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Washington University

Spring 1980

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Archaeoastronomy: Studying the astronomy of the ancients and putting it to use. See page 20.

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Nobel Prize-winning biologist Dr. Francis H. C. Crick talked in Graham Chapel this spring of new developments in the study of "Human DNA." This article is excerpted from that address, which Dr. Crick concluded with a challenge to his audience to begin public discussion of some of the ethical and political problems posed by population planning.
I chose as my topic today human DNA. But I’m going to keep my distance to some extent from the ethical and political aspects, to concentrate more on the “knowledge” side. It’s not that I don’t think these other aspects are important, but rather that I think in the long run, if not in the short run, the actual content of knowledge predominates in importance over the other issues. Sometimes this predominance is delayed for various reasons. For example, everybody has known since Roman times that the earth is round. But the picture of the earth taken from space which showed the earth is round had an impact on people greater than all the previous knowledge. Another example illustrates a further difficulty: Darwinian natural selection is regarded as one of the most important ideas at the basis of our culture. It would be nice to believe that everybody accepts this, but many still do not. In short, although fundamental knowledge can have a wide impact, its influence may be restrained by political, religious, and other considerations.

Before speaking of modern discoveries, I want to spend a few minutes outlining our basic “old-fashioned” knowledge of DNA. Those of you who know this will excuse my rapid scanner through the subject.

The first thing to get hold of is that DNA is an extremely long, thin molecule. It has a very regular backbone and, importantly, at regular intervals it has sidegroups, of which there are four types. We can conveniently think of these as four letters. To fix ideas, the number of atoms in each letter is about twelve or fifteen. The genetic message encoded in the DNA is in the sequence of these four letters. It is important to realize that the genetic message is written at the atomic level.

What people mostly know about DNA—namely, that it’s a double helix, two chains wound around one another—is not its most important aspect. What is more important is that each base can pair specifically with one of the others so that an exact, complementary copy of any base sequence can be made. The two chains also serve as a check on each other. That’s important in higher organisms because there are necessarily errors in copying DNA. You can’t have an error rate of one in 10,000 and cope with a message much longer than 10,000 bases. If you have a longer message, you must have a lower error rate. Having a second copy means that when an error is made, it can be corrected by referring to the other copy. Only in small organisms do you find single-stranded nucleic acid. In that case the error rate is manageable.

As you know, not all genetic information is in DNA. There are two similar families of molecules, DNA and RNA, and we believe (although we have no overwhelming evidence) that at the origin of life the first molecules were RNA. The messages were short, and they were probably not double-stranded all the time. RNA also has an important function today. Although the genetic message is extremely long, to read off bits of it—a paragraph here and a paragraph there, as it were—working copies of RNA must be made. One piece of the DNA can be copied many times to make “messenger RNA.”

Now let’s come to sizes, to see exactly what we’re talking about. As an example, consider the polio virus or one called SV40 (simian virus 40). A virus is a parasite—it has genetic information which goes into a cell, takes over the metabolic machinery of the cell and uses it for its own purpose. The size of a typical small virus is about 5000 base pairs. Five thousand base pairs doesn’t seem an awful lot, but you’ll find that it would actually take an appreciable time to write down the sequence of 5000 letters. When you come to an organism which isn’t a parasite, a free-living organism, a bacterium such as E. coli (Escherichia coli), you have about two million base pairs. That is the sort of size an organism needs to exist on its own. As we go higher up the scale, it’s convenient to pause at the little fruit fly, Drosophila, which has, in round terms, a hundred million base pairs. When we come to man, the haploid value—what you get from one parent—is about three billion base pairs—equivalent to a sizable library, you might say. You can see why a genetic message must be written at the atomic level: because, to a good first approximation, half of the information needed to make you came from your father; it came from one sperm; it came in the head of such a sperm. That clearly couldn’t have happened if it wasn’t written at the atomic level. Now, of course, we are learning the language in which it’s written.

The next thing is to ask what DNA does. Its major function is to code for the other great class of macromolecules—proteins. Proteins are a family of molecules built on the same principle as DNA. That is to say, they have a uniform backbone—quite a different backbone this time, a so-called polypeptide chain—and at regular intervals there are different sidegroups, this time twenty different sorts. Each protein has a characteristic length and a characteristic sequence of these sidegroups, which we can refer to as amino acids. Protein molecules are much shorter than DNA, but they are usually some hundreds of amino acids long. DNA, which has only four symbols, acts as a code for the sequence of the twenty symbols in the protein language. The genetic code is the dictionary which relates those two, as the Morse code relates the signals in dots and dashes (which would correspond to the DNA) to the letters of the alphabet. Sometimes “genetic code” is used to mean the message itself, but its normal usage now is as a dictionary relating the two languages.

A stretch of the DNA can be copied to make a number of working copies of messenger RNA. By an elaborate chemical apparatus, each messenger RNA is then read many times to make
many more copies of a particular protein. So you get a double step of magnification. We don’t know how many proteins there are in a particular organism, but a small virus may code for five or ten proteins. E. coli may have 2000 or 3000.

This scheme solves a difficulty which thirty or forty years ago appeared completely intractable. The whole point about a protein is that it has a three-dimensional structure. Each chain is folded up, and in its surface cavities there are chemical groups, which like a machine tool, do one of the jobs needed by the cell. We know that this three-dimensional structure is important, because if you boil a typical protein you unravel it, and it won’t work. That’s exactly what happens when you boil an egg—you denature the proteins, and you get a mess that won’t work enzymatically any longer.

The great problem which confronted us in the late forties was how on earth to make a precise copy of a three-dimensional structure. It’s easy enough to make a copy of the surface, the front and the back of it, but how do you make a copy of the middle of it? The answer is so easy it’s difficult to imagine it was ever a problem. And the answer is trivial: you don’t make a direct copy of the three-dimensional structure; what you make is the one-dimensional chain, piece by piece, and then the chain folds itself up to form the three-dimensional structure.

That is a quick introduction to molecular biology. What I really want to talk about is the new developments, which have been remarkable. People are doing, in labs and all over the world, experiments which we would have considered impossible five or seven years ago.

Our new knowledge depends on a number of new techniques and developments. In human DNA, there are three billion base pairs, but they are not all in one long chain. The DNA is on different chromosomes. We believe that each chromosome contains one long DNA molecule. But, as biologists, we may be especially interested in just one part of that—one gene. A gene may consist of a few thousand base pairs, and we would like to get hold of that particular gene out of the three billion base pairs.

One of the new developments enables us to cut up these long stretches of DNA in a defined manner. It has long been possible to cut them up in an ill-defined manner simply by shearing. Because the molecule is very long and thin, if we subject it to hydrodynamic shearing—just stir it, in fact—it will break. What was remarkable was the discovery of a set of enzymes, known as restriction enzymes, which will cut only at selected places. We now know of fifty or sixty different types of these, each of which cuts DNA in special places. Therefore, it’s possible to cut the 5000 base pairs in a virus, for example, into six or eight well-defined pieces with one restriction enzyme, then to purify one of those pieces and cut it into even smaller pieces by using other enzymes.

In the past, much of the work of biochemistry was done by classical methods. That is to say, you put a chemical in a test tube, you added a chemical reagent of a nature which would attack it in some way, and you tried to get the product. But you also got quite appreciable side reactions—5, 10, 15 percent or more—and you had great problems separating the products you wanted from the ones you didn’t want. The big discovery was to use nature’s own tools, to use enzymes as catalysts to do the job.
for you. Enzymes, having evolved by a long process of natural selection, have learned to do jobs with a very high degree of specificity. Using an enzyme is like having a very fine pair of hands on a very fine scale.

Unfortunately, you can't, as yet, design an enzyme which will do what you want to do; you have to find one and then purify it. But for various reasons people have done this, and many different sorts of enzymes have been purified: there are enzymes for copying DNA; there are enzymes for nibbling away DNA, for breaking DNA, and for joining DNA together. And it's these tools, these molecular tools which we abstract and purify from living organisms, which have made it possible to manipulate the genetic material in ways which were simply impossible twenty or thirty years ago, when everything had to be done by much cruder chemical methods.

Another important development is our ability to fractionate molecules. Two DNA molecules look pretty similar except that the all-important base sequence is different. With new procedures you can now fractionate DNA molecules very accurately according to length, especially those with lengths of a few hundred base pairs. And you can do that by cutting one up so that you can study instead a population of smaller DNA molecules ranging in length from, say, ten to 100 base pairs. Then you can put them on a gel, put an electric field on them, and spread them out so that each one gives a separate band. You can fractionate to such a degree of resolution that you can see that the one which has eighty base pairs is distinct from the one which has seventy-nine or the one which has eighty-one. And there are other methods of fractionation.

There are also methods—which I'll mention only for the sake of completeness—of screening for DNA. If you have a bit of nucleic acid having one sequence and you want to recognize a similar sequence, you can take the two chains apart and then use one of them to mate with the unknown ones. If the sequences are complementary, they will zip up together. (This method is not possible for proteins.) So by using this highly specific method of recognition, you can often screen for what you want.

None of these methods would be useful if it weren't for two other new techniques. If you want to do chemical work on molecules, you need reasonable amounts—not grams, nor even milligrams, but at least a fraction of a milligram. That's a very large number of molecules. In each of your cells there are just two molecules, one from your father and one from your mother. One molecule, in chemical terms, is very, very, very little indeed. So how on earth are you going to get enough of it?

The trick here, again, is to let nature help you. You take the bit of DNA you're interested in, join it up into some virus-like object, often a plasmid, put it into a microorganism, and grow many copies of it. In other words, to get from one copy to the amount that you need for chemical work, you use biological magnification; it can especially be used in microorganisms. There have been some fears that this will be dangerous, but in my view these fears have been greatly exaggerated.

There's been one further development which is equally striking. Two groups of people—one in Cambridge, England, and another one in Cambridge, Massachusetts—have now developed very rapid methods of sequencing DNA. I won't go into detail because it's too technical, but you use the methods I've described, roughly speaking, with a few very ingenious gimmicks added on. The net result is that you can sequence DNA at the rate of 100 base pairs or so every few days. That's quite a lot. For example, one little virus, a single-stranded DNA called \( \Phi X 174 \), which has about 5000 base pairs, has been sequenced completely by Fred Sanger at Cambridge, England. Moreover, he and his colleagues have recently sequenced another one at 5000 base pairs which is a relative. It's very striking to see a slide of this sequence and to realize that it shows an experimental result. Several viruses which produce cancer have been and are being sequenced. A number of our own genes have been sequenced. Human mitochondria DNA, which is 15,000 base pairs long, will be done shortly. This is a remarkable achievement.

Let me give you an example now of what can be done. Suppose you were interested in obtaining your own gene for globin. As you know, the red pigment in your blood is called hemoglobin. It consists of four chains, two alpha and two beta chains. Let's say that you'd like to know the base sequence of your gene for beta globin. Remember, the gene isn't going to be very long, perhaps only a thousand base pairs, and you have 3000 million base pairs in your DNA. What can be done is to take a sample of your blood, then cut up that DNA in one way or another and put it into a bacterial virus. You may then have as many as a million different bacterial viruses with their own DNA, but each with some fraction of human DNA. And among that million, one or two may have the particular bit of DNA that you want. In order to find that one or two in a million, you need what's called a probe—enough DNA or RNA of this general type to use for molecular recognition. It takes only a day or two to screen a million different viruses to find the ones with a copy of your globin DNA. Having found one, you then grow it in large quantities, so that you will have within this virus stretches which are accurate copies of your globin gene. Then, by the devices previously cited, you chop it out, cut out the bits you want to fractionate and get hold of, and then sequence it. If you have a laboratory which is properly set up to do it, sequencing may take two or three weeks. In terms of scientific research, the whole procedure is very short. These techniques are with us now.
O

F COURSE, researchers are using these procedures to answer important questions, and they have already made remarkable discoveries. For example, in your gene for globin, the polypeptide chain of which has about 150 amino acids, we expect to find about three times that number of base pairs (or 450), since the code is a triplet code. But that isn’t the case. There are the expected 450 base pairs, but there are also two long stretches of DNA which have absolutely nothing to do with globin, which we might loosely refer to as junk.

Such a stretch is technically referred to as an intron, or an intervening sequence. It was an enormous surprise to find in the middle of one gene stretches of DNA which apparently had nothing to do with the gene at all. We still don’t know why they are there. We do know, however, that such DNA drifts fairly fast in evolution. If we were to compare your globin with my globin, the chances are it would be identical: we’d have the same amino acid sequence. And we suppose that the bits of DNA which coded for that are probably identical, though we don’t know that for certain because the code is degenerate. But if we looked in a larger population at these other sequences, many of us would exhibit small differences in that region. In one instance, sixty individuals were tested and three or four were found to have differences, even though the whole sequence was not done. If the sequencing had been completed, there would almost certainly have been more. In other words, these “junk sequences” will probably be useful as very fine genetic markers.

