On any campus, perhaps anywhere, architects may define spaces, people define their use. In the University's new Mallinckrodt Center, Beaumont Lounge has become a place of many uses, but except for an occasional organized event such as an informal concert, it is almost always a quiet place—for study, for slumber, for small-group conversation. While most of the rest of the Center buzzes and bustles, the large, comfortable, main-level room and its adjoining terrace barely hums.
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COVER: David R. Francis, alumnus and a director of Washington University, officially opens the Louisiana Purchase Exposition, better known as the St. Louis World’s Fair. A nostalgic look at the Fair and its impact on the University begins on page 6.

Photo credits: Covers and pages 6-13, courtesy, Missouri Historical Society; pages 14, 15, Paul Schmolke; page 28, Rik Serra; all others by Herb Weitman.
Members of the Major Gifts Committee at a strategy meeting. Clockwise: George H. Capps, Chancellor William H. Danforth, David R. Calhoun, Elliot H. Stein, Maurice R. Chambers, and Charles Allen Thomas. The group is spearheading the effort to meet the Danforth Foundation challenge.

Spencer T. Olin, emeritus trustee, retired Olin Corporation executive, and a key member of the Major Gifts Committee, who was out of the city when the meeting pictured above took place.
Response
To a Challenge

A year ago this spring, the Danforth Foundation offered Washington University a $60 million endowment grant based on the University matching that sum in gifts from private sources within five years. At this year’s Founders Day celebration, it was announced that $30 million had already been raised—half the amount needed to earn the full $60 million. Raising the other half will not be easy, but it offers a tremendous challenge.

Meeting that challenge successfully could usher in a whole new and exciting era in the history of Washington University.

ON MARCH 9, 1973, the Danforth Foundation offered Washington University a $60 million endowment grant based on the University matching that amount in gifts from private sources within five years. It was an unprecedented challenge, and upon successfully meeting that challenge rests the future of Washington University. It can be the foundation for a whole new era in the institution’s history.

On March 2, 1974, at the annual Founders Day celebration, it was announced that during the intervening twelve months the University had received gift commitments from private sources totaling more than $30 million—or half the amount needed to reach the five-year goal.

In announcing the $30 million figure, Dr. Charles Allen Thomas, chairman of the Board of Trustees, expressed the University’s gratitude to the many generous donors, but added a note of caution. “While it is no small task to raise $30 million in one year,” he stated, “we are only at the halfway mark and cannot relax our efforts. We must build on the enthusiasm that generated these leadership gifts to raise at least $30 million more, and that is no small task either. We need the help and support of every friend and alumnus of Washington University.”

Chairman Thomas also paid tribute to the leadership of Chancellor William H. Danforth and to the “devoted group of trustees who have worked tirelessly to bring the objectives of the program to the attention of prospective donors.”

Spearheading the fund-raising effort is the Major Gifts Committee, headed by Trustee David R. Calhoun, chairman of the board of St. Louis Union Trust Company. In addition to Mr. Calhoun, Dr. Thomas, and Chancellor Danforth, other members of the committee are University trustees George H. Capps, president, Capitol Coal & Coke Company; Maurice R. Chambers, chairman of the board, Interco Incorporated; Spencer T. Olin, retired executive of the Olin Corporation; and Elliot H. Stein, president, Scherck, Stein & Franc, Incorporated.

Other committees of the University’s Development Program are: the Business and Industry Council, chaired by Mr. Capps; the Friends Council, headed by
John Peters MacCarthy, executive vice president, St. Louis Union Trust Company; the Foundations Council, chairman, Edward A. O'Neal, director, Monsanto Company; and the Alumni Board of Governors, chairman James A. Rodgers, and vice chairman Stanley L. Lopata, president, the Carboline Company.

The Danforth Foundation challenge grant, which is restricted for general endowment, in effect, will serve to perpetuate a $3 million annual contribution which the Foundation has made to the University in recent years under a short-term commitment. Although a vital factor in stabilizing the University's finances, the grant, in the words of Chancellor Danforth, "will purchase no new programs, it will not provide one new scholarship or pay the salary of one new faculty member, it will not reduce the necessity for frugal and efficient operation, and it will not diminish the University's dependence upon loyal and generous supporting constituencies for maintaining and developing its standards of service."

The Danforth Foundation challenge offers no panacea, but it does provide perhaps the greatest opportunity in the University's history. In the past 120 years, the University has evolved into a recognized regional and national center of teaching and research. Although a university by its very nature must address itself to the future, the essential challenge to Washington University is as old as the institution itself—to continue as a first-rate university worthy of the hope of its founders and its generations of supporters.

The decade of the 1970's finds man with more power at his disposal than ever before: power which can be used for good or for ill. In no previous era has it been more vital that man's judgment be informed by wisdom. Washington University adheres to the traditional concept that universities exist primarily to advance and transmit knowledge and perspective, vision and understanding, and, thus, to help men attain wisdom.

An important mission of such a university is development of the analytic and creative capabilities of students and faculty alike. Its commitment is to the powers of reason, to clarity, to intellectual rigor and to creative vigor—attributes critical to a society continually shaping its future.

Such a university is one of the guardians of a democracy. Our government of checks and balances is based on the conviction that even the best men and the best of nations are subject to fits of foolishness and even of evil, that free men keep their balance by the constant interplay of ideas, and that the free expression of these ideas is the best hope for the self-correction and self-renewal that every society needs.

As Washington University entered the 1970's, it became clear that massive new financing would be necessary if the institution was to sustain its level of excellence and to build for the future. It was determined that a minimum of $120 million was needed to meet these goals. The $60 million Danforth Foundation grant offers $60 million to be added to the University's endowment resources, but at least another $60 million must be raised in matching funds for additional endowment, current operations, and development of physical facilities.

Tuition income and earnings from investment cannot begin to pay for quality education. Outside support is essential. Faculty and staff salaries, student financial aid, library resources and services, and maintenance of the physical plant are all continually recurring expenses that will require generous unrestricted support from alumni, parents, corporations, and friends if they are to be met.
During the 1973-74 fiscal year, the University is seeking $2 million in unrestricted gifts from these sources. Specially funded projects make up another important segment of the University's annual educational and research operations. In addition to substantial funding for special purposes from federal sources, the University depends heavily upon private individuals, agencies, and foundations for essential support. Over the next five years, the amount of funds needed for special projects will total approximately $9 million.

The Danforth Foundation grant will furnish a substantial amount of unrestricted endowment income to be applied toward current operations. At the same time, endowment for such specific purposes as professorships, teaching and research funds, student scholarships, and library facilities must be augmented considerably. Leadership cannot be sustained on temporary or insecure funding; it depends on the assured income that endowment can provide. The economic pressures of recent years have reemphasized the crucial importance of endowment to the health and vigor of Washington University.

Among the specific purposes for which additional endowment is vitally needed are professorships, for the professor is at the very center of the whole educational enterprise. An endowed professorial chair serves to undergird the University's recognition of this role and its commitment to academic excellence. At present, the University has twenty-three endowed professorships. More are needed in the humanities, the sciences, the professional schools, and in virtually every other academic area.

Adequate endowment funds are also essential to long-range teaching and research programs. These funds enable the faculty to preserve its scholarly freedom to probe whatever promise seems greatest and to enrich and modernize the curriculum. Creation of an environment where imaginative teaching and research flourishes is possible only where inspired leadership and adequate financial backing exists.

Of extreme importance for the future is the existence of adequate endowment funds to finance needed student scholarships, loans, and other financial aid. Unavoidably higher tuition rates and the pressure of inflation are making it increasingly difficult for students from families of moderate means to attend Washington University. Since 1963, undergraduate scholarship assistance has increased from $537,000 per year to more than $2.5 million. The percentage of undergraduates receiving such assistance has grown from 23 to 37 per cent.

At the very heart of the University is the library. It is a fundamental resource for the learning and scholarly research activities of both students and faculty. The exploding expansion of knowledge means that need for new books and journals is increasing at an accelerating rate at the same time that the cost of books and periodicals is skyrocketing. Acquisition costs for the University's libraries are rapidly approaching one million dollars annually. Additional endowment for the libraries is essential to assure that their quality, and therefore that of the University's, is not eroded by inflationary pressures.

Total construction costs during the next five years are estimated at more than $15 million if the University is to sustain its academic excellence and to move ahead. More than $10 million will be needed for new construction and expansion of existing facilities, and the balance is required for badly needed renovation and modernization of existing facilities. In order for the University to make the best use of its existing space, a master plan has been developed for renewal of physical facilities. To preserve the beauty of the campus, guidelines for maintaining its architectural traditions have been laid down for the future.

