" that Dr. Wagner-Pacifici calls for sounds to me like a recipe for further confusion and social disarray. How better to encourage the growth of more violence-prone cults in the future?

JOYCE MILTON '67
Brooklyn, N.Y.

Don't Drop Distinction

To the Editor:
I read with interest the article in the May *Bulletin* on revising the External Examination Program. I was most concerned that there is a proposal to eliminate the Distinction in Course honorific. I have always felt that the External Examination and Course programs should be separate but equal paths to a Swarthmore diploma. To eliminate Distinction unfortunately indicates that the two programs are not considered equal by many in the College community.

Students who elect to finish their degree programs in Course generally have very strong reasons to do so. Why should they be penalized for this decision by taking away the potential for an honorific? Should only 20 percent of the student body have the potential to receive "with Honors" on their diploma?

I understand the faculty's wish to strengthen and improve a program that is truly unique to Swarthmore. However, these improvements should not come at the expense of the Course program, which has been and will continue to be the choice for many Swarthmore students who feel it is the best way to achieve their academic goals.

JAMES A. ROWLEY, M.D. '85
Baltimore

Editor's Note: In late May the faculty adopted a revised External Examination Program, including the elimination of the honorific Distinction in Course. See article, page 23.

She Was an Angel

To the Editor:
Recently, the *Swarthmore College Bulletin* (May 1994) circulated through the Alumni Programs and Development Office here at Franklin & Marshall. I was delighted to find an angel on page 12.

Back in the summers of '66 and '67, I was a dippy high school kid with no future, just one of central Pennsylvania's many small-town rural poor. I was fortunate to be recruited into the PREP program housed at F&M. PREP had been created in 1964 by concerned faculty and staff members at Swarthmore and F&M to make equal access to higher education among the disadvantaged a reality. (It subsequently became the Great Society's national Upward Bound Program). Among the many wonderful people who helped me and 50-some other kids of all shapes and colors one summer was Marilyn Holifield '69.

As a tutor, Marilyn taught me to write better, talk better, and think better. She shared with me her culture and her love and concern for the welfare of others, no matter what their station. She shared her ideals and beliefs, and she introduced me to others who felt the same. Marilyn represented for me a new and expanded vision of a world to be explored. She was an angel.

Marilyn, wherever you are, you'll always have a fan in me.

RUSS BURKE
Lancaster, Pa.

Terpsichorean Excesses

To the Editor:
The caption on the maypole picture in the May *Bulletin* [Class Notes, page 32] indicated that the dance is no longer performed. Its demise must be fairly recent. The maypole was danced every spring I was at Swarthmore, 1984–87. I was taught the traditional Swarthmore maypole (apparently choreographed deep in the mists of time by a gym teacher) by Margaret Smith and Keith Henderson, both Class of 1984. I danced it myself in '84 and '85, then taught it to 16 more or less willing dancers in '86 and '87. I don't know whether it survived after that.

Swarthmore folk dancers had a chance every spring to dance at May Day at Bryn Mawr. I can confidently report that although their strawberries were excellent, the Bryn Mawrters' maypole event was a mere beribboned footrace when compared to the splendidly complex terpsichorean excesses of Swarthmore's annual logistical nightmare.

CARIN RUFF '87
Silver Spring, Md.

"One of the Brightest Memories of my College Years..."

To the Editor:
If the maypole tradition has in fact died, I am very sorry to hear it, because it is one of the brightest memories of my college years. The Folk and Square Dance Club was where I made some of my best friends at Swarthmore, and folk dancing continued to be a big part of my life after graduation—in fact, nine years after I graduated I met my wife in a folk dance group.

In my first two years at Swarthmore the Folk and Square Dance Club was ruled with an iron hand by Irene Moll, who told us during Freshman Orientation week that she had probably taught some of our parents to dance. She retired in 1977.

I suspect that the only Morris dancers in the [1966] photo are the men. There were no women Morris dancers at Swarthmore until my junior year (1977-78). Morris dancing is traditionally an all-male dance, but that tradition came under increasing criticism in our group until it was finally abandoned.

The Parent's Day performance had two parts. In the morning we processed down Magill Walk, stopped a couple of places in the Ville to perform, then processed to the train station, performing for a few bewildered Saturday commuters, then processed through the dining hall (this was the best part!) and onto Sharples Patio, where we gave a brief performance. To imagine the procession, you have to visualize very bright outfits, sleighbells attached to the Morris dancers' trousers making an unholy racket in the dining hall, flowers in all the women's hair, ribbons across the Morris men's chests, a piper or two, a fool, a "horse," and a virgin if we could find one. In the afternoon we returned to the patio for a longer performance culminating with the winding of the maypole.

DANA NANCE MACKENZIE '79
Gambier, Ohio

CORRECTION

President Lyndon B. Johnson and U.N. Secretary General U Thant received honorary degrees from Swarthmore in 1964, not 1965 as was reported in "A Day in the Life" (May 1994). Thanks to Walter Pinkus '65 and Diana Judd Stevens '63 for their careful reading.

SWARTHMORE HAPPENINGS

New York: The New York Connection gathered at Carnegie Hall for a soprano performance by Susan Rosenbaum '87. A coffee reception with Susan followed the May 20 concert.