Moreover, although we have only a small sample of genes, especially from the higher vertebrates, those we have possess an appreciable amount of this extra DNA. Typically, there is three or four times as much of this as of the coding sequences. Speaking very loosely, there’s a lot more junk there than sense. We also suspect there are large regions between genes which have sequences which don’t have a highly specific function. This is yet to be shown.

Although you have three billion base pairs, probably only a fraction of that, perhaps 10 percent or 20 percent, is performing a highly specific function. The rest may be of lesser importance. It used to be customary to refer to these as performing “housekeeping” functions. I’m sorry to say it must have been a term invented by a male, meaning, “We don’t know what it is, but it isn’t very important.’’

I have been arguing recently that we should look at it from a rather different point of view. I suspect that this is really Darwinian natural selection at the molecular level, and that there’s a lot of our DNA spreading around our chromosomes for its own sake—what we now call selfish DNA. But that’s still a speculative idea. It’s been a great embarrassment for some time that, although we regard ourselves as the lords of creation there are organisms
which have much more DNA than we do. Salamanders, in particular, may have ten times more and so do lilies and many other organisms. However much I try not to be a human chauvinist, I find it difficult to believe that the salamander is at a higher level of evolution than I am (moreover, different species of salamander have different amounts of DNA). We now think that some of this DNA has a nonspecific function; that it may be spreading for its own sake.

It’s important to realize that the theory of natural selection is no respecter of persons. Natural selection says that what replicates and survives preferentially is what will predominate. Recent work in population genetics on altruism, for example, says that if there are genes which promote altruism, those genes will not survive in a population unless they confer a selective advantage. It doesn’t have to be a selective advantage to the individual; it can be a selective advantage to the blood relations. You have to realize that natural selection operates at all levels so much of your DNA is probably what you might call parasitic. People don’t like this idea; they like to think it must have some function. But very few people would take the view that all human parasites are there for the advantage of human beings.

How many genes are there in human beings? Remember, an E. coli might have 2000 or 3000, Drosophila some small multiple of 10,000, so in humans there are perhaps 50,000, 100,000, 200,000.

Although each cell in the different tissues of your body has copies of all your genes, only some of them are working. The genes making muscle proteins are working in muscle cells, but not necessarily in nerve cells, which are making their own set of proteins. To understand the embryological development, we must know how genes are turned on and off, and how to turn them off in a coordinate manner in groups. This problem looked extremely difficult until recently. Now, with the new techniques, these problems may have answers in a relatively short period, perhaps five or ten years. This alone won’t allow us to answer all the problems of embryology—how to build a hand, how cells interact, exactly how the molecules arrange cell division. But if we could understand how genes are turned on and off, that would help us to tackle these more difficult problems, in particular, the development of the nervous system. Of all the great problems which confront us in biology, I think the ones which are going to touch us most deeply in the long run are not about genetics but about how our nervous system behaves.

What are going to be the consequences of all of these discoveries? I won’t go into many of the social consequences, but of course, it will give an additional way of “typing” individuals genetically. This will be useful, for example, for anthropologists interested in tracing the course of human migration. With these much better and much richer genetic markers, we shall be able to answer many problems of that kind. Within two or three years, we shall see anthropologists going into the jungles of Brazil, taking blood samples and coming back and sequencing the DNA they find there. It may also lead to things which one wouldn’t think of. People are used to thinking about their ancestors in particulars: “He has his grandfather’s nose” or something like that. The new knowledge will make people focus in quantitative terms on what it is they inherit.

Now, I said I wasn’t going to touch on social issues, but there’s one matter which has come up in the news recently I feel I have to mention, partly in self-defense. That is the sperm bank which has been on television and in the newspapers. It is said that three Nobel Laureates have contributed to this, and I merely have to say that I am not one of them! Some of my best friends are Nobel Laureates, although I’m not sure I’d want them to marry my daughter. What this sperm-bank gentleman is doing is on a very small scale, and there’s no reason to believe that it’s going to escalate into a much bigger scale. I can’t really believe it will do too much harm. What you’re being subjected to is something which is being promoted by the media. If a Nobel Laureate has children, that really isn’t news. I suppose if a Nobel Laureate had ten wives, that might possibly be news. If a lady had four children by four distinct Nobel Laureates, I suppose that might be news, but it would only really be news if she got them via a sperm bank.

There are, however, certain general principles here that are important. One is that it is quite undesirable that the human gene pool should become very narrow—never mind whether it’s Nobel Laureates or pop singers or whoever. It is not a good idea that one person should have, let us say, a million descendants though I don’t think there’s anything very much against somebody having tens or even a hundred descendants. There are people who believe human evolution was partly powered by this.
It isn't unreasonable to accept that some people should have more children than others. And this is an issue that I want to bring to your attention. Just after the war, it was taboo to discuss how many children people had.

There's been an enormous swing of opinion within one generation. Now everybody is concerned about the size of world population, and the size of the next generation has become an issue which people can talk about rationally.

It strikes me as most peculiar that there is no similar discussion on what might loosely be called the quality of the next generation. People don't like the issue. When it is raised, they think of a whole series of objections which I think are really not particularly relevant. They say, "That's all very well, but how would we select the people?"

In truth, in everyday life you discriminate between people. I don't believe the professors of your university are selected by lot. They are selected for their qualifications, and that is true in most walks of life. People do discriminate in favor of qualities which they think are good. What I think is important is that there should be no monolithic selection. We don't want everybody to be theoretical physicists; we want people with very many talents. It would be foolish not to recognize that some people, for one reason or another—and I don't want to say just how much of this is due to their DNA and how much isn't—are more talented than others in various ways.

Now there are many cautions about the way selection ought to be done. For example, I don't think it should be done by any form of compulsion, such as licensing. I think it should be done by popular opinion. People nowadays limit their families partly because of popular opinion on the matter. I'm not one to argue for any particular solution, especially not the sperm bank one. I do think it's time that this issue came into the public arena and was discussed in a calm manner, not as an acute political issue in the near future, but as something which everyone, especially the young, ought to think about. Americans have a certain handicap. You have statements in your Constitution about all men being created equal, which the authors actually believed to be literally true. But I would put it to you that two hundred years is a long time not to reexamine an issue of this kind. Shouldn't you be thinking perhaps about what the next generation is going to be like and how we can influence it in a humane manner? Shouldn't we be thinking about what the next generation is going to be like and how we can influence it in a humane manner? It is influenced by social forces already, including taxation. So why not do it in some more rational way, in some consensus?

It's a more difficult problem for the United States, because it's tied up with the racial issue. What I think may happen is that some smaller nation which doesn't have that problem—some place like Denmark—will begin to come around to this point of view. Once one nation begins to do something about it, the idea will spread and discussion will become more rational.

When you get new knowledge, you also get a new philosophical point of view, as you can see in the case of the Darwinian theory. We want knowledge to understand our place in the universe. In much of the period over which we've evolved, that had to be done essentially by producing a series of myths which were necessary to unite society and keep it together. Nowadays we still need myths, but we can look at the matter in a more rational way.

The known universe, which in Galileo's day grew by a factor of 10,000, has grown within my lifetime by another enormous factor. Our knowledge of the structure of the atom and of the chemistry that we've built on it, has enlarged enormously, and you can see that biological information also is being greatly enlarged. New knowledge of course is a dangerous thing. But a society which would turn its back on knowledge for this reason is not one in which I would be happy to live. It would be a stagnant one. I would like to see in American society a bit more of the pioneer spirit with which the nation was founded. I feel that the American public to some extent has been overreacting and has become overcautious about these things, that there's been a loss of nerve. You must accept the fact that if you want to understand your place in the universe, you're inevitably going to change the world. Those changes are not always going to be pleasant, but you should be able to face up to them.

The lessons I want to leave with you finally are: first, in biology, new knowledge has been advancing rapidly in the last few years, and it is going to advance even more rapidly. Second, we have a long way to go. It will be fifty, one hundred, two hundred years before we have real insight into our own nature and personality and our place in the world. And third, knowledge brings certain risks and dangers. I think you should be aware of this and not think that you can have the knowledge without the risks and the dangers and the opportunities.
The Life Beside This One

By Nancy Schapiro

When Professor John Morris joined the faculty of the Department of English in 1966, he came as a scholar of 18th-century English literature. Today his renown as a 20th-century poet is as firmly established as his scholarly reputation.

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The Life Beside This One

In the life you lead
Beside this one,
It is natural for you
To resemble America.
You require one woman.
You give her your name.
You work, you love;
You take satisfaction.
You are the president of something.
You are the same.
The children are clean,
They turn into lawyers.
They write long letters
And come home for Christmas.

It is a kind of Connecticut
Not to be twenty-five again.
Carefully in the evening
You do not think
Of the life you lead
Beside this one.

John N. Morris

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IF IT IS TRUE that a man may be known by his good works, then it is easy to know John Morris, professor of English at Washington University, and it's getting easier all the time, as his good works gain more frequent publication and wider recognition. Morris is a poet as well as an essayist and scholar of 18th-century English literature. He has published three books of poems and last year was awarded the Academy and Institute of Arts and Letters Award for his work. His name, while not yet a household word, is becoming more and more prominent among poets and their readers. Particular as poets are about their words, and modest as Morris is about his growing reputation, he wouldn't want his name to be a household word anyway. In fact, he refuses to promote himself in any manner, seeking neither entree to the poets' lecture circuit nor personal publicity of any kind. A very private man, he is uneasy at being interviewed and certain he doesn't deserve the attention. Reading his poems and essays and talking with his students, one becomes certain that he does.

His students praise him unqualifiedly. He is thorough, engaging, humorous, accessible, always kind but always honest, they say. "One of the best teachers I've had," claimed one student, as others nodded in agreement. Watching and listening to him lecture, it's easy to understand the unanimity of opinion. Standing beneath a sign proclaiming, "Please do not smoke in classrooms," Morris puffs away throughout the hour, fumbling with matches and cigarettes, barely making them meet as he inhales his way through Eve's temptation scene in Paradise Lost.
His smoking is not an act of defiance but of obvious necessity, as much a part of his lecture equipment as notes and text. The students are intent on his interpretation of the text, which he brings alive with sharp insights and wry wit. Illustrating Milton’s emphasis on freedom and premeditation, he asks, “If the serpent had smuggled the fruit into Eve’s salad, would she have fallen?” It is one thing to bring humor into discussions of Fielding and Swift, which Morris does, but into Milton and Paradise Lost it is a real challenge, and may require cigarettes.

What the Professor Said

Into my office, arrogant and green
They stalk to stammer
Suspectly of my perhaps obscene
Passion for grammar.

Why should I ask them for, or they expend
Their morning forces?
What if they should, with every sense, attend
All of their courses?

“Shakespeare certainly had the knack for writing”
Is what they’d learn.
I cannot show them even the “exciting,”
For which they yearn.
You’d think they’d try sometimes to catch me out;
But never. Look:
They nod, though I grow dull and wrong about
Some perfect book.

John N. Morris

This semester Morris is teaching a course in the writing of poetry, the first time he has brought together his separate professions of teacher and poet. He is enjoying the class very much, he says, but wouldn’t want to make a career of it. He prefers teaching literature and writing poetry—keeping them separate but equal. He takes his academic career very seriously, saying he would not choose to write full time even if that were a financially practical option for a poet. “I write more when I shouldn’t,” he confesses, “that is to say, in stolen time. If there’s a stack of papers on my desk waiting to be graded, I suddenly have a great desire to write poetry.” He smiles apologetically as he indicates his desk drowning in papers and books. In fact, his whole office looks as if it were going down for the third time. Books cascade from shelves and stacks and flow across the floor. The desire to write poems must be intense right now.

Morris feels that his two careers have been mutually beneficial. Last year when he received a Guggenheim to support his writing, and was on leave from the University, he chose to remain in St. Louis and report for work every day at his customary hours. He does most of his writing at his office, for, although he has a “room of his own” at home, he also has three young children, a wife, and numerous other interruptions/temptations there. He emphasizes that he was brought to Washington University as a professor of 18th-century literature, not as a resident poet, and he likes it that way.