The challenge has been made and the response in the first year has been gratifying and encouraging. To reach the halfway mark in the University's five-year challenge program in the first year is a remarkable tribute to the leadership of the program and to the generosity and vision of the many who responded. To raise the second half of the funds needed to meet the challenge will require the participation of all alumni and friends of Washington University who realize that the success of the program can provide the foundation for a whole new era in the University's history. In this new era, Washington University proposes to use the resources allocated to it to do what a university is best qualified to do: to foster the life of the mind, to provide an environment conducive to teaching and learning, to apply knowledge to human needs and problems, to conserve the best of man's heritage and build on it by exploring the outer reaches of knowledge and understanding.
Meet Me in St. Louis

SEVENTY YEARS AGO this spring, the St. Louis World's Fair opened its gates. From May to December of that year of 1904, the Washington University campus was an important part of the Louisiana Purchase Exposition—as the Fair was officially known. Brookings Hall served as the Fair’s administration building; Ridgley Hall was the site of 186 congresses and meetings, including that year’s national Democratic convention; the first Olympic Games to be held in the United States were staged in the University’s stadium; the official exhibits of Great Britain, China, and a dozen other nations were erected on the University’s grounds; and most important of all, the rental fees the University received from the Fair enabled it to construct four additional buildings and to launch its new campus in style.

The Louisiana Purchase Exhibition was officially dedicated on April 30, 1904. On that glorious day, President Theodore Roosevelt pushed a telegraph key in the White House and on the Fair grounds 10,000 flags unfurled, myriads of fountains sprayed water into the air, massed, brass bands began to play, machinery whirred and clanged, and the crowd of 350,000 cheered. Before the Fair ended seven months later, twenty million paying customers had clicked through the newly invented turnstiles.

The St. Louis Exposition covered more ground and offered more exhibits, displays, and attractions than any other world’s fair in history. Every state and territory in the United States was represented, as well as scores of foreign nations. Among the Fair’s innovations, at least according to legend, were the ice cream cone, the hot dog, and iced tea. Even more amazing, the St. Louis Fair ended up making a profit.

THE FAIR had a tremendous impact on the city and, in fact, on the whole nation. Its impact on Washington University was crucial to the institution’s future. With the zeal and determination that the early founders and backers of the University displayed, there is no doubt that the University would have grown and flourished even if there had never been a fair, but the decision to hold the exposition at the western end of Forest Park proved a golden opportunity for the leaders of the young university and they were quick to seize it.

Since its founding in 1853 as Eliot Seminary, the institution had outgrown its original buildings in downtown St. Louis. In 1894, the University had purchased a tract of land just west of Forest Park and began to develop the site for occupation by 1902. When the Exposition was in the planning stages, it soon became apparent that the 657 acres set aside for the Fair at the western edge of the park would be inadequate. Robert Brookings, president of the University corpora-
The British Pavilion, a copy of an orangery designed by Wren, served as the home of the University's School of Fine Arts until Bixby Hall was built in 1926.

On Dedication Day, April 30, 1904, Brookings Hall, as the Administration Building for the entire Fair, was the scene of numerous ceremonies. Here, an overflow crowd fills the archway.

David R. Francis, president of the Fair, was on one end of the telegraph key on Dedication Day. President Theodore Roosevelt was on the other end to signal the official opening of the Exposition.
tion, and his Board of Directors met with the Exposition authorities and proposed a happy solution for all concerned. For $750,000 in rental fees, the University agreed to postpone moving to its new campus until the Fair was over and to lease its grounds and the buildings already erected to the Fair. In those days, $750,000 was a lot more money than it is today, and that sum enabled the University to erect four new important buildings and to bolster its general financial base that had been seriously weakened by the purchase of the new campus and the construction of the first buildings.

Credit for the happy solution belongs not only to Robert Brookings and his associates, but also to the President of the Exposition and the moving spirit behind the whole concept of the World’s Fair, David R. Francis. A Washington University graduate and member of its Board of Directors, Mr. Francis was a man of remarkable energy and foresight. Before he became the genius of the Louisiana Purchase Exposition, he had served as mayor of St. Louis, governor of Missouri, and Secretary of the Interior. He went on after the Fair to become United States Ambassador to Russia, under President Woodrow Wilson. His name is commemorated on the Washington University campus by Francis Gymnasium and Francis Field, both built for the Fair and turned over at its end to the University.

The Fair’s inspiration was intellectual and cultural. Its aim was to bring to St. Louis, the United States, and the world the latest findings and developments in science, culture, the arts, and industry; but there were many prosaic and mundane matters to be considered before playing host to millions of visitors.

One mundane but extremely important consideration was the water supply. Plans for the Fair included innumerable water displays and attractions. The entire fair grounds were laced with lagoons and pools; there were fountains and waterfalls everywhere, and the Grand Basin was to be the focal point of the whole exposition. With water playing such a dominant role, it was natural that someone finally pointed out that St. Louis water in those days, while copious in supply, left something to be desired in appearance and texture. Before the Fair, the water of St. Louis was notorious for its high mud content and its startling opaqueness. During the entire previous history of the city, the water had to be boiled and filtered in individual homes before it was fit for consumption. When the Mississippi was at flood stage, the water, to quote a contemporary source, was “chocolate-colored and so charged with sediment that a glassful, after standing for a few minutes, was nearly half mud, with clear water on top.”

The problem was solved. St. Louis, for many a long year after the Fair, enjoyed a reputation as the major American city with the clearest, purest water in the land. Credit for this miraculous transformation of liquid mud to clear water belongs almost exclusively to faculty members and graduates of the Washington University School of Engineering. Long before a mechanical engineering professor at Washington University, by the name of Raymond R. Tucker, solved the city’s smoke problem, his predecessors in the engineering school gave the city its pure water.

The electrical supply for the Fair was almost as great a problem. Electricity was relatively new at the turn of the century and the Fair’s plans called for more electric lights, more electric motors, and more electrical gadgets than had ever been assembled in one place before on this planet.

The local utility company, Union Electric, rose to great heights. From somewhere it found the generating capacity, built the transmission and distribution lines, and solved the brand-new electrical supply problems the Fair created. To back up the utility’s supply, however, a separate power plant was built on the University grounds. This plant, which boasts the largest Gothic smokestack in the world, is still hard at work today, turning out steam heat for many of the buildings on campus and supplying much of the campus electrical needs.

When the Fair opened, the Washington University campus was right in the middle of things. Brookings Hall, as the main administration building housed the offices of David R. Francis and the other World’s Fair officials. It was there that all official receptions were held, including quite a few predecessors of the cocktail party, if you can believe contemporary accounts.

Ridgley Hall, that Early English Renaissance building, with its cloister arcade, for many years housed the University library and is now the setting for the Mary Brooks Holmes Lounge. The Ridgley reading room was the site of national and international congresses, conventions, and meetings. It was in Ridgley that the 1904 national Democratic Convention nominated Alton B. Parker for President. It was in that same room that the 1904 graduating class of West Point held the annual Military Academy Commencement Ball.
One of the most beautiful exhibits at the Fair was the Chinese Pavilion erected on the University campus. In background is the Fair's gigantic Ferris Wheel.

Except for the awnings and the absence of parked cars, Brookings Hall looks today much as it did in this 1904 scene. In left foreground is the Italian Pavilion.

The Austrian Building was one of a dozen official exhibits of foreign nations which were erected on the Washington University campus.
The second floor of Ridgley, for long after
the austere home of the library stacks, dis
played the glamorous and priceless exhibit of
Queen Victoria's Diamond Jubilee gifts.

Even the magnificence of a West Point graduation ball,
Queen Victoria's gifts, or the oratory of the Democratic con
vention speakers paled beside the brilliance of the world's
greatest scientists and scholars who met at Ridgley during
the Fair for the Congress of Arts and Sciences of 1904. The
roster of scientists and scholars who assembled in Ridgley
reads like the intellectual Who's Who of 1904.

Many important papers were delivered, but none more
significant and historical than that presented by Henri Poin
caré, the noted French mathematician, physicist, and philos
opher. In what is now Holmes Lounge, Poincaré, as nearly
as historians of science can determine, first used the term
relativity in its modern sense. While lacking the elegance
and the mathematical rigor of Einstein's Special Theory of
Relativity, Poincaré's Ridgley address did anticipate many
of the principal points of relativity theory and is a landmark
in the history of science.

Brookings and Ridgley were not the only existing Univer
sity buildings to be utilized by the Exposition. Busch Hall
of chemistry became the headquarters for the Fair's engineers
and architects; Cupples I and II, the first engineering build
ings, were used for exhibits and displays. The newly con
structed Liggett Hall dormitory was leased to the Fair.

On the northwest end of the campus, now occupied by
Fraternity Row, the Mudd law building and Thomas H. Eliot
Hall, were the Aeronautic Concours and the Barracks and
Parade Grounds. The Concours was the home of the
"intrepid birdmen" of 1904. To protect the balloonists from
wayward winds, the Concours was completely enclosed
within a thirty-foot wooden fence. All kinds of early air
craft were on display, and some of them could even become
airborne on occasion. Some $100,000 in prize money
encouraged inventors of airships, aeroplanes, steerable ball
loons, gliding machines, and manned kites to show their
wares and even to attempt to fly them.

The most successful of the World's Fair aeronauts to soar
from the campus airport was one Roy Knabenshue. Sailing
off into the wild blue yonder in his homemade airship,
Knabenshue came down in the vicinity of Busch's Grove on
Clayton Road. There, he was carried triumphantly into that
great old restaurant, where a drink was invented on the spot
to salute his daring deed. If you drop into Busch's Grove
today and order a Knabenshue, you will be served an ex
hilarating concoction with a cognac and champagne base.