Philadelphia: On May 27 the Philadelphia Connection, together with Swarthmore's graduating seniors, traveled to Veterans Stadium to cheer on the Philadelphia Phillies as they played the Houston Astros. Bob '81 and Carolyn Morgan Hayden '83 organized the annual outing.

Chicago: On June 2 Swarthmore recent alumni participated in a five-college bowling extravaganza with alumni from Carleton, Oberlin, Kenyon and Wesleyan. Mary Schless Roach '81 organized the event.

Los Angeles: Alumni, parents, and friends spent an afternoon at Warner Bros. with *Los Angeles Times* film critic Kenneth Turan '67. The June 12 event was coordinated by Walter Cochran-Bond '70.

Washington, D.C./Baltimore: Close to 20 alumni, parents, and friends spent a Sunday afternoon in June at the Baltimore Museum of Art, having brunch at the museum's café and then enjoying a tour of the Matisse cutouts. Salam Mir, parent of Samy '96, put together the event.

London/Paris: Traveling Swarthmoreans met "local" alumni during a College-sponsored trip with Centennial Professor of English Literature Tom Blackburn. Lucy Rickman Baruch '42 coordinated the London reception Aug. 6, and the Paris Connection did the honors on Aug. 8, led by Gretchen Mann Handwerger '56, Ed Gardner '81, and Elizabeth McCrary '83.

Maine: On Aug. 20 Chris '54 and Jane Walker Kennedy '55 hosted their annual Swarthmore clambake at their home in Damariscotta.

4,200 alumni elect 14 to Council

More than 4,200 ballots were returned in this year's Alumni Council election—a 17 percent increase over last year's total. Fourteen alumni were elected from seven geographic regions to serve three-year terms on the Council, which meets three times each year at the College. They join 28 other Council members under the leadership of Gretchen Mann Handwerger '56.

Zone A
David Newcomer '80
York, Pa.
Anne Matthews Rawson '50
Swarthmore, Pa.

Zone B
Alice Higley Gilbert '48
Garden City, N.Y.
Susan A. Rech, M.D. '79
Plattsburgh, N.Y.

Zone C
Marilyn Modarelli Lee '56
Greenfield, Mass.
Lisa A. Steiner, M.D. '54
Cambridge, Mass.

Zone D
Colleen A. Kennedy, M.D. '72
Arlington, Va.
Betty-Jo Matzinger '87
Annandale, Va.

Zone E
Jean L. Kristeller '74
Terre Haute, Ind.
Dorothy Watt Williams '50
Lakewood, Ohio

Zone F
Charles Lee Bennett '77
Durham, N.C.
Elizabeth Letts Metcalf '42
Coral Gables, Fla.

Zone G
Judith Aitken Ramaley '63
Portland, Ore.
Glenda M. Rauscher '69
Paradise Valley, Ariz.

For the alumni bookshelf...

A SINGULAR TIME, A SINGULAR PLACE

Swarthmore College and World War II

Edited by
Jeptha J. Carrell '45 and
Demaris Affleck Carrell '47

This new book from Swarthmore College contains transcripts from the memorable War Years Reunion and Alumni College held in June 1992. It includes talks by former President John Nason, President Alfred H. Bloom, and numerous distinguished guests and fellow alumni. It features 16 pages of rare photographs.

Order from the Swarthmore College Bookstore, (610) 328-7756. 116 pages. $6.50 plus $1.50 for postage and handling. Credit cards accepted.

Having Her Say and Including Theirs

Film and video review column by Evan Levine '84 contains comments from children.

She's columnist, author, museum coordinator, interviewer, new mother, and wife—and doing it all while living in the heart of Manhattan.

"I've certainly become more organized," says Evan Levine '84.

Levine's column, "Guide to Children's TV and Video," is distributed weekly in 600 newspapers around the country. But the column, which highlights movies, TV shows, and specialty videos that might interest children, is not just an adult's perspective on kid's entertainment; she includes the opinions of children and a ratings scale.

"There have been videos I've liked but to which the children didn't respond at all," says Evan Levine '84, whose syndicated column includes children's opinions.

The column, now in its fourth year, is syndicated by United Media, where Levine formerly worked and met her husband, Robert Levy. Levine finds the child reviewers mostly through word of mouth, and over the years she has built up a reviewing contingent of 25 to 30 children across the country plus several classrooms of children from a Long Island school. The children range in age from 3 to 14. "The older ones write their comments or I talk to them. When they reach a certain age, they just kind of drop out and lose interest in reviewing and new ones always seem to come along," Levine says. "The little ones, who can't write, talk with their parents after viewing a video and then I talk with the parents." The reviewers' youth does not preclude self-expression: Levine said one 10-year-old girl enjoyed reviewing videos so much she declared, "I'm going to do it until I die." And a 5-year-old, when asked his feelings on a compilation video of Disney songs, told Levine in an exasperated tone, "I only like songs about baseball!"