Both careers have prospered since he arrived in 1967. At that time he had had a few poems published in magazines but was badly in need of ego support for his serious but lonely pursuit of the poetic muse. That support, and the muse, appeared in the form of a visiting poet at the University who, recognizing the quality of Morris’s work, recommended him to a publisher. Subsequently, Morris’s first book of poems, Green Business, was published in 1970 by Atheneum. Morris writes slowly. That collection included all of his past work, but since then his pace has quickened, his second book, The Life Beside This One, appeared in 1975, and now his third book, The Glass Houses, has just been published by Atheneum.

His poems have also been appearing more frequently in some of this country’s most prestigious magazines, such as the New Yorker and Poetry, and his work has received greater recognition with each publication. Recognition is about all a poet asks, or gets, for his labors. When asked what his career as poet earned him he counted quickly (on one hand) and said, “All in all, about $3000.” That doesn’t include, of course, the $4000 award from the Academy and Institute of Arts and Letters, nor the Guggenheim support which bought him a year’s time to complete his third book. As earned income from the sale of poetry, Morris’s figure seems to be typical. He quotes his friend and colleague, Howard Nemerov, as saying, “Nobody will pay you for writing poetry, but they’ll pay you for talking about it.” The New Yorker pays quite well for poems but it pays by the inch; unfortunately, Morris tends to write very short poems. The longest he has managed for them so far measured $180, which, as he remarks, “is awfully nice, but it’s not going to change your life. You can go out and buy a sports jacket or something.”

Morris started writing poetry early and says his mother claims he dictated poems even earlier, but he dates his serious dedication from a college Shakespeare course. After a class on Shakespeare’s sonnets, the professor instructed the students to “Go and do likewise,” and Morris was foolhardy enough to obey. “I found it tremendously difficult and a lot of fun,” he recalls, and apparently the process of creating poems still holds for him the challenge and the fun.

Not all of his models were as awesome as Shakespeare; he says he was influenced by Robert Louis Stevenson’s A Child’s Garden of Verses, and Hilaire Belloc’s The Bad Child’s Book of Beasts, which he recited by heart as a young

The Life Beside This One
MANY OF MORRIS’S poems are about the concept of “home,” yet he has a difficult time answering the question of where he comes from. Perhaps the above statement should be reversed as it seems likely that the focus on home and family in his works may stem from their diffusion in his life. He was born in Oxford, England, where his father was a graduate student. He lived for a time in Georgia, but when his parents divorced he moved to his maternal grandparents’ farm in North Carolina. That farm comes as close to representing home as he can get, for after his mother remarried, homes changed in rapid succession. During the war his stepfather was in the Marine Corps, stationed in Virginia, and in 1943, at age 12, Morris chose to enter Augusta Military Academy in Virginia. He remained there through high school. He liked military school, he says. “For a twelve-year-old during the war, when everyone was in uniform, it was like playing soldier.”

When Morris was a senior, his stepfather died suddenly and the family thought it best that John come home to attend college. Home at that time was Clinton, New York, which is also the home of Hamilton College, so Morris entered Hamilton. While he was in college the Korean War broke out and he chose to enlist in the Marine Corps, which allowed him to finish his B.A. in return for two years of service as an officer. He spent six months in Japan, which he found fascinating, and six months in Korea, which he found boring. Fortunately, the fighting had already ceased, so maybe that too was a little like playing soldier, but Morris was no longer a twelve-year-old.

**Man and Boy**

“You send us the boy; we return you the man.”

A Military School Advertisement

You will know that boy on sight.

In the advertisement

The same familiar gray

Half-inch face

Always arises

Out of its bell-hop collar —

The type of the boy

You are to send them

For the man in return.

They have kept that boy

In print these fifty years

In the back of the *Times*

Magazine section and the *Geographic*.

His head turned a bit to the right

And up, he stares at something

Serious a long way off.

You are the man

Returning that gaze. Unwearying,

He goes on

Being about fifteen

Forever, knowing

He will never return.

*John N. Morris*
The situations are spiritual crises, and the struggle is internal, but simply, "It's about nervous breakdowns." Well, it is just that, but story, a tale of men struggling to survive in extreme situations. Like the Man Who Came to Dinner, Morris stayed past dessert, and he still finds the substance nourishing.

Morris says he found no conflict between his two professions even in graduate school. "Columbia had an odd system," he recalls, "at least in my day, in that they required no written work. No papers, no exams, you didn't even have to attend lectures if you didn't want to. They sort of pointed and said, there's the library and when you want to take your doctoral examination, let us know. Of course there were the master's essay and the doctoral dissertation, but otherwise your time was your own." So there was time for poems even then.

Columbia's English department was dominated by Lionel Trilling, a master of literary criticism, who, according to Morris, "could use Freudian ideas without getting hung up on them, and without using the jargon." His work became the model for Morris's approach to his dissertation. The atmosphere in New York at that time was permeated by Freudian theory and, according to Morris, in certain circles one was considered a "serious person" only after passing through the rites of psychoanalysis. That atmosphere accounts in part for the focus of Morris's dissertation, which was to become his first book, *Versions of the Self*, published by Basic Books in 1966. Subtitled "Studies in English Autobiography from John Bunyan to John Stuart Mill," it is far from the dry pedantic study one might expect of a doctoral dissertation. It is as much a creative as a critical work and seems to owe as much to Morris's poetic style as to Stuart Mill, "at least in my day, in that they required no written work. No papers, no exams, you didn't even have to attend lectures if you didn't want to. They sort of pointed and said, there's the library and when you want to take your doctoral examination, let us know. Of course there were the master's essay and the doctoral dissertation, but otherwise your time was your own." So there was time for poems even then.

Of this phenomenon, Donald Finkel, poet in residence, says, "Since writers in general work alone, what we share as professionals is confined to such dreary matters as our relations with publishers or agents. It's no wonder, then, that when we come together we soon run out of shop talk, and our conversation runs to infinitely more diverting topics, like the weather or the vagaries of the internal combustion engine."

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There does seem to be a communal feeling in the whole English department. "There's no division between the professors and the writers here," says Morris, "as I gather there is in some places."

Although Morris feels comfortable in St. Louis, he still tends to think of himself as an Easterner, and as a man not rooted in any one place. His roots may not be geographical but they are historical. The Morris family arrived in Virginia in 1720, and his mother's family can be traced back to the Mayflower. Morris says this
genealogy never meant much to him as a boy, but as he gets older his interest in genealogy increases. His Southern forbears people many of his poems and seem to haunt his imagination. Asked if this family heritage imposed any burdens or obligations upon him he said no, then added, hesitantly, that he would, of course, like to be one of the forbears who is remembered. As a fourth-generation academic in his family, he thinks that perhaps what seemed a fortuitous choice of profession was somewhat preordained. He had thought of becoming an Episcopal clergyman but realized that his interest lay less in God than in The Book of Common Prayer. He liked the literature and the ritual and now thinks that primarily he sought structure, that he wanted to be part of an institution. The university superceded the church and prayers became poems.

The Fathers

When we shall finally be
The children's simple story,
The story they tell the children,
Then we shall be the fathers
Dead in their terrible clothes
There on the mantel beside us
Looking out of their eyes
With their eyes, looking before us.

John N. Morris

THOUGH MORRIS tends to portray himself as a man to whom life happens, to whom chance and fortune dictate, his work indicates a different portrait. He has a strong, disciplined intellect and is a master of his craft. Several critics have noted the craftsmanship and control in his poems. Thomas Pirkle, in *The Denver Quarterly*, remarking on the freshness of the poems in *Green Business*, said it "comes partly from the way Morris is able to hold together...the reason and demand for order of the neoclassical with the irrational and diffusiveness of the modern."

Here again one finds the two professions blending, for the professor of the neoclassical 18th century takes what he needs from the past to contain the experience of the irrational in the 20th century. Morris doesn't borrow Pope's couplets but he does use the elegance and wit, and sometimes 18th century characters make their appearance as poetic subjects, as in the poems, "Crusoe Continuing," and "At the Death of Gulliver." Morris says that at times when looking over his work he thinks, "My, I do have some awfully gloomy poems," and that bothers him a bit, but the effect on the reader is never depressing. The style elevates the subject, the wit shines through. In fact, many of Morris's serious poems are downright amusing.

All He Knows

My dog knows the garbagemen,
Those ruffians out in the alley
In their noisy, enormous truck,
And what they are up to:
They are stealing our garbage.
He's furious about it.
This has got to stop, he seems to say.
Twice a week they come and just Take it away and you do nothing.
Yes. He makes sense in his way,
The way sense does. He does not know
Where it is going, some deep hole
Into the west county, gehenna, a place
Of permanent burning. All he knows
Is what he sees, how all day she
And I carefully feed into the special box
In the special corner all manner
Of deliciousness, spilling nothing; then
In a procession of one as if it were precious
She or I every day
Carry it out to the great
Cans where we store it —
Our effects, the proof of the pudding, the eating,
All he knows is,
Everything ends up there. And gets taken away.

John N. Morris

Morris calls his poems old-fashioned, and that they are, but only in the sense that they are carefully fashioned. If life is often out of control, or far beyond control, it is the poet's task to gather up the shards and construct from them a harmonious whole. John Morris performs this task with precision, economy, and great beauty.

The Way We Live Now

The way we live now
Is coming down the stairs.
It is saying,
"In the suburbs, there you feel free."
This is the morning.
The way we live now
Is shaven, is dressed
In the hair and hide of others.
Its house is paid for.
Its pants are pressed.
Now the way we live now
Is driving to work
That commands respect.
At last it is like the others
Who are happier than the rest.

John N. Morris
Jim Harris (left) and Philip Freemer play 18th-century baroque flutes.
At Washington University an interest in early music has been growing for a number of years. The appointment in January 1979 of Nicholas McGegan as artist-in-residence gave that interest focus, and under his tutelage a solid group of performers is emerging. Michael Fleming, PhD 79, a part-time instructor, musicologist, and free-lance writer and critic, here reports on that old/new wave.

Even in these fast-moving days, most musicians are specialists who find that a single career focus is all they can handle. Anyone involved in the slightly crazy world of early music, however, soon discovers that he must be a jack-of-all-trades, performing, conducting, researching the pieces played, even doing a bit of repair work on the instruments. Although his years number a mere thirty, Nicholas McGegan, artist-in-residence in the WU music department, has plied all these trades, and several more.

Born in Nottingham, England, in 1950, McGegan studied music at Corpus Christi College, Cambridge. As an undergraduate, he played principal flute in the university orchestras and conducted for the chamber orchestra and the opera society. At that early point in his career, he accomplished a coup for a fledgling conductor: he staged a modern revival of Philarid’s comic opera Tom Jones. The score had lain virtually unnoticed in the Cambridge library since the eighteenth century. “I came upon it quite by accident,” he says. “I was just poking around, looking for something to perform.” Since then, he has published his own edition of the opera about the adventures of Fielding’s roguish hero, and he is in the process of writing a biography of the composer.

McGegan first visited the United States in 1972, traveling with the Oxford and Cambridge Shakespeare Company as musical director. The company’s tour, which trekked through “the dreariest parts of the country, in the dead of winter” did not dampen his enthusiasm for transatlantic travel, and he returned in 1978 to teach at the New England Conservatory in Boston. When he was invited to WU to teach the following year, he accepted without a second thought.

He arrived in January 1979 to take up his duties as artist-in-residence and director of the new program in Historical Performance Practices. “I had been briefed on what to expect,” he says, “but I still felt a bit at sea in St. Louis. Since I don’t own a car, I am totally dependent on public transport, which can make life difficult.”

When he returned at the beginning of this semester, he had grown more accustomed to our peculiarities, although he confesses that he still cannot share our taste for ice-cold beer.

The WU early music program is a training ground for performer-scholars who wish to specialize in Medieval, Renaissance, or Baroque music. The program had been guided through its infancy by such distinguished musicians as James Tyler, lutenist, and Bruce Dickey, a specialist in early wind instruments. But when McGegan arrived, it was suffering growing pains. “When I came to class,” he recalls, “I never knew what to expect. One day there would be two people, the next day, I would be face-to-face with ten recorder players and three guitarists.”

After a period of experimentation, the program is now firmly on course, and McGegan is confident that it will guide many graduates into careers in early music. He allows, on the other hand, that the necessity of traveling great distances between major metropolitan centers in this country makes touring a greater burden here than in Europe. “There, the capitals are all so close together that a performer can hop from one to another by air in a few hours—from London to the Hague, to Paris, to Vienna. But financial resources are much greater here. In St. Louis, for example, a wealthy Bach devotee might establish a Baroque orchestra almost in a piece.”