On the University grounds, from Skinker to "Pennsylvania
Avenue," now Big Bend, were many of the official buildings
of foreign nations. Nations with exhibits
on campus included Great Britain, China,
Italy, Sweden, Holland, Belgium, Austria,
Siam, Brazil, Nicaragua, Cuba, and
Argentina.

The China Building, located on what is now the south
Brookings parking lot, was one of the wonders of the Fair.
A copy of the summer palace of the Chinese Prince Pu Lun,
It displayed a wealth of exquisite Chinese art and artifacts,
including jades, porcelains, bronzes, lacquered woods, silks,
and ceramics. Prince Pu Lun himself showed up at the Fair
and seemed to have a marvelous time. At the end he was
so impressed that he donated the entire Chinese Pavilion and
its magnificent contents to President Francis personally.

The British Pavilion was another outstanding display. Sur
rounded by English formal gardens, it was an exact copy of
Queen Ann's Orangery at Kensington Gardens, originally de
signed by Christopher Wren. After the Fair, it was purchased
by Washington University and served as the home of the
School of Fine Arts until Bixby Hall was built in 1926. A
sixteenth-century Tudor mantel from the Orangery can be
seen today in the dean's office in Bixby.

One of the main attractions of the Fair was the Philippine
Stockade, where 1100 Filipino natives lived for seven months
in as near an approximation of their native state as could be
achieved in St. Louis County. (During the summer months,
the natives complained about the St. Louis heat and hu
midity.) Other primitive peoples lived nearby, including the
Igorots, whose taste for dog meat caused somewhat of a
scandal and quite a set-to with the local Humane Society.
For some time, there has been a base canard circulating to
the effect that today's Washington University student resident
halls are on the site of the savage Igorot village. That is not
true: the student resident area is on the site of the Fair's
nursery and anthropology exhibit.

One of the most successful coups that the irrepressible
President Francis pulled off was to bring to St. Louis
and to the Fair the first international Olympic Games to be
held in the United States. The ancient Olympic Games were
revived in 1896 in Athens and were staged in Paris in 1900.
The 1904 Games were scheduled for the United States, and
Chicago seemed to have the location sewed up, at least until
Mr. Francis came along. When the Olympic Committee
leaned toward holding the games in Chicago, Mr. Francis
let it be known that the St. Louis Fair would run a gigantic,
international athletic and sports carnival at the same time.
The Olympic Committee gave in and the St. Louis World's
Fair site was chosen.

To accommodate the Games, the Fair authorities built on
the campus a handsome stadium, the first in the world con
International competitors in the Olympic Games line up for the marathon race. No. 3, at left, is Felix Carvajal, a Cuban postman who came in third although he had never run in competition before.

Receiving a trophy from President Francis is John D. Lightbody of Chicago, the outstanding performer in the 1904 Olympics.
structured of poured concrete, a gymnasium, playing fields, running tracks, and a "swimming lake." After the Fair, the stadium and gymnasium were turned over to the University which, in turn, named them after Mr. Francis.

The 1904 Olympics on Washington University's campus attracted more than nine thousand athletes from all over the world, competing in some thirty-eight separate contests. To attract World's Fair crowds to the Games, some highly unorthodox events were included, among them a pygmy mud fight and a pole-climbing event, won by an Igorot who shimmied up fifty feet in twenty seconds.

Many Olympic records were established at Francis Field, some of which did not fall for decades; but a few of the records are secure. One of them was the mark set by a Hairy Ainu of Japan, who heaved the 56-pound weight for a record low of one yard, three inches.

A highlight of the 1904 Olympics was the Marathon run over a course beginning and ending at Francis Field. The course covered roughly twenty-five miles, going west on what is now Forsyth and returning by way of Manchester Road and Big Bend. Run in St. Louis August heat, along dusty roads, and accompanied by a fleet of 1904-vintage automobiles churning up that dust, the St. Louis Marathon must rank as the most difficult ever run. Thirty-one runners entered the race, including seventeen Americans, ten Greeks, two Kaffirs, an Englishman from South Africa, and a Cuban postman who had never run in competition before.

Fourteen of the original thirty-one managed to survive the heat, the dust, and the automobile exhaust, and staggered back to the campus and into the gates. The winner was Thomas J. Hicks, an Englishman running under the colors of a Cambridge, Mass., athletic club. Finishing the last lap with his handlers giving him doses of strychnine and brandy and sponging him down with warm water from the boiler of their Stanley Steamer, Hicks staggered in as the real winner after the crowd had mistakenly acclaimed as winner a contestant who had traveled most of the course in the back seat of a touring car and then jogged into the stadium far ahead of the pack.

Despite the circus atmosphere and the many rather peculiar events on the schedule, the St. Louis Olympics did focus world attention on the Games and perhaps insured that they would continue in the future. Francis Field today bears a plaque noting that it was the site of the 1904 Olympic Games, and some of the Francis Field records are still in the Olympic books, especially that Ainu's one-yard-three inch shotput.

The great St. Louis World's Fair is seventy years in the past. Yet, it has left an indelible mark on St. Louis and on Washington University. It came along at a crucial time in the University's history, and that history might have been quite different if it weren't for the University's enthusiastic participation in the Fair.
Florence Moog is a noted developmental biologist whose research on enzymes has led to a better understanding of the intestine and its functions. She is an inspiring teacher whose influence has helped shape the lives of many of her former students who are now prominent in science, medicine, and the academic world; she is also a skilled and perceptive writer with the courage to speak out on controversial issues.
Florence Moog: Teacher And Researcher

BY DOROTHY BROCKHOFF

IN mid-April of last year, a tall, imposing woman who is the embodiment of every type-casting director's dream of what a scholar should be—dignified, bespectacled, and silver-haired—strode briskly to the podium in Kane Hall on the University of Washington campus in Seattle to deliver the first of two public lectures there. The speaker was Professor Florence Moog (rhymes with vogue), whose resolute assurance and regal bearing conceal a natural shyness and an innate reserve.

She found herself in Seattle on that particular spring evening because of the international reputation she has acquired as a developmental biologist on the Washington University faculty in St. Louis over the past three decades. In recognition of her achievements, the zoology department at the University of Washington had invited her out to the West Coast as a Walker-Ames Visiting Professor. Such an honor is accorded "only to scholars selected from among the most distinguished minds available," according to the terms of the bequest which established these prestigious university appointments.

Dr. Moog, who has a way of leavening her lectures with subtle and unexpected wit, elected to speak on "New Vistas Along the Alimentary Canal." The audience could not have had a better scientific Burton Holmes to guide them on such a trip, because Professor Moog is a recognized authority on what was, as late as the nineteen thirties, largely misunderstood territory. With characteristic candor which must have startled the more fastidious of her listeners, she said bluntly: "For a long while the alimentary tract was looked upon as a set of organs that breaks down the food we eat and allows the digested molecules to pass into the blood stream—that finishes the cooking, so to speak, and sops up the gravy."

She then made clear that nowadays this simplistic view of the gastrointestinal tract has been discarded as modern biochemical techniques, together with the electron microscope, have revealed a system of sophisticated design. "Inherent in this design," Dr. Moog continued, "is the key to intestinal function."

She herself is one of the pioneer investigators whose research has contributed significantly to our modern-day understanding of how the intestine works. Initially, however, it was not the gut, but curiosity about an enzyme called alkaline phosphatase that sparked her interest in the nether regions of the canal. Dr. Moog explained that "enzymes are the complex chemical molecules which, though present in the minutest quantities, take our inert foodstuffs in hand and manufacture living tissues out of them. Without enzymes no vital process could continue."

Dr. Burr Steinbach, a former mentor at Columbia University where she earned her doctorate, first brought Florence Moog and alkaline phosphatase together. Dr. Steinbach and Dr. Moog both came to Washington University in 1942 at the invitation of Dr. Viktor Hamburger, then chairman of the zoology department and now professor emeritus. Dr. Steinbach joined the faculty as a professor of physiology; she was hired as a research assistant.

Not many years before, a brilliant pathologist at the University of Chicago, George Gomori, had worked out a new technique for detecting the presence of alkaline phosphatase in tissues. With this new method he was able to show that this enzyme tends to be localized on surfaces. Dr. Steinbach suggested to his young associate, Dr. Moog, that "it might be interesting to see where an
enzyme is localized in the course of development. Florence Moog took his advice and, in 1944, published what has come to be regarded as a minor classic in the field of embryology.

Using chick embryos, "I discovered," she explained not long ago in the Monsanto Laboratory of the Life Sciences on campus that "whenever a tissue passes through an early phase of differentiation it always has a lot of phosphatase in it." Differentiation means the sum of processes whereby apparently indifferent cells, tissues, and structures attain their adult form and function. Dr. Moog explained that this observation has been repeatedly verified by scientific experiments on other embryos.