Levine takes satisfaction in the fact that for some children, reviewing videos has a greater reward than just fun. A 12-year-old dyslexic boy living in Hawaii finds the opportunity to review videos gives him a voice and pride. "The stigma of being dyslexic has left him somewhat shy," Levine says. "But being able to stand in front of a classroom of his peers and voice his opinions has heightened his self-esteem. When others in the his class started asking if they could do reviews too, he said, 'No, this is for me.' Things like that really make me feel good. The column is one of the few forums where kids get to express their opinions. It teaches children to be critical thinkers. They need to think about why they liked or didn't like something."

Levine too has learned to become a critical thinker in determining how to phrase questions. "You can't just ask children, 'Did you like that?' All they do is say yes or no and don't elaborate. So I've learned to ask questions like, 'Would you watch it more than once and why?' 'If you were the writer what would you change?' 'Who is your favorite character?' 'Would you watch it with a sibling?'"

Before sending out the videos, however, Levine gets the permission of the parents or teachers. The young reviewers rank the videos on fun factor, believability, humor, visuals, appropriateness, and social value. A number ranking and comment from Levine are placed next to the category headings.

Levine and her rug rat reviewers have commented on everything from *Last Action Hero* and *Batman* to Disney movies and Faerie Tale Theatre videos. "The kids are savvy," Levine says. "They don't like condescending videos." And while the popular purple dinosaur, Barney, may seem to be "irritating and the happiness forced" for Levine and some parents, "there's certainly nothing objectionable about it and young children really like it."

Levine, who holds a master's degree in English from New York University, is also the author of two children's picture books. She came to the publishing world in a somewhat fairy-tale manner. "I was taking a class in creative writing in graduate school at NYU. The teacher had won a Newbery Award for her children's books and I showed her one of my stories. She wasn't interested in that, but on the last day of class, I showed her another story I'd written. She gave it to her publisher, who later wrote me a letter suggesting changes and then said he was going to publish it." That book is *Not the Piano, Mrs. Medley!*, published in 1991. Her book *Kids Pick the Best Videos for Kids* was recently published and is similar to the column but in a longer format. It also provides sources to get in touch with the makers of the video. Her second picture book, *What's Black and White and Came to Visit?*, is expected to be in stores in September.

Levine's full-time job is as coordinator for publications for young people in the Education Department of the Metropolitan Museum of Art. To make the collections and exhibits more accessible, Levine's department produces appropriate literature. In this capacity she has coordinated a booklet titled *20 Questions: Kids' Most Asked Questions About the Metropolitan Museum of Art*, expected to be available in the fall. In it, children will find answers to questions such as "What object in the Museum cost the most?" "Is this the biggest Museum in the world?" and "What is the oldest object in the Museum?" She also writes and develops children's guides for the museum's permanent collections, one of the most extensive of which is of Egyptian art. Her department produced a booklet that includes a guide to the collections as well as recipes for Egyptian foods, stories, how to write hieroglyphs, and books to read for additional information. Family guides to special exhibitions and teacher materials are also produced in this department.

Until recently, however, much of Levine's insight into what children like to watch or read could be said to be informed but not firsthand. That has now changed. Last October Levine gave birth to her first child, Tobias. "Having a baby has made me doubly interested in what's good," she says. "He has strong opinions already." Although at this age one suspects they are more about strained carrots vs. smooshed bananas.

—Audree Penner

Recent Books by Alumni

We welcome review copies of books by alumni. The books are donated to the Swarthmoreana section of McCabe Library after they have been noted for this column.

Karin Aguilar-San Juan '84 (ed.), *The State of Asian America: Activism and Resistance in the 1990s*, South End Press, 1994. Written from the perspectives of labor organizers, artists, lawyers, historians, and others, this collection of essays provides analyses of a range of issues from the rise in anti-Asian violence to the social construction of race and ethnicity.

Margaret Glover (Moore) Foley Ames '38 (trans. and ed.), *The New (So-Called) Magdeburg Experiments of Otto von Guericke*, Kluwer Academic Publishers, 1994. Translated for the first time from Latin, this work details the experiments of 17th-century scientist Otto von Guericke, the "neglected genius" who was associated with the development of the barometer, the thermometer, the air pump, and a rudimentary electric machine.

Emilie Amt '82, *The Accession of Henry II in England: Royal Government Restored 1149-1159*, The Boydell Press, 1993. This book focuses on Henry II's achievements in the last few years of King Stephen's reign and the first years of his own, especially in administration and finance; on the people who contributed to those achievements; and on the local and communal dimension of the events of these years.

Lotte (Lazarsfeld) Bailyn '51, *Breaking the Mold: Women, Men, and Time in the New Corporate World*, The Free Press, 1993. Using real-life cases, Bailyn illustrates common problems facing this country's work force as businesses stuggle to address the problem of coordinating work and private life and explains why current company efforts usually fail.

David Cateforis '86, *Willem de Kooning*, Rizzoli International Publications, 1994. Willem de Koonig is a painter opposed to any and all systems. This fully illustrated volume traces the ever-changing career of this artist who altered the course of American art.

Michael C. Ehrhardt '77, *The Search for Value: Measuring the Company's Cost of Capital*, Harvard Business School Press, 1994. Providing a framework for practitioners, this book details the various methods for accurately evaluating investment in projects, divisions, or entire companies.