This summer, McGegan returned to the European summer festival circuit before settling in for another year’s residence at WU. “I have a love-hate relationship with travel,” he confides. “I miss the excitement of touring and performing when I’m away from it, but I enjoy the chance to work on my book, to be free from the pressure of concerts.”
Peter Klevorn on an 18th-century serpent horn. Almost all instruments are reproductions.

McGegan plays an 18th-century harpsichord.
LIKE ANY performer, McGegan craves the stimulus of the concert platform, so that even during his current stay at WU, he managed two recitals of his own. For St. Louis concert-goers, these were a rare opportunity to hear the flute music of Bach’s time and earlier, performed on the instruments for which it was written. “In Britain,” he says, “no one makes much fuss about ‘old instruments’ any more—we simply take that for granted.”

Although he is not bothered when curiosity-seekers attend his concerts, he says with fond hope, “If one plays reasonably well, people will simply listen to the music and forget about the instruments, won’t they?”

When he returns to residence at the University, McGegan believes that his increasingly intense, skilled corps of students might undertake more ambitious projects. One of these, he speculates, could be an in-depth study of a Baroque opera, for which students would dig into the original sources to investigate every aspect of this little-known art. He says with élan, “There is a lot of material right here, waiting to be read—production books, actors’ memoirs. Why not make use of it?”

He is clearly encouraged by prospects for the future, and looks forward to returning to teach and perform with a group of students whose enthusiasm has been kindled by his own. “Besides,” he says, “this will be my first chance not to arrive in the midst of a St. Louis winter.”
Teacher of the Year

O n April 16 at the White House, Beverly J. Bimes, a teacher at Hazelwood East High School in St. Louis County, received the 1980 national Teacher of the Year award. Her selection from among 140,000 active competitors was, in part, recognition of the success of a small new St. Louis program to instruct teachers to teach writing.

In 1978, Bimes notified her department chairman and her principal that she intended to quit teaching. She was, she says now, "simply burned out." The trail between that state of mind and this year's award leads through Washington University.

Educated at Greenville (Illinois) College and Lindenwood Colleges (St. Charles, Missouri), Bimes taught for two years, then quit to stay home with her children, Kimberly, Terri, and Cheryl, now 14, 12, and 10, respectively. During this period her husband, James, who is a curriculum consultant in Hazelwood, was pursuing a master's degree and a specialist's degree in education at Washington University. That was Bimes's first educational contact with Washington University. She explains, "Jim was enrolled in a wonderful fellowship program that was unlike any educational program either of us had ever known. It was exciting, and I got tremendously involved.

I read all of his books and we had frequent and long discussions. I think that my whole educational philosophy — as well as his — changed as a result."

She returned to teaching ten years ago, but after several years became dissatisfied. "I think," she explains, "that people do not realize how isolated a teacher is. There is little time in a school day for professional exchange among teachers. Anyway, I was feeling very tired and I wanted to quit, but I simply could not find a good job.

"While I was looking, I became very angry about how teachers are perceived. Society seems to place little value on their skills. It is almost as though people believe that we teach because we can't do anything else."

Meanwhile, however, a Washington University alumnus, Max Wolfrum, PhD 70, assistant superintendent at Webster Groves Schools, was campaigning hard to establish a local program for writing teachers similar to one being successfully pioneered in San Francisco by a friend of his. Wolfrum was joined in his effort by other educators including Alan Tom, associate professor of education in the University's Graduate Institute of Education, who resolved to find a place for the summer program at Washington University.

In 1978 the Gateway Writing Program was funded through Federal Title IV-C. It was to be administered by its own board in cooperation with eleven St. Louis school districts and Washington University. As one of the cooperating districts, Hazelwood asked Beverly Bimes to attend.

"I think," says Gateway director Judy Shook, who is also director of student/curricu- lum services for the Kirkwood School District, "that the five-week workshop was planned so well and the expectations were so high, the experience changed many lives. We had asked the districts for top teachers and each knew what his or her commitments were to their fellow teachers. Our teaching was a bit ahead of its time, but was bound to succeed."

The program was offered through the Washington University Summer School and was given "tremendous support by the Summer School staff and by the University libraries," says Shook. It offered participants full tuition and a stipend and asked, in turn, almost total commitment for the five-week period.

Each day participants wrote, read aloud from their work, critiqued it, read supplementary works, and wrote some more. "I took the course right along with the twenty-nine regular participants," Shook explains, "and I know that by the end of the period, we all believed in our ability to write, in our ability to judge writing, to teach students to write, and even to teach teachers to teach students to write."

I n addition to the summer workshop, each participant was required to undertake an ongoing commitment for the next year. They were asked to give ten hours of in-service training within their districts (and often participants taught across district lines), to meet monthly for program evaluation, and in June to evaluate hundreds of student papers from all districts to assess the
Beverly Bimes credits her two associations with Washington University as having had a subtle, but very real, influence on her development as a teacher. She found here "a warmth that radiates beyond classroom walls."

impact of their year's work. Like Bimes, many participants also came back to the workshop as guest lecturers the following summer.

But in September after the first summer, Bimes went back rejuvenated to her communications skills classes at Hazelwood. "The workshop had made me look at why I was a teacher and I emerged convinced, but also determined to change society's image of the teacher." She changed her own classes and taught other members of the English faculty what she knew. They in turn have worked with other teachers to establish a writing improvement program that pervades the entire school. Her Total School Writing Assessment Program is now in its second year, but already its success is apparent.

Bimes feels that this program was largely responsible for her national recognition. Her own students, however, know that Bimes herself deserves the award. They ask what other communications skills teacher would come to class in a red housecoat with her hair in curlers, accompanied by a male coworker volunteer in robe and shaving cream, to dramatize a domestic scene in which both have stopped communicating.

"Well," she says, "I do what I can to attract my students' attention."

Beverly Bimes is particularly pleased to be Teacher of the Year because the award has allowed her to climb onto a national soapbox to say, "I think teachers underestimate their own success. They need to be out telling the world what they do and do well."
Michael W. Friedlander has been a member of the faculty of the Department of Physics since 1956. His own research concerns cosmic rays and infrared astronomy, but both as a teacher and scholar, he has long been interested in archaeoastronomy. This article is adapted from two early chapters of an introductory college textbook on astronomy which he is currently writing for Prentice-Hall.
Astronomy is probably the oldest science. In even the oldest written records, such as the cuneiform tablets from Babylonia, we find records of movements of the Moon and Venus that represent many years of careful observing. At least as old as these tablets are the circles of standing stones, such as Stonehenge, whose planning attests to surprisingly sophisticated awareness of subtle features in the movement of the Sun and Moon.

Within the past few decades, there has been a growing collaborative interest among astronomers and archaeologists in what is now termed archaeoastronomy. This new discipline covers all aspects of ancient astronomy, which was largely directed to observing the rising and setting of bright objects. While Stonehenge is by far the best known of these megalithic structures, we are now finding worldwide evidence for the acuity of ancient observations.

But what of such knowledge? How does it enrich us? Two answers are possible, both of which I want to explore. In studying ruined monuments of ancient societies (I use the word "monuments" to indicate that in important ways Stonehenge and other sites have served to memorialize for their users and for us the achievements of their builders) we are learning about these societies. That is the archaeological fruit of our study.

We are, however, also reaping astronomical benefit. The study of megalithic astronomy is helping us to trace the development of astronomical knowledge and theories. And, unexpectedly, the ancient written records are turning out to be a unique and invaluable resource for modern astronomical theory.

Let us go back to deal briefly with some specific, representative examples of both kinds of archaeoastronomical research.

The best known and most extensively investigated megalithic astronomical site is Stonehenge, which lies on the Salisbury Plains of southern England. What we know of Stonehenge and its builders is based on archaeological findings and on radiocarbon dating of bone and charcoal. By piecing together evidence from both sources, we theorize that Stonehenge was built in stages extending over nearly a thousand years starting about 2500 B.C. It is probably safe to say that Stonehenge predates the Babylonian cuneiform records and that its beginnings were roughly contemporary with the oldest pyramids.

Here is little doubt of the intentional solar and lunar alignments of the structure. We have long known that Stonehenge was aligned on solar positions, such as sunrise at the summer solstice. That is one thing: these sunrises and sunsets recur every year. The moon's movements, though, are much more complex and present a challenge. To validate these, careful measurements and alignments must be made for many years. Such observa-
Archaeoastronomy

Woodhenge near Cahokia, Illinois. Diagram based on Wittry's work shows three circles. The plus marks indicate where centers should be. A post pit was found five feet east of center of Circle 3. Solid dots mark positions from observation post. Open dots show positions from geometric center of Circle 2.

There is also a growing body of quite diverse information on the ancient role of astronomy in the Americas. We need review only a few representative sites, starting nearby at Cahokia, Illinois.

The site is a few miles south of the junction of the Mississippi and Missouri Rivers, about 150 miles north of the point where the Ohio River joins the Mississippi. This favorable position for transport and trade was well settled by 1000 A.D.; estimates of its population at that time run as high as 30,000. This Indian population constructed more than a hundred mounds of earth, including Monk's Mound, the largest in America north of Mexico. The population declined after 1300 A.D., and the white settlers found no descendants of those early inhabitants.

Over the years, many of the mounds were levelled, some to provide dirt or to make way for farms, one for a parking lot, and another for that modern sacred place, a discount store. Several, including Monk's Mound, are now protected within the Cahokia Mounds State Park.

Federal legislation now requires an archaeological survey before one can proceed with federally funded projects and so there was a hurried survey in the early 1960s, prior to the construction of Interstate 70. It was then that Warren Wittry, a Michigan archaeologist then working with a University of Illinois team about half a mile due west of Monk's Mound, uncovered evidence for what he has termed a "woodhenge." Around a very accurately laid out circle he found a series of holes that had originally held wooden posts about eighteen inches in diameter. As the site was excavated, a stump of red cedar found in one in 1978, and the impressions of others could be seen in other postholes. Wittry obtained good evidence for three interlocking circles, of which one, with a diameter of 205 feet, was very well defined. There is no marker at the geometric center, but five feet east is a hole which at one time held a very large post.

From this woodhenge, the solstice sunrise positions are along a low line of bluffs about four miles to the east; the equinox sunrises are over the southern tip of Monk's Mound. Sighting from the near-central position of Circle Two across appropriate postholes on the circumference, these sunrise positions are well defined. Wittry's final analysis of his field data and the accurate specifications of the positions of the postholes are not complete. A preliminary map published in 1964, and updated in 1977, revealed postholes close to the rising and setting points of the star Capella. Bisecting Capella's positions could have been used for determining celestial north, but this remains an interesting conjecture, for there is no posthole indicating due north. Over the years, the western sector of the ring has suffered such damage that it probably will not be possible to complete the circle.

Wittry has had a local utility company place posts at the near-center and the three sunrise positions and on several occasions he has clambered up these to observe and photograph the sunrise. The alignments seem very accurate. We must remember that we have no knowledge of the height of the original posts nor of the actual method of observing. But the reconstruction is impressive.

In 1974 John Eddy, a solar astronomer at the High Altitude Observatory in Colorado, was the first to sur-

ve the Bighorn Medicine Wheel in Wyoming. Cairns (small rock piles) have been set out in lines, both around a rough circle ninety feet in diameter and along twenty-eight spokes radiating out from the central cairn. In addition to the central cairn there are six others, each with a central hollow which may once have held a wooden post. The alignments aim at the summer solstice positions, and three of them seem to be directed towards the rising points of very bright stars. Although there is a question as to whether these stellar alignments are genuine, these three stars—Aldebaran, Rigel, and Sirius—rise dramatically just before the sun in summer and could well have been used as calendar markers between 1400 and 1700 A.D. in the way Egyptians earlier used Sirius. Aldebaran's rising marked the summer solstice, and this dating is consistent with archaeological evidence at the site. During those years, Rigel's rising was twenty-eight days after Aldebaran; Sirius rose after another twenty-eight days. Lest we rush to identify these numbers with the number of spokes of Bighorn Medicine Wheel, Eddy reminds us that there are 28 ribs in the buffalo. He believes that the spokes are decorative, perhaps done to create a sun symbol.

Bighorn, like other known medicine wheels, is located with a clear view of the horizon, rather remote from areas that were attractive for settlement or even grazing. Reasons for selection of such sites can
Bighorn Medicine Wheel in Wyoming is one of many found throughout the Rocky Mountain area. This wheel is about ninety feet in diameter with six cairns marking its circumference. The alignments shown were found by Eddy.