Initially, Dr. Moog concentrated on only the first eight days of the chick embryo. She observed that there was very little phosphatase in the intestine during this early developmental stage, although the mature gut is rich in this enzyme. "When does it appear?" she wondered. "Does it build up slowly until the gut is about to be used or is there a dramatic increase just before the chicken breaks the shell and emerges?" Dr. Moog was able to demonstrate that the big phosphatase increase occurs in the last forty-eight hours before hatching.

Next, she began the first of her experiments on mice. Her research demonstrated that there is a substantial phosphatase build-up in this creature just before birth, and another major increase just before the mouse is weaned. Dr. Moog was the first to show that the increase may be elicited prematurely by stress. This observation, in turn, led to her recognition that the adrenal cortex is involved, and prompted her to conduct further experiments which demonstrated the role of the pituitary and adrenal glands. What causes the maturational change, in the sense of triggering the pituitary-adrenal system, remains unknown.

Over the years, Dr. Moog has done pioneering research on various correlated changes (morphologic, functional, and biochemical) which occur in the intestinal lining around the time of weaning as a shift from infant requirements to more adult digestive needs takes place. That many people have turned their attention to the complexity of these changes and the concomitant problems associated with them is due in part to her early work.

Despite all of this concentrated effort, however, much still remains to be learned about phosphatase. "It is quite possible," Dr. Moog believes, "that this enzyme (or perhaps a group of related enzymes) has more than one function. She suspects that phosphatase is necessary to permit the absorption of phosphate from phosphate-containing compounds in the food. A few years ago, in collaboration with a student, Howard Glazier, Dr. Moog published a paper providing evidence to support this view. Other researchers, including Dr. David H. Alpers, professor of medicine at the Washington University School of Medicine and a noted gastroenterologist, have shown a relation between phosphatase and fat absorption. These findings support her belief that this enzyme is of key importance in intestinal function, because, she reasons, "nature would hardly devise such an intricate control system for something that was not related to the over-all functioning of the intestine."

That she still doesn't have all the answers after more than a quarter century of work doesn't discourage Dr. Moog, and she and her associates are continuing their research unabated. Early this year an account of the newest finding in the Moog lab was published in Science magazine, as influential a journal in scientific circles as The Paris Review is in the world of letters. A joint effort of Kwoyih Yeh and Dr. Moog, this article established that the thyroid gland is "extremely important in the development of the intestine. We may," Dr. Moog said, "have opened up something new and important."

Eventually, a scientific investigator like Dr. Moog must ask herself what influence such work has on her capacity to teach. Dr. Moog wrote eloquently about this matter fourteen years ago in the Washington University Magazine, and the convictions she expressed then are those she continues to hold today. "Research and teaching go together," she said recently. "I don't think that I could teach effectively if I had never done any research, because it is only by doing research that one comes to understand science from the inside. But I certainly don't regard research as being more important than teaching."

"Frankly," she said, speaking with the forthrightness with which she has come to be identified, "I think most research is not really very important. What most of us do in research is pretty dispensable. It's derivative, it's second-hand. It is following somebody else. The number of people who really have the kind of original, important ideas that lead into new areas is a small minority. It makes sense for such investigators to avoid teaching, if they prefer, and join research institutes."

She added, however, that she regarded "research as useful because, in the aggregate, what we turn out is important, even if one piece is not likely to be significant. In doing research," she observed, "we maintain a kind of vital-
ity." Evaluating the two areas, however, Professor Moog opted for teaching. "While your research may ultimately turn out not to be worth anything, if you have influenced students and made some difference in their lives (and I think I have in some cases), that has lasting value."

Dr. Moog has been instrumental in shaping the lives of many. Hundreds of undergraduates, including a great many pre-medical students, have taken her classes. One young man, Gary Lerner, A.B. 71, wrote her a note shortly before he entered medical school in which he said: "I hope I am able to bring to the profession of medicine all the sincerity, intellect, personality, and dedication which make you such a fine teacher." Former undergraduate Dr. Richard D. Aach, now an associate professor of medicine at Washington University's School of Medicine, echoed Lerner's opinion of her teaching skill. He reminisced recently about "the great impact she had on her students. Her lectures," he declared, "made a lasting impression because of their well presented organization and content."

Former graduate students also confirm that "she has had a profound effect on the careers of a number of people." Writing recently from the University of California at Davis, Dr. Marilynn Etzler, assistant professor of biochemistry, declared: "On this campus there are two of her former students—Bob Grey and myself. I think both of us have patterned our teaching styles after hers. I am still at the beginning stages of my career . . . but if I am successful, a lot of that success will be due to the training and encouragement I received from Florence."

Dr. Moog keeps track of the thirteen students who have earned Ph.D. degrees under her guidance and of a great many others once in her classes who have since done well in the medical and academic worlds. "One I'm particularly proud of," she wrote recently, "is Edgar R. Thomas, who earned his master's degree while working for me as a research assistant. Thomas was the second black person to be employed in a professional capacity on this campus. He is now dean of the Graduate School at Millersville State University in Pennsylvania."

The above information arrived in the mail. That fact itself reveals a great deal about Dr. Moog. She has a penchant for writing letters, some of them composed on a Smith-Corona which she operates flawlessly. One of those who hears from her fairly regularly is the editor of the St. Louis Post-Dispatch letters column, who shares this correspondence with his readers. Because her interests are eclectic and her style pithy, these messages make for lively reading. Moog opinions, selected at random from her archives, cover everything from opera, which she adores, "to the one surviving variety of laundry soap" which she ruefully admits doesn't sell well because of uninspired merchandising. "Color it rose or chartreuse," she advised with tongue in cheek, "and Eddie [Albert] and Arthur [Godfrey] could do the commercials with a clean conscience."

Dr. Moog spoke no less tartly about this country's waste of women back in the fifties before Steinem and Friedan discovered Women's Lib. "As long as Russia draws on the talents of her whole population, while we utilize only half of ours, we can only fall further behind. . . . [In this country] a girl with the courage to enter an engineering school makes herself hardly less conspicuous than the bearded lady in a circus," she wrote.

Throughout her career, Dr. Moog tried to ignore the discrimination against women in institutions of higher learning. "For a long time I accepted the values of the male world. When I was a graduate student at Columbia during the depression, I couldn't get a teaching assistantship because I was a member of the wrong sex. Fellow students who happened to be male could live comfortably on the thousand dollar stipend plus tuition which they received as
"TA's. Meanwhile, I had to work furiously grading business English papers at New York University to earn seven hundred dollars, half of which went for tuition. Looking back on it now I can see how miserably unjust it was, but at the time I didn't even have the sense to resent what was wrong."

Until the end of the 1960's, Dr. Moog considered the women's liberation movement to be a matter for other women. It was reading Joseph Lash's *Eleanor and Franklin*, with its recounting of the decline and fall of an earlier women's movement, that led her to a new understanding of the position of women in male-dominated society. "Then there began to be some activism among women on this campus under the leadership of Liselotte Dieckmann of the German Department," Dr. Moog continued, "and in attending meetings among a lot of justifiably aggrieved women I came to see myself as a white, female Uncle Tom. It was a real shock and a very unsettling experience. In a sense what I've done since is a kind of expiation to make up for my previous failure to recognize the problems of other women."

Ever since her rude awakening, Professor Moog has been making up for lost time. Two years ago she raised the hackles of officials at the National Institutes of Health when she fired off a letter to *Science* magazine pointing out that the ratio of women to men was only 2.8 percent on ninety-six advisory committees of the Institutes. Her complaint was not inspired by personal pique. She herself had served on an important study section of the Institutes for four years. What made her angry was the hypocrisy of the situation, for at the very time that the NIH was blithely refusing to take women scientists seriously, its parent organization, the Department of Health, Education and Welfare, which has administrative control over the Institutes, was attacking universities on the grounds of discrimination.

By return mail, she received impassioned pleas from eminent women scientists urging her "Right on, sister," and a response from an NIH official indicating that he believed that there were very few women qualified to serve as consultants. An exchange of letters between Professor Moog and the official ensued in which she ultimately sent him the names of sixty-three able and productive women scientists whom she knew personally or by reputation.

It was undoubtedly not by chance that soon afterward the then Secretary of Health, Education and Welfare, Elliot L. Richardson, handed down a directive which stated: "Assuming qualified women are available to fill vacancies, at least one-third of all nominees or appointees for committees shall be women."

Meanwhile on the Washington University campus, Dr. Moog became a member of the Affirmative Action Committee which was organized to ensure equal opportunities for minorities. The Affirmative Action Plan which this group had a key role in drafting and implementing at the University is reportedly considered by the Health, Education and Welfare Department to be one of the best in the country.

Currently what worries Dr. Moog most is the possibility that the feminist movement may lose momentum. In her second public address at the University of Washington, entitled "After the Fad Is Over, Do Women Have a Future?" she warned that "eternal vigilance will be the price of liberation. . . . What we need most of all," she concluded, "is a generation of girls growing up without the latent feeling that there's something deficient in their makeup. That still lies ahead."