Andre Gunder Frank '50 and Barry K. Gills (eds.), *The World System*, Routledge Inc., 1993. This book confronts the idea that historic long-term economic interconnectedness did not begin 500 years ago but rather 5,000. The editors gathered an array of scholars involved in world system analysis and include both statements and responses to the idea of a "one world system."

Patricia Gillespie '72 and Mary Mathews, *Voices from Within: Faith-life Stories of Women in the Church*, Hope Publishing House, 1994. This theological primer is the result of a four-year consultation project whose object was to let women explore how they think/feel/experience their faith, their relationship to God, and their place in the church.

John W. Harbeson '60, Raymond F. Hopkins, and David G. Smith (eds.), *Responsible Governance: The Global Challenge*, University Press of America, 1994. A festschrift honoring Charles E. Gilbert, who retired from Swarthmore's Political Science Department in 1989, this volume contains essays related to one or both of Gilbert's seminal articles, "The Framework of Administrative Responsibility" and "Operative Doctrines of Representation."

Anne T. (McCaghey) Keene '62, *Earthkeepers: Observers and Protectors of Nature*, Oxford University Press, 1994. More than 100 naturalists and environmentalists—from ancient times to the present—are profiled in this reference aimed at adolescent readers. It also includes tables of plant and animal classifications, the geological ages of Earth, a further reading list, a glossary of terms, and a list of organizations that promote nature study and conservation.

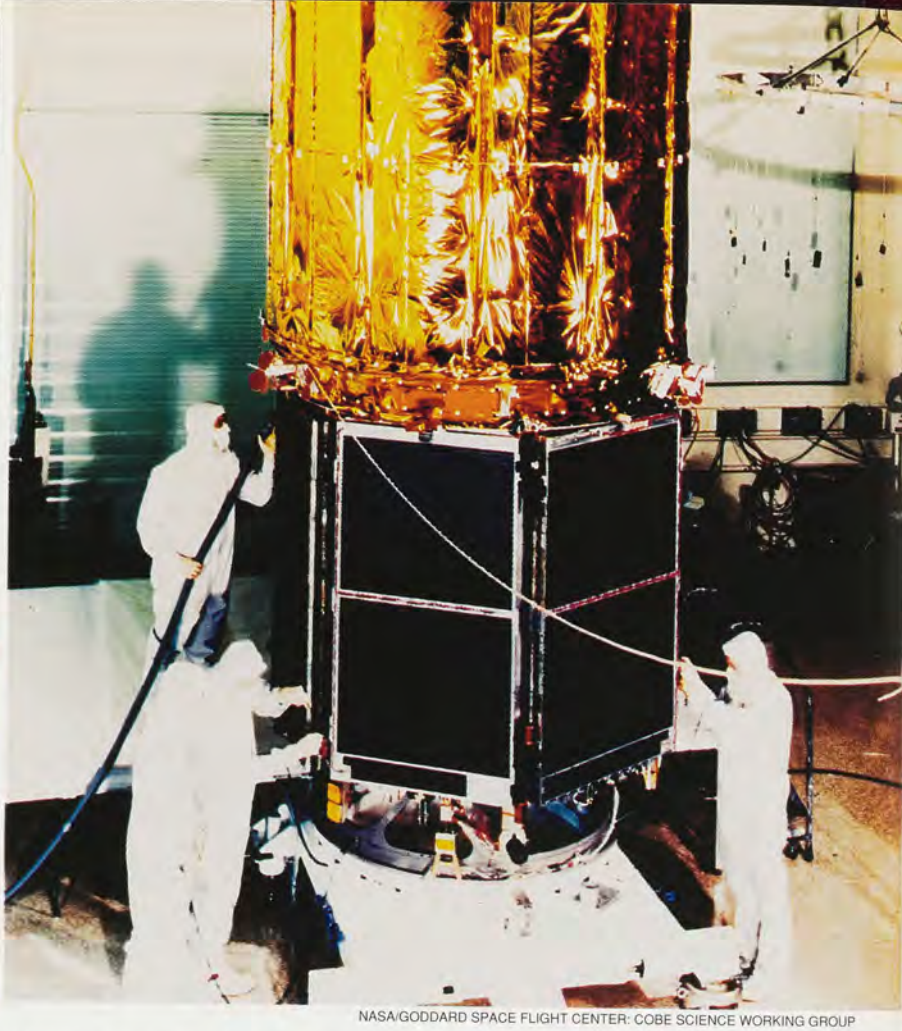
Martha P. King '73, *Healthy Kids! State Initiatives to Improve Children's Health*, National Conference of State Legislatures, 1993. This publication examines state issues and highlights a variety of programs in insurance coverage, Medicaid improvements, children with special health care needs, immunization, adolescent health, minority health, early intervention, and emergency medical services. **Martha P. King** '73, Melissa K. Hough, Jennifer M. Laman, and Julie A. Poppe, *Maternal and Child Health Legislation 1993*, National Conference of State Legislatures, 1994. Summarizing approximately 500 laws and resolutions concerning maternal and child health issues, this publication covers such topics as adolescent health, child fatalities, coordination of services, prenatal care, and school health.

Richard Martin '67 and Harold Koda, *Waist Not: The Migration of the Waist 1800–1960*. The Metropolitan Museum of Art, 1994. Published in conjunction with the exhibition "Waist Not" held at the Metropolitan Museum of Art, this volume contains drawings illustrating the variability of the "fashion waist," from the Empire dress of the early 1800s to the trapeze dress of 1958.