Astronomical alignments have also been sought in recent years among the many Indian buildings in the U.S. southwest. The Sun Temple in Mesa Verde National Park in Colorado is a large and elaborate structure whose modern name is not based on any clear evidence as to its uses. Repeated modern surveys have yielded conflicting results. Claims have also been made for sighting lines in other Mesa Verde buildings and also at Chaco Canyon and other Anasazi (Pueblo) ruins in New Mexico and Colorado. The claims require quantitative documentation and a consideration of various sources of error. While some may be correct, many should be treated with reserve.

In contrast, there is no doubt about the astronomical awareness of the Maya in ancient Mexico. Very few of their writings (codices) escaped the systematic destruction by the Spaniards. The translation of the elaborate Mayan script started with the Mexican equivalent of the Rosetta Stone. Bishop De Landa, after encouraging the burning of many books because of the superstitions they recorded, then himself helped to compile a dictionary of the glyphs and pictographs which also appear carved on stone slabs (stelae) that survive. From these codices and stelae, we know that the Mayas were keen observers with an elaborate sacred calendar based on cycles of 260 days, and another calendar based on 365 days. The 260-day period still has no agreed explanation, although two astronomically sound possibilities have been mentioned. One notes that the town of Copan, in Honduras, was at one time the major center of Mayan astronomy. Copan is situated at 15-degree north latitude, where the sun is directly overhead on two days of the year, 260 days apart. Zenith passages were of interest to some peoples living between the Tropics, so this seems a reasonable theory.

The other suggestion is based on Jupiter’s motion. It takes, on the average, 520 days for Jupiter to complete one part of its complicated motion against the background of the fixed stars, but here again, the evidence is minimal and we are left undecided.

Many of the extensive architectural ruins in Mexico have been subject to careful survey, and we know from the sixteenth-century writings of Father Toribio Motolinia that some buildings were indeed astronomically aligned. Father Motolinia refers to the Templo Mayor where the sun was seen to rise between two small temples atop the Templo. The orientation of the ruins have been found to be seven and one half degrees off true north-south, in a clockwise direction. From reconstruction based on archaeological evidence, it has been calculated that the horizon rising point of the sun should have been obscured, but that when the sun rose above the Templo slightly later, it should have been seen, seven and one half degrees south of east.

The Caracol Tower in Yucatan, now also ruined, still has a complex of windows through which alignments have been found to the summer solstice sunrise, the equinox sunsets, the extreme positions of Venus and some stars. The lower platform of the Caracol was built around 800 A.D. and it faces twenty-seven and one-half degrees north of west. This is not a good alignment on the summer solstice sunset, but is closer to the northern setting point of Venus, whose importance to the Mayan astronomy has been well
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The Caracol (snail) Tower in Yucatan. Even in ruins, the tower testifies to the Mayas’ keen observation of movements of the Sun, Moon, Venus, and some stars.

documented by its elaborate tabulations in the Dresden Codex, one of the very few surviving written records of Mayan civilization.

Whereas the alignment of the front of the Caracol platform can be reconciled with Venus, no such understanding emerges from the carefully measured alignments of most of the other Mexican sites. On sites dating from the fifth century B.C. to the fifteenth century A.D., the layout of buildings and streets (in contrast to sightings from within buildings) generally seems to be deliberately off from the cardinal directions, by as much as twenty-seven degrees. Given the Mayas’ known intense interest in astronomy, this apparently random orientation in their urban planning is surprising. Where astronomical alignments have been found, they generally relate to individual buildings only, and not, for example, to the direction of major streets.

Although much more could be written—within the past few years, reports have been published that described claimed astronomical alignments at Angkor Wat in Cambodia, at a site in northwest Kenya, and in the construction of English churches—what is beyond doubt is that people in widely separated parts of the Earth created structures that reflected their own astronomical knowledge and needs.

Many of the ancient records, such as the cuneiform tablets of Babylon and the Dresden Codex of the Mayas, contain information on the regular cycles in the solar system. They seem to have played a role similar to our Nautical Almanac. We can use these to trace the development of astronomical knowledge and theories, but they do not add to our modern knowledge of astronomy. Other ancient records, however, do.

One of the great assets of written ancient records, in contrast to ancient structures, is that records can be quite accurately dated, through their references to kings or dynasties or to events that we can pinpoint from other evidence.

Many of these well-dated records can be combined with modern observations to relate to a central theme in astronomy today: the evolution of our universe and its components. This very theme represents quite a change from the view that prevailed in medieval Christian Europe, when to doubt the unchanging nature of the heavens was to invite persecution. We can improve our understanding of a particular star, for example, if we have reliable information on its brightness at different times. If we can push the time base of our data much further back into the past, even before the use of telescopes, we may be able to eliminate some theories or strengthen others. In pursuing this line of inquiry, we need to be alert to two pitfalls: the notorious unreliability of some records and the careless use of some materials.

NOW LET US TURN TO THE ANCIENT WRITTEN RECORDS TO LOOK AT THE KINDS OF NEW KNOWLEDGE THEY MAY YIELD.
A look at the use of ancient records to study three astronomical phenomena—eclipses, sunspots, and supernovae—will serve to illustrate the ways we can proceed.

The eclipse of 15 April 136 B.C. was reported by Babylonian astronomers, who also noted that Mercury, Venus, Mars, Jupiter, and many stars could be seen during totality. Now, with our present accurate knowledge of the positions and speeds of the Earth and Moon in their orbits, and with the use of computers, we can calculate the positions of all of these bodies at various times both in the future and in the distant past. We can, in a sense, run the celestial movie backwards and tabulate those occasions when the Sun, Moon and Earth lined up for an eclipse. The accuracy of these calculations is quite sufficient for our present purposes.

One of the 66 plates illustrating the *Rosa Ursina*, a book on sunspots published in 1630. The illustration shows the daily location of spots (dark areas) and faculae (bright spots or streaks) from April 4 to April 18, 1626.

Although we can now be fairly certain that the Sun’s activity changes, we still have no good explanation for the underlying causes.

Sunspot data can also be put to another use. The spots that we tally to keep track of the eleven-year cycle appear, grow, and shrink until they finally disappear, but all the while they are being carried across the visible face of the Sun as it rotates. The Sun takes about twenty-five days to rotate once, and we can see spots disappear around one limb and reappear later at the other limb. Spots can therefore be used to measure the rotational speed of the Sun. Some of the older records include accurate sketches showing groups of spots and their changing positions day by day. It has emerged from analysis of these records that the Sun’s rotational rate was slower in 1612 than it is now and that it accelerated in the years leading to the Maunder minimum.

Once again this phenomenon is well documented, but we have no explanation for it.
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PROBABLY THE BEST known use of ancient records involves novae—violently explosive stars whose unpredictable increases in brightness were so sudden that to the ancients it seems as though new stars virtually appeared from nowhere. (These new stars, or “stellae novae,” are now known simply as novae or, in the few cases of special brightness, supernovae.) The historical record is fascinating both for its inclusions and omissions. There are many reports in the Chinese, Korean, and Japanese annals, stretching as far back as several centuries before Christ.

No supernova has been seen in our galaxy since before 1610, when Galileo invented the astronomical telescope, so we have no very close look at the features and changes as a supernova evolves. But we do have very good visual descriptions of the two most recent galactic supernovae from Tycho Brahe (in 1572) and Johannes Kepler (in 1604), two great observers. From these and the modern observations of supernovae beyond our galaxy we have developed a clear enough idea of the early appearance of a supernova to be able to identify and make use of the supernova sightings in ancient records.

We know something of the number of stars in the galaxy and the rate at which new stars are still forming; knowledge of the rate of supernovae explosions (which are thought to occur late in the life of certain stars) could complement this and help in the formulation of an overall theory of the galaxy. Making an estimate for the entire galaxy on the basis of the observed supernovae is difficult because there are large regions of the galaxy that we cannot see. We can probe these with radio waves but not visible light, and we know that the historical record of sightings must be incomplete. After other sources of bias are allowed for, we arrive at the rough overall figure of about one supernova per fifty years.

BEYOND THE statistical evidence, we are interested in the individual supernovae. Our understanding of this stage in the evolution of a star is still very tentative in many aspects. The amount of energy that is released in the explosion is indicated by the brightness; the way in which the brightness changes in the days after the outburst tells us something about the expansion of the debris and the changes taking place. A graph that displays the observed brightness, as it changes, is termed a light curve, and Tycho Brahe’s records, which compare the new star’s brightness to that of well-known stars and planets, are accurate enough to be used by modern astronomers to reconstruct the light-curve for that supernova.

The star of 1572 was visible for about a year and a half, and it is interesting to quote from Brahe’s original description:

... behold, directly overhead, a certain strange star was suddenly seen, flashing its light with a radiant gleam and it struck my eyes. When I had satisfied myself that no star of that kind had ever shown forth before, I was led into such perplexity by the unbelievability of the thing that I began to doubt the faith of my own eyes, and so, turning to the servants who were accompanying me, I asked them whether they too could see a certain extremely bright star when I pointed out the place directly overhead. They immediately replied with one voice that they saw it completely and that it was extremely bright ... immediately I got ready my instrument. I began to measure its situation and distance from the neighboring stars of Cassiopeia, and to note extremely diligently those things which were visible to the eye concerning its apparent size, form, color and other aspects.

This supernova was also observed in the Far East, where lists of “guest stars” (including comets, meteors, and novae) were carefully maintained for two millennia. It was recorded in the Ming-shih-lu, which notes that “The Emperor ... was alarmed and afraid, and at night he prayed in the open air on the Vermillion Steps.”

No star can be seen today at the location of Brahe’s nova, but the careful analysis of his observations by Walter Baade in the 1940s stimulated a search by radio astronomers that led to the discovery of the supernova remnants in the 1950s. These remnants emit radio waves and show up as a wispy shell of gas, still expanding at a very high speed and forming a nearly circular ring centered on the place so well described by Brahe. Very recently, these remnants have also been found to be a source of X-rays.

While the Eastern records are rich in their reports of comings and goings in the sky (seventy-five novae and supernovae were sighted before the invention of the telescope) there is an almost total silence in the West. Apart from the sightings of Brahe and Kepler, only the giant supernova of 1006 A.D. was re-
corded in the West, and that in a very brief note in the monastery of St. Gallen in Switzerland. That supernova was probably the most spectacular ever seen, but its location in the sky was too far south to be seen from much of Europe. For the rest, there is silence, and our knowledge of those events rests entirely upon Eastern sources. This silence is generally attributed to the rigid position of the Church. In the case of comets, which were consigned to the atmosphere, there was no problem, and the terrifying appearance of Halley's comet in 1066 has been memorialized in the Bayeaux tapestry.

The Great Event of 1054 A.D., now identified with the Crab nebula, provides another interesting example of this theologically selective silence. There is not one report from Western Europe, only one from the Middle East. But among many in the Chinese annals, we find:

First year of the Chih-ho reign period, seventh month, twenty-second day . . . Yang Wei-te said, "I humbly observe that a guest star has appeared; above the star in question there is a faint glow, yellow in color. If one carefully examines the prognostications concerning the Emperor, the interpretation is as follows: The fact that the guest star does not trespass against Pi and its brightness is full means that there is a person of great worth. I beg that this be handed over to the Bureau of Historiography.

By now, the Crab nebula has probably been studied more than any other object in the sky outside the solar system and we are fortunate that its early phases have been so well documented.

Unlike Brahe's nova, the Crab does today have a visible remnant that was listed in catalogs before its full significance was appreciated. In the eighteenth century, Charles Messier, one of the foremost authorities on comets, observed that although comets do not have the point-like appearance of stars, they can be confused with other hazy objects known as nebulosities. Messier, finding that some nebulosities were continually getting in the way of his comet searches, compiled a list of the most prominent, so that other astronomers could save time by not repeatedly having to check on those nebulosities that were well-known. The Messier catalog has 103 items, with M.1 being the Crab and M.31 the Andromeda.

The value of old records lies in identifying supernovae whose remnants we can now study, and in establishing their chronologies very firmly, so that their evolution can be followed. In recent years, radio astronomers have found other supernova remnants of which we have no records. In many cases, the characteristics of the remnants suggest that the explosions took place long before any historical records were compiled. Without knowing the supernovae ages, some of our analysis is limited, although their present properties are of considerable interest.

We have no records. In many years, the Church played a dominant role, and we find the first tentative stirrings only after Luther had broken away. Even then, Copernicus was most circum­spect in his presentation of his ideas, and Galileo, a century later, suffered for his boldness. Brahe and Kepler, in a Europe that was becoming more Protestant, were able to report their observations, but the overall picture was still patchy. The Crab brings this home to us: it was bright enough to be seen by day, for twenty-three days, yet there is no record of it in the West, simply a conspiracy of silence.