Once this goal is achieved, what then? For those young women who earn their doctorates and aspire for a university faculty career, Dr. Moog has been waging a battle "to abolish the tenure system as it stands today." She sees it as the "major barrier to the female scholar and the reason why there are so few women on university faculties." In a hard-hitting editorial in *Science* magazine, Dr. Moog laid it squarely on the line. She wrote: "According to the hollowed rules, made by men for men, the aspirant has about five years in which to establish himself as worthy of guaranteed employment to the age of sixty-five at least. No provision is made for the typical 'herself,' for whom the critical five years coincide with the period when the care of small children is most demanding."

She built her argument on a much broader base, however, than the fact that this system militated against the female sex. "It is not only women who are victims of the tenure system—the most important victims are the students," she contended. "It is time," she insisted, "for students to realize to what extent poor teaching is permitted and even encouraged by the tenure system."

Although her polemics have been praised by administrators, her views have been largely ignored by the academic profession. Looking back, she perceives the quixotic character of her tilt against the tenure system. "Until recently I persisted in the naive belief that university professors are somehow nobler or more idealistic than other people," she said. "I'm old enough to know better. When it comes to defending special privilege, people are all pretty much alike, I guess."
The possibility of stirring up controversy and evoking protest has never silenced Dr. Moog. She did both in another memorable Science magazine piece in which she freely roamed over several centuries of scientific thought to make the point that between Aristotle and Francois Bouriere there have been people “who could make science and write about it too. And why not?” she inquired. “Good writing, after all, is just clear thinking. Anyone who can think well enough to make advances in any learned field ought to be able to write about his work.

“I am, of course, aware that many research papers submitted to scientific journals are, from a literary standpoint, putrid; but usually such essays are scientifically not very fragrant either,” she concluded.

Dr. Moog knows whereof she speaks because she herself is a gifted writer. In 1948, she won the AAAS-Westinghouse $1000 prize for Distinguished Science Writing in Magazines for her beautifully honed article on the “Biology of Old Age” published in Scientific American. A year later she put together a laboratory manual, “Structure and Development of the Vertebrates,” regarded by Dr. James Ebert, one of the deans of developmental biology in this country, “as the nation’s first truly critical attempt at integrating the subjects of comparative anatomy and embryology.” This slim volume was written after Professors Hamburger and Moog took what was then a novel step and unified these subjects in one course instead of following tradition and teaching them separately. She is also co-author with Dr. Thomas S. Hall, professor of biology, of a text, Life Science.

Florence Moog started publishing at the age of eleven, when she sold a story on the French Revolution to the New York Herald Tribune for two dollars. While attending high school in Brooklyn, she served as a correspondent for the New York Times, and later, as a Columbia University graduate student, sold that newspaper gardening articles for two cents a word. For a time she considered becoming a newspaperwoman, but abandoned the idea when she became convinced that she didn’t have the temperament for the constant deadlines and pressures in journalism.

What she does have, however, is a remarkable capacity for self-discipline and organization. She carries a heavy classroom load and is a faithful member of key University committees. This spring she was re-elected to the Faculty Council after having served as a member of this body some years ago. Meanwhile, she is just completing her term as a member of the Personnel Advisory Committee. Merle Kling, dean of the Faculty of Arts and Sciences, in commending her for her service as a faculty stateswoman, said: “Some people have a passion to participate in administrative affairs, but may not have much talent. Other people may have the talent, but be unwilling to participate. Florence isn’t an avid volunteer, but she does respond to draft notices and she does have the talent.” Despite all of her many responsibilities, however, Dr. Moog continues to log many hours in her research laboratory.

By working extra hours and budgeting her time, Dr. Moog also squeezes in assorted avocations. Now and again she takes off for some archaeological globe trotting, and she has been observed studying an operatic libretto on an airplane. (Some of the Moogs are musically gifted—nephew Robert is the Moog synthesizer man.) She also happens to be a devoted Trollopian. “Sometimes I amuse myself by writing sketches about Victorian womanhood as reflected in Trollope’s novels,” she confided. It is a beguiling and revealing list of hobbies and one which would have delighted Trollope, who “revelled in mankind’s idiosyncrasies.” Were he alive today he probably would have returned the favor by shaping a novel around an extraordinary woman of our age—Dr. Florence Moog.
The Celestial Timescope and The Reincarnation Of the Universe

By JOHN W. CLARK
Professor of Physics

Professor Clark, a theoretical physicist whose special fields of interest include nuclear many-particle theory, quantum mechanics, and neutron stars, writes here of the latest speculations of cosmologists on the origin, nature, and ultimate fate of the Universe.

During his intellectual childhood, man has been repeatedly burned by nature when he naively tried to fit reality into the mold of "common sense" or human chauvinism. Common sense says the earth is definitely flat—especially if you live in Kansas. Nevertheless, Magellan circumnavigated the round earth. The Ptolemaic view, obeying the dictates of common sense and human chauvinism, says the earth is the center of the heavens—after all, we feel no motion, and just look up in the sky at the revolving sun and stars! It came as a shock to the human ego when Copernicus and Galileo announced that the earth is a minor planet circling the sun, and again, much later, when it was discovered that the sun is but a minor star, located out in the boondocks of our home stellar system, or galaxy.

Adding confusion to injury, Einstein's exploration of the consequences of the finite and constant speed of light in free space upset cherished commonsense notions about space and time and simultaneity (the paradoxes of special relativity).
The expansion of the universe challenged the belief that “the heavens endure from everlasting to everlasting.”

To make matters worse, it appears that space is curved, at least near massive bodies, much to the dismay of those (meaning practically everybody) who think in terms of the Euclidean geometry they learned in high school. There are abundant examples of the breakdown of common sense, or the “principle of human chauvinism,” to use again the term coined by Carl Sagan, in domains other than astronomy, not least in microphysics and biology.

Modern cosmologists take most seriously the lesson learned from these ego-deflating attempts to apply human chauvinism. They make use of a contrary principle, called the Copernican view or cosmological principle: There is nothing special about ourselves and our locale. This means that the laws of physics any place and any time in the universe are the same as they are here and now on earth. Let’s call this the first implication of the cosmological principle. In particular, light is assumed to travel through a vacuum at the same constant, finite speed of 186,000 miles per second, at all places and at all times.

The vast universe exterior to our galaxy looks isotropic (the same in all directions), apart from random statistical variations. The cosmological principle would urge us to say that the universe looks the same to any other observer located anywhere else, no matter how far from us. That would make the universe homogeneous (of uniform structure) as well as isotropic, at least on the large scale of relevance to general cosmological arguments. It is conventional to regard the universe as having a uniform density, smoothing out irregularities like stars, galaxies, and clusters of galaxies.

Because the universe may be, and apparently is, evolving in time, we should, however, restrict this application of the cosmological principle to observers whose locales have reached a similar stage of development on the cosmic scale. Thus we should say that the universe is necessarily homogeneous and isotropic, in the large as always, at a given stage in its development. Let’s call this the second implication of the cosmological principle.

A giant wheel of stars, the spokes twisted into spiral arms containing dark dust and bright, young, metal-rich stars, the central hub a dense glowing agglomeration, the whole surrounded by a halo of aged, metal-poor stars. Some galaxies are just elliptical blobs of metal-poor stars. A typical galaxy contains perhaps a hundred billion stars and is a hundred thousand light years across.

Galaxies are associated into clusters, the distance between galaxies within a cluster being about ten times their linear dimensions. The clusters are well separated and seem to be receding from one another as if experiencing a mutual repulsion, or better, as if they were participating in a gigantic explosion. It is the phenomenon which first gave evidence for the overall expansion of the universe, strong, though not in itself conclusive, evidence that the universe is evolving in time and that the permanence of our local heavens is an illusion. If, indeed, the universe is evolving, it would look younger to an observer on a distant galaxy at the time its light was emitted to us, to be seen by us now, the universe would look younger. Thus my qualification of the second implication of the cosmological principle.

How do we know the galaxy clusters are fleeing from one another? From the red shift of the spectral lines of the light we receive from them. It is a familiar fact that each element puts a characteristic signature on the light it emits when excited, the spectrum of its emission frequencies. Invoking again the first implication of the cosmological principle, this characteristic signature will be the same for a given element anywhere and anytime in the universe. If a distant star sends light to us, this light can be analyzed into its various frequency components or colors and the luminous elements in the star can be identified by matching against the spectra.
of the elements on earth. From very distant galaxies we note that characteristic elemental spectra are the same as on earth, but shifted to the red, to longer wavelengths.

We are reminded of a wave phenomenon called the Doppler effect: the wavelength of radiation from a receding source (for example, a train whistle) is apparently lengthened. Thus we are led to attribute the red shift of the light from a distant galaxy to a relative velocity of the galaxy away from us. In the 1920's, Hubble found observationally that the recession velocity of a particular galaxy, as determined from its red shift is proportional to its distance, as estimated in terms of its brightness. Hubble's law holds well even out to a billion light years (a billion years in the past). The recession velocities of observed galaxies, based on their red shifts, reach an appreciable fraction of the speed of light. The mysterious and fascinating quasars can have much greater red shifts than even the faintest galaxies, corresponding to recession velocities closely approaching light-speed.