Jean Michener Nicholson '49, illustrations by **Judy Nicholson Asselin** '75, *Feeling a Little Bit Afraid*, Peace and Justice Press, 1993. This children's book captures in simple language the many fears young children face as they brave the world and how they find comfort and courage in the process. **Jean Michener Nicholson** '49, *Feeling a Little Bit Lonely*, Peace and Justice Press, 1994. Also for children, this book looks at the lonely times young children experience and shows how they develop creativity to deal with their loneliness.

Sarah Van Keuren '66, *A Non-Silver Manual: Cyanotype, Brownprint, Palladium & Gum Bichromate*, published by the author, 1994. Based on 14 years of teaching non-silver photographic processes, Van Keuren developed this manual to supplement classroom instruction by teachers experienced in the processes and to help those already committed to printing in non-silver.

William Foote Whyte '36, Hon. '84, *Participant Observer: An Autobiography*, ILR Press, 1994. Considered one of the premiere social scientists of this century, Whyte, Professor Emeritus of the New York State School of Industrial and Labor Relations of Cornell University, gives his first-person account of his life and career as a scholar-practioner in sociology and ethnography.



NASA/GODDARD SPACE FLIGHT CENTER: COBE SCIENCE WORKING GROUP

Left: *The COBE was launched into a 559-mile high polar orbit by a Delta rocket.*
Right: *The satellite had to be completely redesigned after the Challenger explosion made a space shuttle launch impossible.*

BEGINNING

Continued from page 8

spiritual issues are about moral priorities, and they are not in conflict with, or even very much related to, the shape of the physical universe." Asked if he thinks there was a spiritual force behind the big bang, Mather is concise: "That's way beyond my capabilities."

Still, the God question hangs over the work of every cosmologist. If you accept the big bang, you have to ask what happened before the beginning. Mather calls this "a currently unapproachable question. Because we're part of the expanding universe, we can't observe it from an external perspective. As far as we can tell, the big bang happened, but there's virtually no trace of the conditions that caused it to happen.

"We're on an almost entirely mathematical adventure here," he points out. "Einstein's theories of relativity were propelled by intuition and mathematics, and everything he said about it turned out to be true. The hope of the mathematical cosmologists is that we'll be able to do that again, to say what is the topology or shape of the whole universe."

Knowing the shape of the universe might help settle one of the most vexing cosmological questions. One theory suggests that there might be enough mass in the universe to allow gravity to halt the expansion, that all of the objects would ultimately pull back together into another infinitesimal point, creating another big bang. This so-called "closed" universe may be attractive aesthetically and philosophically, but the missing mass—or "dark matter"—has not been found.

The opposite ("open") theory holds that the universe will expand forever, becoming infinitely large—a beginning but no end.

The question isn't likely to be resolved anytime soon, says Mather, who, with the COBE research winding down, is thinking about new projects. "We have only two ways of figuring out whether the universe is going to stop expanding. One is to know all the laws of physics and to know how much gravity there is coming from all kinds of matter. That's a hard problem. The other is to measure the shape of the universe so well that we can actually see if things are slowing down. That's awfully hard too because you don't know how far away things really are. There's no good yardstick."

But Mather and his cosmological colleagues have solved hard problems before. "You sort of just circle around them and chew on things, try to immerse yourself. It's like learning a language. You work on it, memorize the words, talk to people in it—and eventually you can do it. You can't quite pin down the moment in which it happens. Doing science is a skill a lot like that, and sometimes ideas come from who knows where."

Is he attracted more to the aesthetics of a closed or an open universe? "I sort of like the idea of infinite expansion for ever and ever," says John Mather. "But as an observer I have no preferred view. I have to go measure." ■

MIRACLE

Continued from page 21

patiently, waiting their turn, eating fruit, or sipping lukewarm drinks. This is a day that many here never thought they would live to see, so they're prepared to wait a few hours more.

"Today we're putting apartheid in the grave," one woman giggles. "We don't know what will come out of the grave...." Her companion chimes in, "We don't know what is going to happen. We were suffering a very long time, you see. Now we are looking to go forward."

On Wednesday most of South Africa's 22 million voters are expected to vote. By the time I get to the Henley Primary School in Soweto just before 7 a.m., when the polls are scheduled to open, several hundred people are already in line. Those at the front say they've been there since 4 a.m. However, neither the ballot boxes nor the polling booths have arrived. Shortly after 7 a pickup truck manned by election commission workers comes speeding up and they start scrambling to get the polling station set up.

By the time voting gets started two hours later, the line is almost a mile long and growing longer by the moment. Tavern owner Masuga Mota is at the front and is so excited he said he couldn't sleep all night. "I feel like I'm above the moon," says Mota. "I feel like I'm finally a human being, like this is my country too. I'm finally a citizen."

Officials seriously underestimated how long it would take to collect and count nearly 19 million paper ballots by hand. The logistical problems that plagued the elections themselves also afflicted the vote count, and it was almost another week before the results were officially announced and the election was declared "free and fair" by the Independent Electoral Commission.