A combination of language skills and astronomical knowledge is opening up an important field. Some of the pioneering studies were Baade's. In the 1950s, Josef Shklovsky, of the Sternberg Astronomical Institute in Moscow, used his contacts with the Chinese to encourage an expansion of these studies into a systematic search in their ancient records for other novae among the "guest stars," and several extensive tabulations and detailed analyses have emerged.

There is another aspect of archaeoastronomy that deserves at least a brief mention. It has become accepted that civilization gradually spread from its earliest centers in the Middle East. The discovery of megalithic sites far from ancient Babylonia that seem to be contemporaneous or earlier has put a strain on this diffusionist view. If, as has been suggested, sites such as those in the British Isles even predate those classic places in the Middle East, an alternative view would have to be considered: that civilization developed in several isolated centers, rather than spreading from a single area. The evidence is tantalizing, but by no means conclusive.

Archaeoastronomy is more than simply the history of astronomy: it is, in a sense, the recycling of many records to excellent effect.
Souvenirs of a

By William Jay Smith
Professor of English, Hollins College
Alumnus William Jay Smith, AB 39, MA 41, poet and translator, is the author of three books to be published in October. Army Brat, A Memoir (Persea Books), from which this story was excerpted, explores his early life at Jefferson Barracks army post in the years between the World Wars. Persea Books will also issue The Traveler’s Tree, New and Selected Poems, and Delacorte Press will bring out Laughing Time, Nonsense Poems, a selection of children’s poems.

A telephone call that came on the quiet Sunday afternoon of December 7, 1941, cut not only through my nap but like a lightning stroke cut right through my life. I was stretched out on a sofa in the living room of the brick bungalow we then occupied on Telegraph Road, just west of Jefferson Barracks. A classmate at Washington University, where I had received a master’s degree in French the previous June, telephoned to tell me that the Japanese had attacked the American fleet at Pearl Harbor.

When I turned on the radio to hear the reports of the Japanese assault on Battleship Row, I had the sensation that the bombs striking there were coming down on us too and were about to blow the bricks of our little bungalow sky high. And, in a sense, they were. The reason was simple: although my mother and I were safe, only a few miles from the military post I had known for most of my life, my father, a corporal in the regular Army, was at Schofield Barracks where the bombs were falling. Or worse, he was perhaps on one of the ships already sunk at Pearl Harbor or in the vicinity of Oahu.

We had had a letter not long before addressed to us from Schofield Barracks, saying that my father’s two-year term of duty on Oahu was over and that he would be returning to the States on the fourth of December. We did not have the name of the transport and we did not know whether or not it had sailed, but we assumed that it had.

While my mother sat weeping quietly at the kitchen table, I tried to find out what ships had sailed from Honolulu by calling every possible source of information I could think of, but without success. Another week passed before we found out that my father’s ship had not sailed and that he was safe at Schofield Barracks.

As my father later told it, since the sailing of his transport had been delayed, like almost everybody else on Oahu he had been out on the town the night before, but was up early to enjoy the Sunday breakfast specials (bonus rations of milk to go with eggs and pancakes). The first explosions he took to be blasting or perhaps just another alert; they had had so many in
recent weeks. When he went out of his barracks and saw what was happening, he did not linger. In the event of an emergency it was his duty to get his men to the storeroom to pick up their weapons, but since no one was around to unlock the storeroom and since it held no weapons anyway, he decided there was nothing for him to do. And so, while the younger men in his company rushed about like mad roused roosters, he went back calmly into the mess hall and finished his scrambled eggs.

At our kitchen table some four or five thousand miles away, my mother and I were less cool. All the events of my life had prepared me for this afternoon, but I was all the same in a state of shock. I brought my hand up to my eyes as if to shade them from this present horror and to try to review some of the memories of my college years, now being brought so abruptly to an end.

D uring my freshman year at Washington University, my mother took a job at the Jefferson Barracks Laundry to help pay our rent. I shared a ride to the University every day with my friend Jack Glascock, a major’s son who had enrolled to take courses and I enrolled in ROTC and I soon got a taste in a small way of what West Point would have been like. It was clear to me that I would never have lasted there. At the end of my first term I was invited to a meeting of the military fraternity, which accepted Jack as a member but turned me down. The fraternity members saw clearly that he was headed for a military career and that I was not.

Toward the end of my freshman year, we heard that the owner of our house at the North Gate was returning to St. Louis and wanted his house back; we had to find another place. My father was then a frequent customer at Regnier’s tavern just beyond the West Gate of the Barracks, and there he learned that a small brick bungalow, owned by Joe Regnier’s son, Jo-Jo, was for rent just down the road—on the corner of Sigsbee and Telegraph—which is where we moved and where we found ourselves on December 7, 1941. At the time of our move, we had acquired a Model-A Ford—the “Puddle-jumper” or the “Cucaracha,”’ as it was immediately christened—and it was in the driveway when the Japanese struck Pearl Harbor and Schofield Barracks. Ours was a brick bungalow like so many built in the thirties in the area—sturdy, solid, incredibly ugly—four rooms with a cellar, an attic, and a fenced-in yard behind, and a front porch high off the ground, where no one ever sat.

The shift between high school and college is for many students abrupt. For me it was the miraculous crossing of a deep chasm: at times I wanted to destroy the bridge by which I had crossed and to blot out any reminders of my life with the Army.

My ROTC uniform was one such reminder, and I wore it as little as possible; in my sophomore year I hung it up and only occasionally attended class. (I had taken ROTC in the first place only to avoid taking gym.) Most of my friends at the Barracks had moved away or were soon to leave. Dean Short had gone with his parents to Fort Benning, Georgia, and afterward to West Point. Tommy Reagan had also gone to the Point, and I never saw either of them again. But I still lived on the edge of the Barracks and there were constant reminders that my connection with the military was not over. During my freshman year I still lived in the earlier house, where I slept and studied, perched almost literally above the North Gate of the Barracks. I drove through the post almost every day past all the scenes of my childhood to pick up my mother at the post laundry. On Telegraph Road, after we moved, my father would still come home daily with the large sacks of commissaries, and when I returned at night I would sometimes find him at the kitchen table drinking with his fellow bandsmen. But now, more and more, his off-duty hours were spent in taverns—at Regnier’s at the West Gate or at the Blue Goose, farther out in the country.

One day during my freshman year I read a notice on a bulletin board at the University about a meeting of the College Poetry Society, to which any interested students were invited. It was to be held at the house of Professor Alexander “Sandy” Buchan of the English Department. When I looked carefully at the address, my eyes almost fell out: Professor Buchan lived on Telegraph Road, about a mile from the North Gate of the Barracks. There were no streetlights anywhere in those days along Telegraph Road, and the numbers on the houses were rarely in evidence. I allowed myself ample time, and after a struggle down the dark road, up treacherous driveways, past fierce watchdogs, I found the house and within it a group of friendly young people discussing all that I cared most about. The group consisted mainly of bright and pretty girls who all seemed to know one another and who spoke quickly and knowledgeable of many modern writers I had never heard of. They deferred to a young man, older than most of them, who spoke with great authority. He was Clark Mills.
McBurney, who, as Clark Mills, had already published several poems in national publications. Tall, with sandy hair and an open and friendly manner, he punctuated his sentences with a chuckle that seemed to come from deep within. Several of his poems had been published in College Verse, the publication of the College Poetry Society, edited by Ann Winslow from the University of Wyoming.

Miss Winslow, with what appeared to be inexhaustible energy (she must have written hundreds of letters every day to campuses around the country) and a passion for poetry, had organized the College Poetry Society at twenty or thirty major colleges and universities. She raised money for prizes and enlisted the help of established poets to serve as judges for the magazine’s annual contests. She had just edited an anthology of selections from College Verse, entitled Trial Balances. Work of a number of undergraduate poets was presented, accompanied in each case by a critical assessment of the work by a well-known poet. Here Clark’s poems were presented with an essay by R. P. Blackmur; Marianne Moore commented on the poems of Elizabeth Bishop. There were other contributions by Theodore Roethke, Josephine Miles, Ben Belitt, and many others who were just beginning to publish. I bought the book immediately, and it became my introduction to modern poetry. And then — urged on by Clark — I started to read T. S. Eliot and the young English poets: Auden, Spender, Day Lewis, and MacNeice.

Clark became my mentor, and I his adoring pupil. He was then a senior at Washington University, and his field was French. He lived in Clayton, not far from the University, and soon invited me to his house, where I spent many hours. On weekends we went together to parties in the suburbs of Webster Groves or Kirkwood at the houses of girls who were students or former students at the University. In these houses, usually the property of well-to-do businessmen, we spent hours reading poetry and listening to music, and I continued to receive the kind of cultural indoctrination that Mrs. Bradbury, my expression teacher, had begun for me some years before.

My meeting with Clark Mills occurred at about the same time as another event that had a lasting effect on my life. Because of my excellent grounding in French, I was placed in an upper section of French composition. I was delighted to learn that there were classes taught by native Frenchmen, and I joined the class of Professor Albert Salvan, who afterward taught at West Point and later became chairman of the French Department at Brown University. In the class, conducted in French, we were reading Le Grand Meaulnes (The Wanderer) by Alain-Fournier, which I thoroughly enjoyed.

As an assignment early in the semester we were given a list of topics, suggested by the novel, on which we were asked to write. The topic I chose was “Silence.” I thought about it for a while without putting a word down on paper, and then just as I was about to start writing, some friends came by and lured me off to the picture show at Jefferson Barracks. We walked to and from the post theater over the road from the North Gate where the streetcar track once ran. I can’t remember which film we saw, but with all its bright images behind us, we plunged on our return into the woods and were soon surrounded by the mysterious night sounds to which over the years I had become accustomed. The darkness around us seemed unending and the stars above us appeared as close as they must have to those early explorers who made their way down the Mississippi. I thought of the line from Pascal: “The eternal silence of those infinite spaces frightens me.”

It was late when we got home but still under the spell of the vast silence of the night through which I had walked, I quickly put down my thoughts on “Silence.” When the papers were returned a few days later, I noticed that mine was not among those that Professor Salvan distributed. The next moment I realized that he was holding it in his hand and reading it to the class. At the end of his reading he pronounced my composition of great merit and worthy of a talented French writer, all the more extraordinary to have come from a young American student. He took my essay to Professor Harcourt Brown, who had just come to Washington University as head of the French Department, and Professor Brown soon called me to his office. He questioned me about my background and my plans for the future, and asked in which courses I was enrolled. I explained that in addition to English, French, and science, I had enrolled in courses in education, since these were required for a teacher’s certificate. High school teaching appeared to be the best I could hope for on graduation. He urged me—commanded me, I felt—to drop the education courses at once and to sign up for courses in French literature, which he gave me special permission to enter. The following week I enrolled in a senior course with Professor Salvan and, with new friends Clark Mills and others, was soon reading Marcel Proust in the original.

Clark Mills came home with me sometimes, but he and a brilliant Mexican classmate, Edgardo Beascochea, who also became a close friend, were the only college associates who knew anything of my background. The others knew that I came from Jefferson Barracks, but to most of them Jefferson Barracks meant only the photographs of marching men which the St. Louis papers frequently printed.

I was the youngest member of the small circle that gathered around Clark Mills, but I was accepted intellectually and artistically, and that was all that mattered. I developed a new feeling of confidence. I began to put aside my image of myself as a pimply-faced country bumpkin and to take pride in my accomplishments. I saw that it was not necessary to be part of the fraternity/homecoming/prom-oriented section of the student body to feel that I belonged. Indeed I began to think that we in our
group were leaders, whatever anyone else thought, either at the University or in the city. St. Louis had produced a number of important writers, even if they had all been recognized only when they had left. I was confident that we too would one day be recognized.

M y literary apprenticeship was intensified during my sophomore year by the introduction into our group of another young writer, Thomas Lanier Williams—later known as Tennessee Williams. Tom, who is several years older than I, enrolled at Washington University as a senior. He had already spent several years at the University of Missouri and a disastrous period working in the shoe firm where his father was employed in St. Louis. Clark Mills met him first as a member of Professor Heller's course in modern European literature, where he wrote brilliant papers. The three of us were soon inseparable: we met regularly with the College Poetry Society and sent our poems off to College Verse, but we formed an even more closely knit group within the group since we were its most serious members. We met usually at Tom's house on Arndel Place, a few blocks from the University, first in the living room where Mrs. Williams received us, and afterward on the sunporch, where we sat for hours criticizing one another's poems.