What is so remarkable about the quasars? They seem to be small objects, cosmically speaking, of the order of light months across to judge from the time scale of their changes in brightness. Yet they emit typically a hundred times as much radiation as an ordinary galaxy, which is a hundred thousand light years across. The energy required to keep a quasar burning for a reasonable astronomical time, say a million years, is at least ten billion times the energy release of the sun during its entire life of ten billion years. The quasars were apparently prevalent during the relatively early stages of the universe. When we see them, we are looking some eight to ten billion years into the past, to a time long before our sun was born, five billion years ago, and possibly less than a billion years after creation.

Perhaps even more astonishing, we can look back in our celestial timescope to an epoch before galaxies, or quasars, were formed. The evidence is the cosmic, microwave, "black body" radiation, which as far as one can tell, is perfectly isotropic, coming equally from all parts of the sky. What leads us to interpret this universal background radiation as arriv-
ing from the far, far distant past?

The answer is that it fits beautifully into a cosmology proposed in 1927 by Lemaitre, a Belgian priest, an evolving model based on Einstein's general theory of relativity. Lemaitre postulated that the universe began in a state of ultra-high density, believed now to be in excess of that in an atomic nucleus, perhaps even infinite. This "cosmic egg" was endowed with awesome energy, which powered an explosion of unimaginable proportions, the so-called Big Bang. It exploded because it was tremendously hot, even infinitely so.

In the first millisecond, the temperature was in excess of some trillion degrees, and there was a menagerie of every kind of elementary particle you can think of and many you can't. But after a dozen or so seconds of expansion accompanied by elementary particle reactions and decays, there remained, besides neutrinos, mainly electrons, protons, and neutrons (the familiar material particles) and lots of photons (the particles of light). During the first half hour, as the temperature dropped from billions toward a hundred million de-

The process of galaxy formation is poorly understood theoretically. It would be nice if we had instruments sensitive enough to look back far enough in our timescope to see it happening. It may be that the quasars have something to do with it, but they may, on the other hand, be only short-lived cosmic animals of a completely different species. Be that as it may, there is an enormous gap between the largest quasar red shifts and the red shift of the primordial black body radiation. That time domain is not yet open to us. Most exciting of all, would be a glimpse beyond the fireball, all the way back to the first hours and minutes and then to the cosmic egg itself—but we might not be able to make much sense out of what we saw.

The story I have told is one that is now believed by most astronomers (although there are a few diehards in the steady state camp of Fred Hoyle). After all, the history of the universe is written in the heavens for all to read, though if not always clearly enough for easy understanding by humans. Prediction of the future of the cosmos is far more problematic, and it is here that speculation begins to hold sway. Nevertheless, there is a growing number of relevant observational data, and the physicist must take these into account in his forecast, along with the cosmological principle.

The most obvious and important question one can ask about the future of the universe is: Does the expansion continue forever? Or does it run out of steam, slow to a halt, and go over to a collapse of the universe of galaxy clusters back upon itself? This is one of the most profound alternatives in the history of physics, and scientific opinion is about equally divided on the issue. The technical discussion is usually confined to what is called the Friedmann class of solutions of Einstein's general relativistic field equations. One has to assume something about the dynamic laws of the universe; it would seem prudent to place one's bets on Einstein.

The general theory of relativity is Einstein's bold revision of Newton's theory of gravity incorporating, along with mat-
The Celestial Timescope

ter, the very fabric of space-time as an essential dynamic entity. It has survived difficult tests in the solar system. It was used by Lemaître in his original Big Bang model of the universe and is the foundation of essentially all modern Big Bang models. Briefly, in Einstein's theory the material content, more precisely the mass-energy density of matter and radiation, warps the structure of space and time. The structure of space-time in turn determines the motion of matter and radiation: a particle, for example, an electron or photon, follows, from one space-time point to another accessible space-time point, its so-called geodesic, the "easiest," most direct path through the four-dimensional space-time continuum (three space dimensions, one time dimension).

The geodesic, or the equation it gives for the position of the particle in three-space as a function of time, may not define a straight line in the sense of Euclidean geometry, which is another way of saying the space may be curved. Thus in the solar system the mass of the sun curves space-time around it, and the earth moves in a curved path, almost a circle, around the sun. This is how gravity—described in Newtonian theory as a magical attraction exerted by one mass on another and vice versa—is described in general relativity. The geometry of space-time emerges as a vital dynamic element which is tied to matter, which is tied back to the material content, more precisely the mass-energy density of matter and radiation in the universe. The structure of space-time in turn determines the motion of matter and radiation, the "easiest," most direct path through the four-dimensional space-time continuum (three space dimensions, one time dimension).

The opposite of a black hole would be a white hole, which would endlessly spew out matter and radiation to infinity. Certainly no such thing has been recognized in astronomical observations, but I would like to think of an open universe as corresponding to such a thing on a grand scale. The central question of the destiny of the universe now reads: Is the universe a gigantic black hole or a gigantic white hole?

There are at least two types of observation which bear on this crucial issue. For one thing, the total density of matter in galaxies can be estimated. The result falls short of the density needed for closure by a factor of about twenty-five. This estimate, however, is not very reliable because galactic evolution, structure, and dynamics are so poorly understood. Also, there may be appreciable amounts of intergalactic dust. Nevertheless, one is confronted with the mystery of the missing mass, so named by those who for one reason or another (usually aesthetic) believe the universe should be closed.

Another observational approach to the central question is that when we look at great distance, we are looking at a sample of the universe nearer in time to the Big Bang. At such an earlier epoch, the expansion should have been progressing more rapidly than it is now because, in the meantime, gravity has slowed the rate of recession of the galaxy clusters. Thus, there should be a systematic deviation from Hubble's law, which should allow one to estimate the deceleration of the universal expansion. This has been done by Sandage in terms of distance estimates and red shift measurements on very distant galaxies. The uncertainty in the estimated deceleration parameter is so large that one cannot decide between an open or closed universe, but a closed one is not
ruled out. Further studies proceed apace, and, being optimis-
tic, we may well know the answer in the next decade.

What if the universe is open, i.e., what if it is a white
hole? Then the future of the universe is not very interesting, in
fact it is rather depressing. The galactic clusters will re-
cede further and further from one another. As time passes,
over a period of as much as a trillion years, all the thermonu-
clear fuel in a given galaxy will be gradually consumed, until
finally the stars wink out one by one. Darkness and cold and
death will embrace the limitless depths of space. Locally,
some black holes may form and gobble up others—maybe
each galactic cluster will end up as a large black hole, with
these super black holes fleeing endlessly from one another,
embedded in the dying universal white hole. There would be
a long future for life, but ultimate death for the universe.

A closed, black hole universe is in some ways a far more
appealing prospect. Though it would allow a shorter time for
life to evolve from man to higher stages, it implies the pros-
spect of a rebirth, or rather, reincarnation of the universe.
The universe is destined to collapse back to an enormously
potent cosmic egg, back to the singularity of energy density
from which it sprang. One expects it to rebound in another
explosion—the cosmic egg bursting again to give birth to a
new universe. The eminent and highly imaginative theorist
John Wheeler believes that the result will be a truly new uni-
verse, perhaps vastly different from ours in the sense that
quantum effects inside the cosmic egg will produce an un-
predictable change in such fundamental constants as the ra-
tio of the strengths of electric and gravitational forces and
the number of protons plus neutrons in the universe. The
second universe will expand and collapse back to provide the
raw material for a third universe, and so on into the infinite
future of a sort of super time transcending any individual
universe. Before our universe, there was another, which ex-
ploded and then contracted to allow the birth of ours, and
so on into the infinite past of super time.

In this fantastic picture, there is no need to postulate a
definite time for creation—one instead envisions a cyclic re-
processing of the universe, including the physical constants,
from everlasting to everlasting. The time scale for our cycle,
the life span of our universe, is expected to be at least sixty
billion years. We have at least twenty billion years to wait
before the turnaround, at which time the radius of curvature
of the universe will be at least nineteen billion light years.
There are at least forty billion years till the end of our time.
Since it took life some three billion years to evolve to us, seri-
al evolution to life of our stature could take place more than

a dozen times during the existence of our universe.

Depending on the physical constants, in some universes
life as we know it will exist; in others it will not. One can
imagine, with physicist R. H. Dicke, a kind of "biological se-
lection of physical constants," or, with science fiction writer
Olaf Stapledon, an intervention of the "Star Maker" (God)
in the workings of the cosmic egg, adjusting the physical con-
stants to produce universes worthy of Him.

In this view of cyclic reprocessing of the universe—which
presupposes a continued black hole nature—we may be re-
turning full circle to a picture imbued with human chauvin-
is, or rather, life chauvinism, or better still, consciousness
chauvinism. According to Dicke, as interpreted by J. A.
Wheeler:

... the right order of ideas may not be, here is the uni-
verse, so what must man be; but here is man, so what
must the universe be? In other words: (1) What good
is a universe without awareness of that universe? But:
(2) Awareness demands life. (3) Life demands the
presence of elements heavier than hydrogen. (4) The
production of heavy elements demands thermonuclear
combustion. (5) Thermonuclear combustion normally
requires several billion years of cooking time in a star.
[Man is made from the dust of long-dead stars; man is
literally stardust.] (6) Several billion years of time will
not and cannot be available in a closed universe, accord-
ing to general relativity, unless the radius-at-maximum-
expansion of that universe is several billion light years
or more. So why on this view is the universe as big as
it is? Because only so can man be there!