Under procedures set up by electoral officials to guard against fraud, ballots were supposed to be counted twice before results were released. This slowed things down so badly, it was finally abandoned. This led to an unusual problem for the South African Broadcasting Corporation. The SABC, which controls radio and TV broadcasting in South Africa, had planned round-the-clock, American-style coverage of the results on radio and its three TV channels. The election specials in English, Afrikaans, Zulu, and Xhosa were going to pre-empt regular programming for a few days until the final results were in.

When the shows went on the air for the first time on Saturday, there were literally no returns. For the next few days, results staggered in, a few hundred or a few thousand at a time, with hours passing with no significant news. The network gamely tried to carry on but eventually surrendered to reality (and audience pressure) and returned to regular programming.

None of this mattered, of course, because the result was a foregone conclusion. Opinion polls had predicted a comfortable victory for Mandela, so it came as no real surprise when the ANC was declared the winner, though it didn't get the parliamentary majority enabling it to write a new constitution without support from other parties. De Klerk and the National Party finished a distant second.

That evening Nelson Mandela and F.W. de Klerk, the two men who presided over the miracle, spoke to the nation of reconciliation and cooperation. Mandela, the humble victor, took no credit for his role in the liberation struggle, thanking the people as the true heroes. He shared again his vision of one South Africa, united, arising from its disparity of races, cultures, and languages.

"We might have our differences," Mandela said in the nationally televised address, "but we are one people with a common destiny in our rich variety of culture, race, and tradition."

Mandela also paid an eloquent tribute to de Klerk, his partner and adversary in engineering this orderly and relatively peaceful transition from white-minority rule to democracy.

"We have worked together, quarreled, addressed a sensitive program, and at the end of our heated exchanges we were able to shake hands and drink coffee," Mandela said.

But for me, there was a moment in de Klerk's concession speech, a speech of tremendous grace and eloquence, that somehow captured the dangerous passage the nation had just completed and set out the difficult challenges that lie ahead.

"A power greater than man has given South Africa the spirit, the chance to come forward in peace," de Klerk said. "God Almighty has been kind to us. Now it is up to the political leaders to join together, to work together, for the good of our people and to complete the task of healing and reconciliation. God bless Africa." Then he paused and repeated "God bless Africa" in Xhosa. "*Nkosi Sikelele iAfrika*," he said. It's also the name of South Africa's new national anthem. ■

Michael Fields '69, shown in South Africa with new president Nelson Mandela, is national desk editor for National Public Radio. He helped coordinate the network's coverage of the historic elections that brought the African National Congress to power this spring.

Staying Power

By Jeffrey Lott

This year Professor of Astronomy Wulff D. Heintz and Sproul Observatory closed the book on an 82-year program of photographic observations of the heavens. More than 90,000 photographic plates of about 1,500 stars or star systems have now been cataloged and evaluated—the largest collection of its kind to have come from one telescope. The program has "run its course," said Heintz. "We have squeezed out of photography everything we could do at this location."

The research has concentrated on two distinct classes of stars—binaries and dwarfs. Binary stars are systems in which two (or sometimes more) stars orbit about each other, swinging in a gravitational do-si-do. Dwarf stars have smaller-than-usual masses and low luminosities. Most stars belong to one or both of these categories, explains Heintz. But it takes close observation to optically separate the binaries or to find the faint dwarfs.

"Much of what is known of the masses of smaller stars has come from this instrument," says Heintz, noting that decades of astronometric measurements are often needed to calculate stellar masses. "The first goal is to find the distance of a star and hence its luminosity. For binaries, through careful measurement we then determine the orbits, periods, and masses of the members of the system. This information allows theorists to determine the internal structure and evolutionary status of the stars."

Sometimes a binary system will have one bright, easily seen member and a darker unseen companion of lower mass whose existence can only be inferred through the periodic motion of the larger star. The gravitational tug from the companion makes the bright star waver in its path like an unbalanced tire. But because the period of this wiggle might be as long as 15 to 20 years, long-term observation is needed to detect the subtle changes in direction.

The Sproul observations began shortly after the observatory's 24-inch refracting telescope was tested out in 1912. At the time, the Swarthmore telescope was the largest refractor on the East Coast and the third most powerful in the nation. Professor John Miller became the first of a long line of distinguished Swarthmore astronomers that included Sarah Lippincott and Peter Van De Kamp.

Heintz has worked at the refractor for 26 years, helped in recent years only by student assistants. "It's difficult for us to be awake for class the next day after having spent a night at the telescope," he says, "but the observations and their processing have continued on schedule." Dozens of students have contributed to Heintz's work since he joined the faculty in 1967.

Of particular interest has been the Sproul Observatory hunt for so-called brown dwarfs, stars of such small mass that their nuclear furnaces haven't quite enough fuel to shine brightly. Theoretically, a brown dwarf is about one-twelfth, or less, of the mass of the sun, too small to emit light from a hydrogen thermonuclear reaction like our star but big enough to glow faintly as its gases collapse under the pressure of gravity.