I am frequently amused by those who take Tom's autobiographical projection of his family in The Glass Menagerie literally, and picture him as having inhabited a run-down, seedy old house, if not a downright hovel. The house on Arndel Place, with its oriental rugs, silver, and comfortable, if not luxurious, furniture, was located in an affluent neighborhood and was higher on the social ladder than Clark Mills' modest house in Clayton. Our entire bungalow on Telegraph Road would have fitted comfortably into one or two of its rooms. Mrs. Williams presided over it as if it were an antebellum mansion. A busy little woman, she never stopped talking, although there was little inflection or warmth in the steady flow of her speech. One topic, no matter how trivial, received the same emphasis as the next, which might be utterly tragic. I had the impression listening to her that the words she pronounced were like the red balls in a game of Chinese checkers, all suddenly released and clicking quickly and aimlessly about the board.

In contrast Tom was the shyest, quietest person I had ever met. His stony-faced silence often put people off: he appeared disdainful of what was going on around him, never joining in the quick give-and-take of a conversation but rather listening carefully and taking it all in. He would sit quietly in a gathering for long periods of time until suddenly like a volcano erupting he would burst out with a high cackle and then with resounding and uncontrollable laughter. Those who knew him well found this trait delightful, but to others it seemed rude and disconcerting. He was certainly quick and ready with words when we discussed our poetry. With one another's efforts we were nothing if not severe. Tom's great god was D. H. Lawrence, and some of his lyrical Laurentian outpourings got cut back in our sessions. Clark's poems had a finish that Tom and I both attempted to emulate, but we raised questions about some of his images and allusions when they did not come through to us. I arrived one evening with a poem about centaurs and what I thought was a powerful treatment of the conflict between head and heart. I still have somewhere my manuscript with Tom's indignant scrawl across the bottom: "Back to the laboratory." And back it went.

Tom's sister, Rose, was rarely mentioned when we came to the house, but we knew that she was up in her room, perhaps listening at the top of the stairs. Tom had told us that Rose had undergone a lobotomy, one of the first performed by doctors in the St. Louis area, and perhaps one of the first performed anywhere. It apparently had been of little help. Clark saw much more of Rose during the following summer, while I was away in Michigan on a summer job, so much more indeed that he appears to be the prototype of the Gentleman Caller in The Glass Menagerie. That summer Clark and Tom set up in Clark's basement what they called a literary factory. They were visited, Tom said later in an introduction to his poems, by Clark's mother—bringing them chocolate and cookies—more often than by the muse.

At the end of that summer Clark went to Paris to study at the Sorbonne on a fellowship provided by the University, and his parting left a gap in our little group. But Tom and I went on with our literary endeavors. Continuing to meet regularly on Arndel Place, we were soon joined by Louise Krause, who had attended Mills College in California and had come back home to St. Louis to take a master's degree in English at the University. Louise, when not busy with her thesis on John Donne, composed metaphysical poems that impressed Tom and me. The three of us formed what we called "The St. Louis Poets Workshop." We were joined by Elizabeth Fenwick Phillips, who later married Clark Mills and as Elizabeth Fenwick wrote several fine mystery novels. We had some stationery printed with the words "St. Louis Poets Workshop" as the letterhead and Tom's address below. We sent poems to all the leading magazines with a covering letter signed by a fictitious secretary of the workshop. In a few carefully chosen words the letter described the great poetic flowering then taking place in St. Louis. The poems enclosed, the secretary stated, were representative samples of this remarkable Midwestern Renaissance. The editors addressed were less impressed by our flowering than we were: the poems all came back. I had forgotten all about the St. Louis Poets Workshop until one day five years later on Palmry Island in the Pacific I received a letter from my father written on the Workshop paper that he had found
somewhere on my desk. Perhaps it was his way of reminding me of the foolish things that I had put behind me since becoming a responsible Naval officer.

While Tom at the time wrote chiefly poetry, he had already written at least one play, and as a member of Professor William G. B. Carson's playwriting course, he had embarked on others. Clark and I listened one evening to a reading of his play "Ishtar," a Babylonian bedroom saga. Tom intended it as a deadly serious drama, but the language and the situations that it presented were so absurd that we doubled up with laughter. It also went back to the laboratory and was never mentioned again.

Tom’s next involvement with the theater was as an actor in a French-language production of Molière’s Les Fourberies de Scapin, put on by the University’s French Department. Mrs. Harcourt Brown, the wife of the French Department chairman, had a passion for theater and a determination to present French drama, however difficult the casting and however varied the French accents of the actors she rounded up. Edgardo Beascochea, Thelma Richardson, and I had acted in one of Mrs. Brown’s first efforts, La Bataille des Dames, but that was a modest effort beside Scapin. We were again enlisted, and Tom was persuaded to take the part of the old father. He read his French lines with a kind of hound-dog ferocity and deliberation as if he were chewing on a large section of the Mississippi delta. When he moved woodenly across the stage with absolute seriousness pounding the floor with his cane, small and square in his satin suit, an enormous blond wig flopping about on his shoulders, he gave a performance that a more sophisticated audience would have taken as deliberate high camp. As it was, our local audience had not the remotest idea of when to laugh but that was a modest effort beside Scapin. It felt good to have their approval and to have them share this day with me. Conversation rippled on while my mother laid out a delicious luncheon of fried chicken, a rich assortment of vegetables, and corn bread.

When we went in to the table, I draped the gown over an armchair, its wide black sleeves hanging down like the wings of a fallen bird.

I had a fleeting sense as we ate of the dark gown as a kind of shadow that hovered over our joy. For however joyous the occasion, it was obvious to all that one important person was absent from the table. It had been my father’s luck to draw guard duty at the West Gate of the Barracks that day, and a picture of him waving the cars on flashed through my mind. Aunt Lucinda’s laughter became more and more insistent, taking on a hysterical edge as it moved in to cover my father’s absence. I could see him waving the cars past more quickly, his arms flailing in the air like wounded wings. No one needed to tell me that he was drunk.

That evening after Aunt Lucinda and Erminie had left, word reached us that he had had his belt pulled and was in the guardhouse. This time his negligence had been too blatant to be passed over. My day of triumph may have made him sense all the more acutely his own past failures. Or was it sheer cussedness or some inner torment that even he could not understand that led him to lose all control on this particular day? He never spoke to me of it afterward, and I never knew. He was busted, and to spare his family further embarrassment, he was allowed to transfer to another base. It was thus that he had joined General Short at Schofield Barracks in Hawaii, where he was eating scrambled eggs on the morning of December 7, 1941, when the Japanese planes swooped down.
As New York City is not the U.S.A., so Paris is not France. A group of Washington University students who spent last summer in France studying the language and the culture found that one of the keys to the success of their program is that it is "French Provincial."

ALWAYS THERE IS but one brief heroic age, one inaugural class, one group of founders. So it was last summer for the first group of Washington University students and one professor studying in the Loire Valley of France.

"What happened at La Herceire was pure magic," says Professor James F. Jones, Jr., director of the Washington University Summer Language Institute in France. "It surpassed anything the University administration had imagined, anything I had imagined, anything the students had imagined, anything the French government officials had imagined."

What happened at the French student center, housed in the historic château and park once owned by the Marquis de Sade, was that these twenty American students were taken to heart by the staff of the center, the neighbors, the villagers of La Croix-en-Touraine, the townspeople of nearby Bléré. For their part, the students, who were there to immerse themselves in French language and culture, were enchanted by the gracious hospitality of the French country people and warmly returned their affection.

Monsieur and Madame Bretheau (he the chef of the center, she the director) and their 17-year-old son Eric took the entire group into their family fold. So concerned was Mme. Bretheau that these students were away from their families on Pentecost (an important family holiday in France) that she was inconsolable about their loss; nothing
would do but to expand her own family’s celebration to include the lot. In turn, when Professor Jones took the group to Mont-Saint-Michel and Saint-Malo on the Normandy coast for a final day-long excursion beginning at 5 a.m., the students prevailed upon him to include the Bretheau family in the outing.

The six-week program was characterized by this kind of exchange. Tim Dibble, a junior in architecture from Eureka, Missouri, had interviewed Monsieur Dumoulin, the mayor of Biérré, for an oral presentation on some facet of French life each student was required to make. Not only did the mayor arrive at the château to hear Tim’s presentation (in French, of course), but he returned for the final banquet. For that ultimate occasion, made the more special by M. Bretheau’s unbridled culinary artistry, one of the neighboring vintners, also the subject of a student project, sent over several cases of fine wine. The gaiety of the event almost successfully banished the bitter fact of its finality.

THREE YEARS AGO, the undergraduate program in French offered by the Department of Romance Languages was entirely reorganized. That program, like similar programs elsewhere, had been ailing since the language requirement for arts and sciences students was abolished in the 1960s. Professor Richard Admussen, then director of undergraduate studies in French, believed, however, that a new method of language study pioneered by John Rassias at Dartmouth College could be beneficially applied to the Washington University program.

Admussen’s faith and enthusiasm became contagious. The faculty and the administration sat to plan and eventually approve a comprehensive new oral approach to teaching French. The major thrust of the Dartmouth method is to encourage students to use the language as quickly as they can. From the first day of French 101, students speak French. The key to this approach is a small tutorial section in which the instructor directs rapid-fire questions in French to specific class members and expects quick, simple responses. A second important ingredient is the new language laboratory, which the University’s more than $60,000 renovation turned into a sophisticated electronic listening/speaking post. The third ingredient had to be a summer program in France to carry on after French 101 and 102, allowing students to use and improve the language proficiency gained in the first year of study. In 1977, Professor Jones was commissioned to develop that program.

Meanwhile, however, what was happening to French classes began to justify Admussen’s confidence. Enrollments increased 100 percent in two years. Professor Jones’s eyes twinkle and his soft Southern accent lingers lovingly over the story: “As Dean Morrow told me last fall, when someone from the sciences or mathematics comes in to say that there is an urgent need to open another section of some beginning course, he understands what he is hearing. But when we go over to Brookings to say that we need a sixth section of third-year French grammar, he has no historical framework to help digest that request.”

In the fall term of the 1979-80 academic year at Washington University, where a foreign language is not required for the A.B. degree, there were 132 students (five sections) in first-year French grammar (French 101 and 102); eighty-five students in third-year grammar (French 307 and 308); and forty-six students in Professor Jones’s Introduction to French Literature class. Because the students who have taken 101 and 102 and the summer program have already completed two years of French study, second-year French enrollment was not correspondingly large.

In addition, some of the students who spent the summer in France and a group of their less fortunate fellow students of advanced French last year organized, quite on their own, French-speaking suites—housing twenty residents—in the dormitories. The arrangement for a graduate student from France to serve as a live-in, informal instructor was made by the department in response to the students’ initiative.

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which I also enjoy, and French. I chose French because I felt that if I passed up this opportunity, it would never come again." Now Tim is a drill instructor in French 101—a course he enrolled in as a student sixteen months ago. The self-descriptive sentence, "I'm a double major in ___ and French," is heard often at Washington University. And the combinations and commitments are astonishing.

Jean Swanson, a biology major whose freshman and sophomore advisor was Professor Jones, had a dangling elective in her junior year and decided to dabble in his area. Within two months, she had borrowed money to join the Summer Institute to make up for the lost time. She has managed to squeeze two French classes a semester into a heavy biology schedule this senior year. When she goes to graduate school for biology study next year, that school will be selected so that she can also pursue French. "I really feel that I just came alive last year," she confides. Jean, a vegetarian, is now interested in combining her knowledge of biology and French to study international agriculture. "I'd like to work on providing the nutritional need for protein through plants," she says.

Others were similarly impressed with the work habits of the Americans. "The château personnel and visitors were amazed to find that the students used their evenings to study," said Jones. "Eventually the staff began setting coffee in the drawing room on evenings before tests. Our French hosts often accused me of working my students too hard. I would explain that I wasn't requiring them to study those long hours, that they were doing it voluntarily. Many times, my accusers would walk away unpersuaded, shaking their heads."

The winter of 1977-78, when Professor Jones began to search for accommodations for the proposed study program, he wrote to fifty-two French inns, asking to rent accommodations for six weeks. "I received four responses—all saying, quite eloquently, 'under no circumstances,' and I was disheartened." One day, however, the mail brought a response from a woman in Chinon who had somehow learned of Jones's search. She sent a flyer on a European student center nearby, a note saying that she had telephoned the director there who had most enthusiastically received the idea, and an address in Paris to which Jones should write to pursue the matter. He did so immediately.

"The Parisian address was that of the Centre d'Échanges Internationaux (CEI), an affiliate of the Ministry of Education. They answered my letter cordially, asking for details of my needs and purposes. They responded to my inquiries with a tentative suggestion that they might be able to accommodate us.