This is almost the antithesis of the statement: The scale of
the universe is far too great for man to be its central
theme. Why almost? Because by all odds the universe is in-
habited by countless other intelligences, cosmic brothers to
man.

Finally, what about creation itself? Here the physicist, in
truth, is at a loss. Physics is good only at "how" questions,
asked once the boundary conditions on the system are pre-
scribed. Understanding creation involves asking "why" ques-
tions about the boundary conditions on the universe. The
usual device of the physicist is to remove the question of a
beginning or an end by formulating a globally static world
picture (Einstein) or a steady state universe (Hoyle) or
cyclic reincarnation of universes (Wheeler). But the ultimate
"why" question, at the heart of religion and metaphysics, re-
 mains: Even if any such theory mimics reality, who or what
set up the whole scheme in the first place, and why?
When the student residence halls were constructed in the late 1950's and early '60's, a problem completely new to the University's hilltop campus was created. For the first fifty years or so, the main campus was an oasis amid the spreading city and the burgeoning suburbs. No streets, roads, or public thoroughfares of any kind intruded on the campus. Then the residence halls began to go up and the out-of-town students began to come in, until today there are about 2000 students living in the residence hall area who must cross busy Forsyth Boulevard to get to class or to do anything else on the main campus.

In the early '60's, to protect the students who had to cross Forsyth, the University built a wide and well lighted underpass. The concrete walls of the underpass hadn't even dried before they were covered with graffiti. For many years, students would write impolite and often vulgar if witty remarks on the underpass walls. As quickly as possible, University authorities would erase or paint over those attempts at al fresco but sub rosa belles lettres.

In recent years, the problem has solved itself. The underpass walls are seldom bare, but the usual graffiti has been replaced by birthday greetings, get-well wishes, philosophical observations, still lifes, portraits, abstractions, and news bulletins. The underpass has become the wall newspaper of the campus, a free gallery for one-person art shows, and a gigantic greeting card. Pictured here are a few of the student messages and works of art that appeared during one week in March. By now, it's all changed, we're sure. The show must go on.
Notes from the Underground
Upbeat Editor From Downstate

By ROGER SIGNOR

About two years ago, the Wall Street Journal decided to document the adage that small city newspapers are particularly subject to business and political pressures. The Journal was looking for a paper which took courageous editorial stands, but then backed down when pressured. In researching the story, a Journal reporter checked out a Washington University graduate, Jack Stapleton, Jr., who is publisher, editorial page editor, and columnist of The Daily Dunklin Democrat of Kennett, Missouri, a town of 10,000 population, located about 175 miles southeast of St. Louis. After his investigation, the reporter told Mr. Stapleton that the Democrat didn't fit the mold of a paper buckling under pressure. In fact, the reporter added that if he ever wrote a story on a paper which stood by its editorial convictions under pressure, the Democrat would be on top of his list.

While Jack Stapleton showed a certain amount of pride when asked about the Wall Street Journal incident, it was characteristic of him to peer through his pipe smoke and say with a deadpan, "Just the same, I'd like to know how the hell we got on that reporter's list in the first place." Stapleton is not a typical small town (or any town) editor. His paper has won numerous awards for excellence, his columns have been reprinted in books and are syndicated by the Associated Press, the paper's consistent quality has led to its choice this year as the subject of a University of Missouri graduate student's thesis.

Stapleton's philosophy of journalism is not "stay aloof and raise hell," but "be political and raise hell, too." He can spare the time to be political because he has hired bright and dedicated individuals who can handle the responsibility of day-to-day news gathering and news editing. Stapleton himself takes care of most of the paper's business matters, the editorial page, and his column. He often writes editorials and columns in the evening, when his staff has gone home. And he still writes news stories—about two a day. He is quick to point out, though, that he spends many hours of each week in politics. It is a tragedy in Stapleton's mind that to many Americans, politics is a dirty word, when, at the same time, most of them have never tried it.

"I think that newspaper people who don't get involved in politics and look down their noses at politicians don't really know what's going on," Stapleton said. A long-time political activist for improved mental health care in Missouri, he added emphatically, "When I visit a state legislator to talk about mental health—that's politics, pure and simple." Frequently, he has found himself pleading a mental health cause before legislators whom the Democrat had raked over the coals in an editorial or column. "My experience has been that most elected officials, if given the chance, will do the right thing. It's hard to be down on people who will act responsibly on mental health programs even though you've given them enough time in your editorial pages," Stapleton observed.

It is apparent from the record that Stapleton is extraordinarily dedicated to the cause of mental health. He is an officer of the Missouri Commission on Mental Health, which is ultimately responsible for the care of some 60,000 patients—more than the patient population of all general hospitals in the state. There is little public recognition for doing good works as a mental health commissioner, just problems. Despite their responsibilities, commissioners receive no salaries and are paid only for travel expenses. Why Stapleton takes on such demanding responsibilities in addition to his newspaper, gives insight into his personality. His answer is not the usual, shucks, somebody had to do it. It is a direct and personal answer.

"Frankly, until 1960, I had never been a crusader for mental health," Stapleton replied. "In August of that year, Governor Jim Blair held a conference on mental health in Jefferson City. The director of mental health, Addison Duvall, arranged for site trips and I was assigned to one at Fulton State Hospital. It was hot and very uncomfortable, but there was no air-conditioning at the hospital. We were taken to a ward for forty children, who were severely ill. Most of those children were tied to their beds. I don't mind telling you that it was enough to make me cry."

Stapleton did not simply return to Kennett and write another indignant editorial about deplorable state hospital conditions. He did publish considerable material on the subject, but, more importantly, he joined forces with other volunteer leaders in the mental health field. He became a formidable planner and lobbyist for better mental health care. "Those patients had almost no citizen advocates. I was proud to register as a lobbyist for them in Jefferson City," he said. Eventually, he was elected president of the Missouri Association for Mental Health and, after serving a three-year term in that office, was appointed to the Missouri Mental Health Commission in 1967.

It is interesting to note that Missouri's mental health budget has increased from $21 million in 1960 to more than $120 million for the 1974-75 fiscal year. Facilities have improved enormously and, certainly, the days of children being tied to beds are well behind us. For that, Missourians owe considerable thanks to many individuals like Jack Stapleton, who in the 1960's, acted rather than merely talked about mental health problems. At present, he sees the shortage of
qualified personnel to staff mental health facilities as the biggest obstacle to quality care. "Money alone won't buy better, individualized care," he added.

It is also true that quality in journalism depends on the availability of talented individuals. When asked how he is able to attract talent to a small city, Stapleton replied that in recent years young persons have been rejecting the notion that bigness is synonymous with quality. "Yesterday, I filled a reporter's job with a bright young Pennsylvania resident who is graduating from Bryn Mawr. She read copies of our paper which she borrowed from a college friend who is a native of Kennett. And she knows from her friend that Kennett is an attractive place to live." The county seat of Dunklin, Kennett has an excellent public school system, diversified industry and good health care, which includes the new Southeast Missouri Community Mental Health Center to serve Dunklin, New Madrid, and Pemiscot counties.

"It's the people in Kennett who give it the potential to grow," Stapleton continued. "They are informed and have a sense of priorities. Kennett recently passed by a 19 to 1 margin a bond issue to build a campus style high school with eight buildings, including a vocational school." Among Kennett's community leaders are a number of Washington University alumni, including: Sol Astrachan, businessman and mayor from 1961-69; surgeon Dr. Paul Miltonberger; and Stapleton's wife, the former Patricia Krueger of University City, Missouri, who also spearheads mental health projects in the area.

Jack Stapleton represents the fourth generation in his family to attend the University. Among his favorite professors were political scientist Carl McCandless and English professor James N. McClure, Sr., who taught journalism and encouraged Stapleton to become a newspaperman (both professors now have emeritus standing). Upon graduation from the University in 1949, Stapleton was accepted at both Northwestern's and Columbia University's journalism schools. But instead of continuing school he joined the Nevada (Missouri) Mail, turning down an offer for the night editorship of a daily paper in Honolulu. After finding that he liked journalism enough to make it his career, he took over the weekly Stanberry Headlight in northwest Missouri. The paper had been owned for many years by his father, who in 1953 decided to buy the Daily Dunklin Democrat and the Albany (Missouri) Ledger. Jack, Jr., assumed management of the Democrat and his father became publisher of the Ledger.
Stapleton frequently writes his editorials and columns in the evening, when the rest of the Democrat's staff has gone home. He spends many hours of each week in Missouri politics.

"My father always had a paper among his businesses," Stapleton continued. "He devoted considerable time publishing because he liked it, but it was not the most profitable of his interests." Jack Stapleton, Sr., also has always been heavily involved in politics, having served as manager of five statewide campaigns, including one for the U.S. Senate and two for governor. Jack Stapleton, Jr., can't recall when politics wasn't part of the Stapleton family life. Many prominent politicians visited the Stapleton's home in Stanberry. On one occasion, Stapleton recalled, Harry Truman was a house guest and fell asleep in the guest room while wearing only his underwear and spectacles. The scene was so amusing that young Stapleton, then ten, rounded up all his neighborhood playmates to observe the slumbering HST. "We had a great time giggling outside his window, but he didn't wake up."