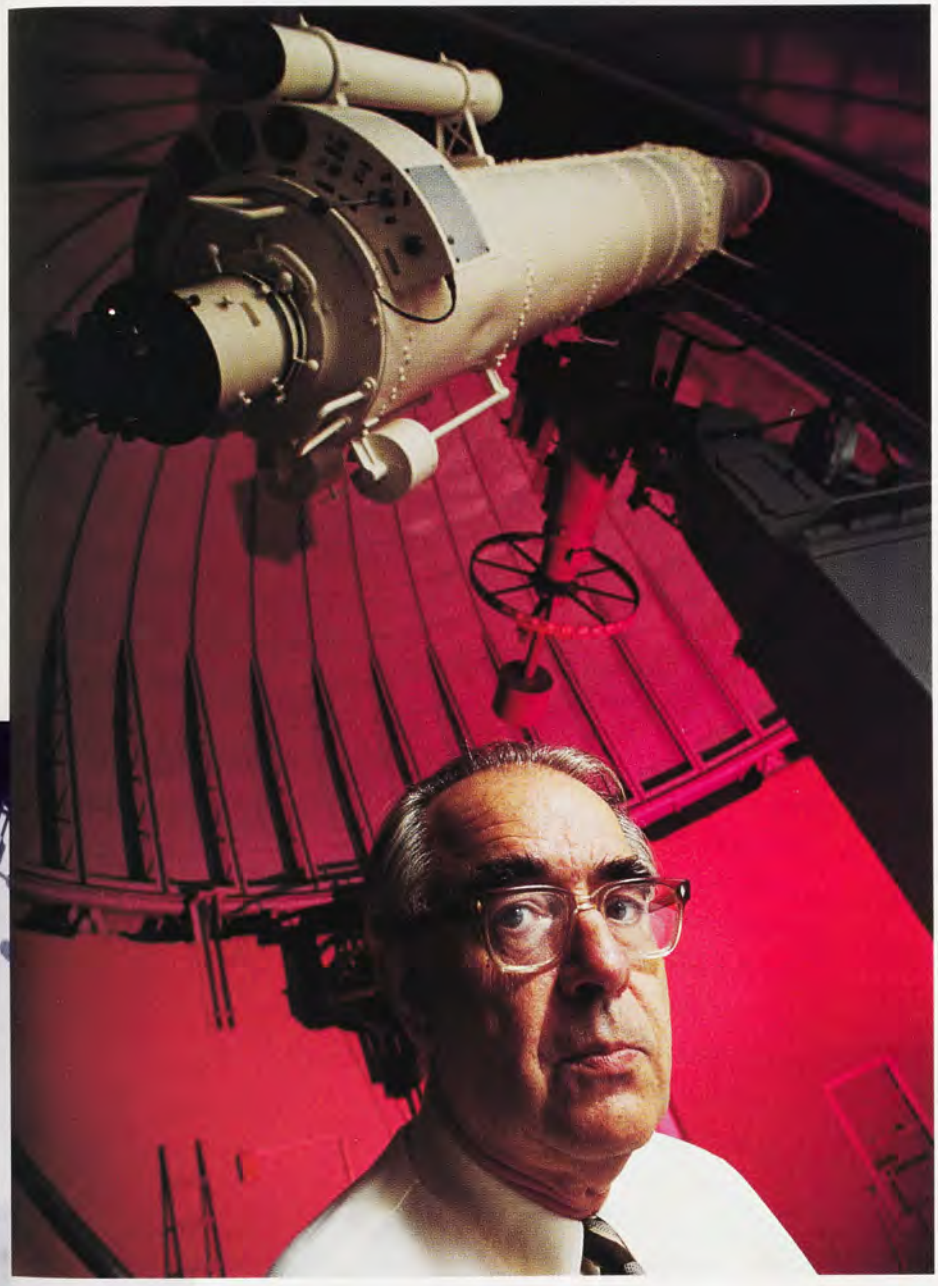
In 1972 Heintz put theory and observation together, announcing that a binary system known as Wolf-424 could be a pair of brown dwarfs. (The object is named for Max Wolf, the astronomer who first cataloged it about 85 years ago.)

He made this announcement after studying Sproul photographic observations of the object dating back to the 1930s. Then in 1989, after 17 more years of observing it through another of its periodic wiggles, Heintz published a research note in the journal *Astronomy and Astrophysics* claiming that Wolf-424 was indeed a brown dwarf system. He received wide publicity for his work, which *The New York Times* described as "a victory for old-fashioned astronomy, in which astronomers used to dedicate their lives to the study of a limited number of objects in space."

Though Heintz's findings have yet to be confirmed (and in fact have been disputed by some other scientists), he argues that "only our long-term observations permit an accurate calculation of their masses and thus back up the claim."

He is critical of the way the United States supports basic research like his. "Governmental support has long been the lowest among industrialized

The 24-inch refracting telescope in the Sproul Observatory, the gift of Sen. William Sproul, came into full use in the spring of 1912. It was built by the famous telescope maker John Brashear of Pittsburgh. The observatory's first director, Professor John A. Miller (below), followed his friend, President Joseph Swain, to Swarthmore from Indiana University. Professor Wulff Heintz (right) joined the College's faculty in 1967.