"On the basis of that, I set out that summer for France to investigate possibilities. I really had only one, but it had become clear that we desperately needed to get the summer program going."

He went with an understanding from the University administration that his trip was strictly preliminary.

First stop was the CEI in Paris; then he went to see the château, one of three government-maintained student centers in France. (The other two are on the Riviera and the Normandy coast.) The Loire Valley center is set in a thirty-acre park. It has a staff of five—a director, a chef, two housekeepers, and a gardener. Although the center is technically open year-round, it operates at capacity only in July and August, when groups of students from all over Europe come for two-week periods. At other times, it is used for mid-day or overnight stops by travelling student groups.

"I was totally delighted with the prospect of using the center in early summer for our purposes. It had absolutely everything I had been looking for and more, so I returned to Paris for what they called 'budgetary' sessions.

"As I sat in on these, I was astonished. It seemed that the French government was indirectly willing to underwrite the venture by giving us a low per diem cost for rental of the second-floor bedrooms.

"I went to France that summer only to look, you realize, and I had no power-of-attorney for the University, but I ended up signing everything they put in front of me. I knew that to let such an opportunity slip away would be lunacy."

When upon his return Jones reported his arrangements to the
department and Ralph Morrow, then acting dean of the faculty, and confessed his audacity, his actions were applauded. He was instructed to work with Michael Nelson, director of the Summer School, to award credit for the program through that school.

Nelson was at first skeptical, but Jones's enthusiasm was undampened. Using his own blurred snapshots of the chateau and some better photos supplied by the government, Jones produced a homemade poster announcing the program. Within a month, he had twenty students signed up to rendezvous in Paris in mid-May and proceed to the Loire Valley for residential study through June.

Participants take French 201 (five units of intermediate language) and French 350 (two units entitled Topics in French Literature and Culture). They live in Europe for six weeks with almost all expenses covered—lodging, meals, tuition, excursions and group trips—and earn seven units of college credit for a cost comparable to that of taking those seven credits at a U.S. university.

During the spring of 1979, the group met often to discuss the upcoming event. "But none of us could really get a feel for what was going to happen," Jones says. During one of these sessions, students asked if they might rent bicycles for the summer. The estate is a ten-minute walk from the Cher River, but only a short bike ride from the lovely and historic city of Amboise, and a longer ride from several other famous sites in the vicinity.

In one of his many letters arranging matters with the CEI, Professor Jones asked the government to facilitate bicycle rental. When he arrived at La Hercerie, five days before his charges, he asked about the bicycles and was directed to one of the small buildings on the grounds. "I opened the door to a garage to find it filled with bikes. The government had answered our requests by purchasing them and permanently attaching them to the Center."
to us. Everyone knew who we were and they were most gracious, even though I am sure that we at times destroyed their language," says Ann Sundberg, a senior from New Mexico.

At La Herce, students would report each morning to Monsieur le professeur for class in the séchoir, a small building with two walls of windows overlooking the park. (The classroom, which Jones lived above, had originally been built in the 1730s as an indoor drying room for laundry.) There, Jones would conduct three hours of class—an hour of grammar, an hour of phonics drill, an hour of literature. M. Bretheau would serve lunch after the morning classes.

"The food," sighed Tim, "was superb. We had roast duck for lunch on the day of our arrival. That set the tone for the rest."

After lunch, students scattered across the countryside to pursue their own projects for French 350. Each was to develop a topic having to do with French life and culture, interview an appropriate French person or persons, and prepare a report for oral presentation. In addition, Jones assigned as literary texts abridged French editions of novels by Prosper Mérimée, Victor Hugo, and Honoré de Balzac and an unabridged collection of short stories by Guy de Maupassant.

Dinner was served at the château at quarter to seven. Since the château's large bedrooms housed from four to six students each, the various common spaces of the first floor were used for both study and social exchange.

On weekends, many of the group, who had purchased economical student Eurail passes, scattered across the face of Europe. Jones smiles in recollection of the extent of this travel: "Someone in Bléré once quipped that our students had surely become experts on European trains. They would catch the 1:29 from Bléré into Tours on Friday afternoons and disperse from there. They went to Venice, Geneva, Amsterdam, Brussels, Germany, Austria. One group even took a 14-hour train trip to Spain."

For others, however, Paris was the foremost destination. "Although this was my first trip to Europe, I had come to see and experience France, so a group of us stayed pretty close to the château," says Ann. "We found that by venturing off to Chartres, for instance, we could meet very interesting people."

In some ways, France also came to the château during this period. A hot-air balloonist club from Paris, of which one current member was a de Sade, a descendant of the château's famous owner, came to the estate one weekend to launch its balloons in the park.

Jones relates, "I was walking back from dinner one Saturday afternoon, and Jim Cohan ran up to me and said, 'See that red balloon up there? Ann Sundberg just took off in it.'"

On another weekend, a group of French and German veterans of World War II and their families came to the center to plant a tree and dedicate a plaque commemorating the founders of the Centre d'Echanges Internationaux. A coalition of veterans had begun these centers at the end of the war to foster friendship between the students of their respective cultures, believing that this friendship and understanding might be a step toward peaceful solution of differences.

And as word of the American venture in the Loire Valley spread, the Washington University contingent received many visitors who were journalists and teachers. "Most of them were amazed at the pro-
iciency our students had achieved in French in less than a year of intensive language study," says Jones. "They often lamented that many years of English study by French students did not result in the same ability to communicate.

"I am firmly convinced that one of the keys to our success was in being able to locate the Institute in the country. We were, in a sense, isolated. We were surrounded by people who knew no English. And, most important, everywhere we were hospitably received by these genuinely sincere individuals."

SO PLEASED was the French government with the program that it has increased its allocation for cross-cultural exchange, asked Jones to bring thirty students this summer, and volunteered to support one of two assistants he will have for the 1980 session.

"We will have no trouble finding thirty participants," he said in the fall. On October 31, he had twenty-eight Washington University students enrolled. He had also already begun to receive requests from other colleges to fill any available places.

This year will, inevitably, be different. "Unfortunately," he says, "we were unable to head off one of the French government's misguided efforts. Despite our strong urging to the contrary, they are spending vast sums this year at La Hercerie to 'modernize.' As they proudly told me when they showed me the plans, they are making the bedrooms 'more efficient and American.' In other words, they are breaking those beautiful large old bedrooms into smaller double rooms with private baths."

"We didn't need that," wails Jean Swanson.

"Although I'd never before lived with four roommates, there was surprisingly little tension among the whole lot of us. What we could have used, however, was a modern laundry. Doing our laundry by hand was a shock."

Although this summer, and the next, and the next, for as long as the arrangement continues to be amiable for both parties, Washington University students will arrive at La Hercerie on the Tuesday following commencement, none will experience quite the magic of the inaugural class.

AT THE farewell banquet, the students gave the center's staff WU mementos such as T-shirts and jogging shorts, but two of the young men made a more personal gift for M. Bretheau, who represented for them the best of Gallic wit and hospitality. On a three-foot wooden plaque they painted "Chez Bretheau" and gave his "restaurant" five stars. On the reverse side of the plaque were likenesses of the University seal and La Hercerie. "M. Bretheau was quite overwhelmed," said Jones. The plaque now hangs prominently in the dining room of the château.

"That last day, the staff and some of the neighbors and villagers saw the students aboard the little two-car train that goes from Bléré into Tours. Seeing the experience come to an end was hard on all of us, and after they had gone I wondered just what had been achieved," reminisces Jones.

His question is answered appropriately by the students. For them, life at La Hercerie was one of the cherished, privileged times of their undergraduate education. In their struggles to learn a language and to adjust to a different culture, they developed an extraordinary sense of belonging. As one of them phrased it, "Our façades were stripped away by the utter necessity of communicating, really communicating, with each other and with the people around us. In those six weeks, we learned much about ourselves and we each grew in ways that have since changed our lives."
This spring George H. Capps, AB, JD 39, was elected chairman of the Washington University Board of Trustees succeeding Maurice R. Chambers, who recently resigned after heading the Board since May 1977. In the same action the Board named Chambers a life trustee.

In 1975, Chambers, speaking of the role of a trustee, expressed a philosophy, a characteristic style, and a concern which he later brought to his chairmanship. "I don't profess to know anything about University administration or teaching," he said. "I consider my responsibility as a trustee to be comfortable with the people who are running the University. . . . We [trustees] are a varied group, and I feel that we've got men who know a lot about the things that I don't. Usually I listen to them—and they don't always agree—and if after listening, I think they are not on the right track, I'm not bashful about saying so."

"As far as I can see, there's only one serious problem with the University: being sure that we have money to continue to be a good university in the long run."

As inflation climbed into the teens during his three years as chairman, this long-range vision served Washington University well. Speaking of the change in chairmen, Chancellor Danforth said, "Mr. Chambers has been a particularly outstanding leader. We are most grateful to him for his inspiration, his wise and prudent counsel, and his excellent judgment."

"As his successor, Mr. Capps will fulfill his new responsibilities capably and confidently. A man of mature judgment, he has demonstrated almost unbelievable devotion and dedication to the University. No one has worked harder for the institution. There is no person with whom I would rather work to further the academic goals of Washington University."

Capps is the first alumnus to serve as University board chairman since the resignation of Ethan A. H. Shepley from that post in October 1963. Although there is no doubt that the board has been in able and devoted hands in the interim—under James S. McDonnell, Charles Allen Thomas, and Chambers—there is a sense of continuity which an alumnus brings to this important position. We are sure that George Capps feels also that the torch has been passed to him through a long line of worthy predecessors.

In early April, the mail brought a letter from Martin Bronfenbrenner, AB 34, Kenan professor of economics at Duke University, objecting to an inference in an article in the Winter issue that the University came to excellence only twenty years ago, when it began to recruit a national student body and seek more national recognition.

Professor Bronfenbrenner, who received an alumni award for his excellence in 1970, is vehement in defense of his alma mater: "As a local-student streetcar alumnus of the hungry thirties, let me for the nth time inform my snooty successors about WU way back when. It was not a small spoon-feeding liberal arts college with its upper-level offerings thin or absent in most fields. Neither was it an intellectual-icebox education factory whose undergraduates saw no senior faculty members other than superannuated castoffs, an occasional clown or failed comedian, or a boring succession of graduate assistants. . . . It was neither of these. It had the merits of both and the faults of neither. It was a near-ideal compromise between the two. Some of our name professors both could and did teach, while tuition was $250 a year."

His point is well taken. There are differences in Washington University since 1960, important differences, but they are not qualitative, nor even noticeably quantitative in regard to undergraduate education. In fall 1959, when the first four dormitories on the new South Forty were opened, undergraduate enrollment was 3819 and graduate and professional enrollment was 2045. (Tuition, by then was $750.) In 1979, full-time undergraduate enrollment was 4431 and graduate and professional enrollment had almost doubled, reaching 3988.

The changes which have occurred in the Washington University student body in the past two decades are largely geographic. More non-St. Louis students come here, and, we are sure, more St. Louis students go elsewhere. That is a matter of general affluence and mobility.

Because most students now live on campus or in nearby apartments, the tenor of campus life has also changed. Its hours are much extended into the evening. The library is open until midnight. Life stirs on the South Forty much after that. Weekends are lively—even Sunday afternoon and evening are filled with activity.

The two very diverse groups of Washington University students—the under-thirty full-time day students and their older part-time evening counterparts—no longer file in and out of classroom buildings like changes of the guard. They overlap, they mingle, they sometimes even socialize, because now day students do not hesitate to take a subject they want which is offered at night.

The campus is, to some extent, a different world than it was as a streetcar college, but name professors still both can and do teach.

It is also true, however, that in the past several decades we have seen public relations come of age. We may talk more now about our excellence and the excellence of our students. Since our audience is more diffuse, we need to. We also talk about the excellence of our alumni, acknowledging that the students of our past reflect a quality that we have not created in twenty years, but have maintained.

If, in our present fervor to spread the word that Washington University is a middle-sized school where undergraduate, as well as graduate and professional, education is of primary concern and top quality we seem to neglect our roots, the inference is unintended. It is good to be reminded of our past and of the loyalty (and sensitivity) of those who shared it.

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Commencement Is a Movable Feast

The Farmer's Almanac predicted that the weather on May 17 would be "bright as a jewel." It rained, catching the University's commencement in a steaming downpour. Though the event moved to the fieldhouse, what is important transcends time and place. Those receiving degrees—from undergraduate to honorary (like Lou Brock)—brimmed with pleasure and their joy spilled over on all.