You can't rush things, says Professor Wulff Heintz, who has spent 26 years at the Sproul Observatory telescope.

nations, and in recent years what dollars were available have been consumed by expensive space missions. On long-term projects, ground-based observers have the advantage over usually short space missions," he says, "but it is always easier to get funding for shiny new equipment than for operating and maintaining existing equipment. Even large research universities are now seriously affected." Heintz's work was funded until 1990 by substantial National Science Foundation grants, but financial support has since been scarce.

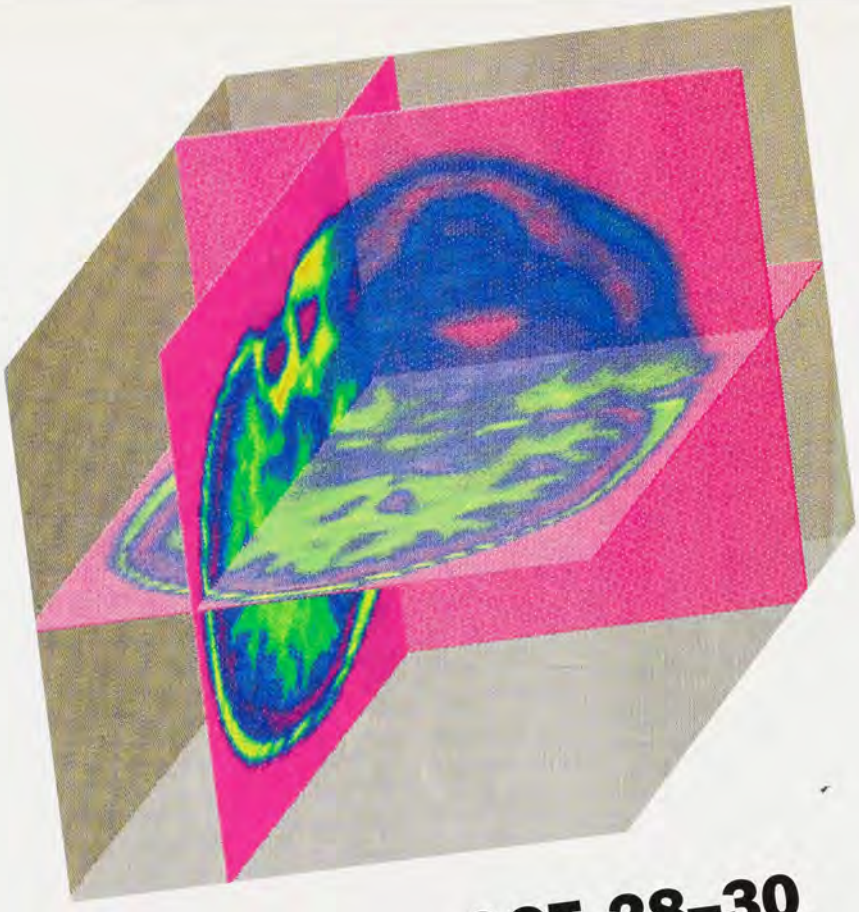
For the past four years, Heintz has worked jointly with Harry Augensen of Widener University revising and translating from German a three-volume *Compendium of Astronomy*. The English edition appeared this summer.

Now 64, Heintz looks forward to more years at the Sproul eyepiece, though no longer with photography. He expects to continue the visual observation of double stars by micrometer, a high-magnification measuring device with crosswires. He first did this type of work in 1954 at Mount Stromlo Observatory in Australia, and he has continued to hunt binaries at Swarthmore and at Cerro Tololo Observatory in Chile. Heintz has discovered more than 850 double stars in his career.

Even without photography the Sproul Observatory will have its uses, says Heintz. There is talk of adding a charge-coupled device (CCD) to the instrument—an electronic imaging tool that could measure star brightnesses more accurately over shorter observing times, permitting shorter, more student-oriented projects. Heintz hopes to make the telescope more useful for science instruction and also for the popular open house nights.

Though photographic observation is now considered old-fashioned, after measuring three 16-year-long orbits of Wolf-424 recorded on more than 700 plates, Heintz told a reporter, "You can't rush things. I've made my reputation by being very careful." ■

Swarthmore is helping to revolutionize the teaching of science—and you don't have to be a rocket scientist to understand it. Learn all about it at this year's



SWARTHMORE FALL WEEKEND OCT. 28–30

The above image represents orthogonal slices from a three-dimensional reconstruction of a human brain. It's a preview of what you'll see at the Saturday morning forum on Fall Weekend, when members of the faculty demonstrate the fascinating potential of state-of-the-art computer imaging for the classroom and laboratory.

Science today makes challenging demands on students, no matter what their aptitudes. You'll learn how techniques made possible by Project KIVA (Kresge Initiative in Visualization Access) allow students to "steer" computations, visualize results, and drive the discovery process. In addition to offering new learning adventures for students who excel at math and science, visualization opens windows and offers fresh motivation to beginning students and those who think they "can't get" scientific and mathematical concepts. It's enough to make alumni wish they were back in the classroom.

Join us on Oct. 29 for Fall Weekend's Saturday morning forum. Homecoming athletic competitions, arts events, open houses, and tours—and the spectacular glory of October on campus—will round out the weekend. No matter which attraction brings you back, a very warm welcome awaits you. For details please call the Alumni Office at (610) 328-8402.