Today, Stapleton regards the late President as "a good example of a politician who tried to do what was right despite the consequences. Raymond Tucker, when he was mayor of St. Louis, made very unpopular decisions that proved to be right in the long run," Stapleton continued. "I think that government at the local level is the most difficult. You have to answer your constituents every day." Stapleton respects many political Americans who, though not professional politicians, have taken unpopular stands on various controversial issues. They include John Gardner of Common Cause, and Washington University professor Barry Commoner, who has been outspoken on environmental issues.

When Jack Stapleton, Jr., moved to Kennett in 1953, he had to exert special leadership to transform the then twice-weekly Democrat into a vital daily. It had a circulation of only 3000, a twelve-member staff, one operative type-setting machine and one broken one. For several years, the financial going was rough. Finally, the Stapleton formula—a lot of local news plus his own brand of progressive editorials—caught on. The paper is financially solvent and its circulation and staff have doubled. The Democrat's relatively small circulation, however, doesn't reflect its influence. Its editorials, which deal frequently with state and national issues, are reprinted regularly by the St. Louis Post-Dispatch; the paper is read by many state and some national legislators, including Senator Thomas F. Eagleton, who often writes witty and incisive letters to the editor; and by Governor Christo-
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viously, supporting a Republican isn’t popular in Dunklin County, where the party doesn’t even bother to run a slate at the county level. Stapleton concedes that the kitchen heated up considerably when he endorsed Bond, but he stuck to his editorial guns (“Bond has a fundamental integrity that we must have in public office.”) Now, after the heat of the campaign, Stapleton has found that most of his friends have apparently forgiven him. On an recent occasion, however, he wasn’t forgiven for an unpopular editorial in which he attacked a tavern for illicit practices. Stapleton received a call from a man who threatened his life if he didn’t stop the criticism. Stapleton’s response was to write directly to the State Liquor Control Board, documenting his evidence and demanding a raid on the tavern. The raid was carried out and the tavern was closed. “I don’t take threats like that lightly,” Stapleton continued. “You have to take precautions because you worry about your family.” (Patricia and Jack Stapleton have three children, Carolyn, 19; Sara, 16; and Jack, 14.)

Some measure of the Democrat’s quality has been its awards: The Missouri Press Association sweepstakes award for general excellence in 1960, 1961, and 1962, when the association retired the trophy to the Democrat; citations from the American Political Science Association in 1961, 1967, and 1970 for distinguished public affairs reporting; and, perhaps the most significant honor, that of finalist in 1972 among all of the nation’s dailies for the Associated Press Managing Editors Public Service Award.

Most of the ten finalists that year, which included the St. Louis Globe-Democrat, the Miami Herald, and Philadelphia Inquirer, were cited for a single series of stories in the public interest. The Daily Dunklin Democrat was a finalist because of a range of projects in one year: reporting and editorizing on how unwed mothers were deprived of their legal rights by being barred from public education in an area high school; a drug education series; a successful campaign against Kennett eyesores and legal loopholes which allowed them to continue; free “situations wanted” ads for returning veterans; a traffic safety campaign; and a number of fundraising projects for medical emergencies, aid to the aged, and the indigent. “We didn’t win the final award,” Stapleton said. “The Newark News won and it should have. It did a tremendous series about drug abuse.”

One aspect of the Daily Dunklin Democrat that hasn’t been recognized by awards has been Stapleton’s fine sense of humor. This is revealed in his columns, where witty barbs are aimed at many institutions, but where he also pokes fun at himself. Here are excerpts from a column he published last March 1:

Sometimes America resembles nothing as much as a band of junkies trying to send a rocket to the moon to check out a rumor that the craters are filled with smack. I draw the parallel because now, as if we didn’t have enough to worry about, the nostalgia-mad purveyors of mass culture are trying to cook up a full-fledged revival of the Fifties.

Well, show me a young man dressed in a white sports coat, pegged flannel pants, a Mister Slim tie, a pair of oxblood brogues and a ducktail haircut and what do you have? You have one of the ugliest human beings on earth, that’s what you have.

I happen to belong to the Unknown Generation, that unhappy group of Americans who belonged neither to the Fifties nor to any other recognizable decade in which teenagers could display their idiocy and thumb their noses at the rest of the world.

Too late for the Depression, too early for the Fabulous Fifties, the only thing my generation can discuss with any nostalgia is a World War. How’s that for a memorabilia gap?

It’s an era that suffered the deprivations of no television, no rocket shots to the moon and no marijuana (which wasn’t used by anyone except drummers who upon inhaling one puff immediately became crazed clear out of their skulls). And who, save a few iconoclasts, could venerate a generation suffering from that kind of deprivation?

Still, on occasion, I think it might be fun to trade one of today’s frozen TV dinners for just one national leader who could look us all straight in the eye and tell the truth. That’s the trouble with a generation that’s only got a World War to remember—we’re too nostalgic.

Stapleton is sympathetic to the need for self-expression by others and goes out of his way to provide a platform for high school students, who may speak out as they wish on any issue. He also believes that idealism should receive support beyond the columns of the Democrat. This is one reason why he actively serves on the boards of such southeast Missouri organizations as the Missouri Delta Ecumenical Ministry, which helps poor people to share more fully in the economic and political life of the area. At the end of a long day, he drove by the group’s storefront office in nearby Hayti, Missouri. He stopped to go in and talk with five young workers who were assembling a newsletter. As he left the office he said, “They’re doing a terrific job. I don’t think it hurts to stop by and say so.”
The Art of printmaking has been relatively neglected in modern times. Yet, the medium can combine creative artistic expression and expert craftsmanship in a way that no other technique can approach.

Peter Marcus, associate professor of fine arts and chairman of the University's Print Department, has devoted the greater part of his career to the creation of prints. He is currently producing probably the largest lithographs from a single plate being made anywhere. Some of his gigantic creations measure 77 by 58 inches, which are gargantuan dimensions in printmaking. Marcus produces these giant works of art on a press he built himself. His insistence on impeccable reproduction prevents him from issuing large editions of his work; each print must be perfect in execution.

His craftsmanship, however, is only a vehicle for his art—although one must admit it makes a most elegant vehicle. In a recent review, New York art critic Jean Reeves wrote, "Marcus is what might be called a painter in the print... he is achieving a high level of artistic sensibility in these immense works. The best are as valid as works of art as large paintings are in their own sphere."

Pictured on the following pages is a selection of recent works by Peter Marcus, many of which have been exhibited at the St. Louis Art Museum, the Albright-Knox Gallery, and other museums and galleries throughout the world.
Marcus (right) rolls ink on printing plate as Don Taylor, fine arts graduate student, applies water by sponge.

All prints pictured are 77 by 48 inches.
Marcus puts paper down, registering carefully for application of second color. He works in his home studio.
After second-color printing, Marcus and Taylor, who has worked with him for two years, check as print is pulled off.
After each color's application, print is hung to dry. Next color is printed about a week later.
Comment

ON ELIOT HALL

As this issue goes to press, final preparations are being made for the formal dedication of a major University building as Thomas H. Eliot Hall.

During his two decades of service to Washington University as professor, department chairman, dean, vice chancellor, and chancellor, Thomas H. Eliot made an indelible mark on the institution. It is appropriate and fitting, however, that a major building on the campus his presence helped transform should bear his name as a permanent memorial. The choice of a building which will house the departments of political science and economics is a happy one, for Thomas Eliot is, first of all, a noted political scientist with a distinguished career as a teacher of political science, a scholar in the field, and a practical politician who has served in both the Congress and his government's executive branch.

It could be argued that the name of Thomas H. Eliot could be commemorated in many other places at the University—particularly in the residence hall complex that was completed during his chancellorship or in the splendid new Mallinckrodt Center that he helped so much to bring to the campus. But, it is most appropriate of all to link his name with the political science faculty on which he served for twenty years.

It is fitting, too, that the building which will bear his name is part of a larger complex that also houses the School of Law. Mr. Eliot is a lawyer as well as a political scientist. For four years of his Washington University career, he served as Charles Nagel Professor of Constitutional Law and Political Science.

Designed as one entity, the law school and Eliot Hall will share a common courtyard which is the entrance to both buildings and serves as a new northern entrance to the whole Hilltop campus. The buildings were conceived during Mr. Eliot’s administration and he presided at the groundbreaking ceremonies. Thomas H. Eliot Hall will become part of the new building complex that also includes the Seeley G. Mudd Law Building and the Eugene A. and Adlyne Freund Law Library. It is also linked to McMillan Hall, which houses the departments of sociology, anthropology, and the Social Science Institute.

As part of the dedication ceremonies, it is planned to unveil the portrait of Thomas H. Eliot painted by the late Fred Conway of the School of Fine Arts. The portrait will hang permanently in the building that is to bear his name.

The first symposium of its kind ever held in this country, a three-day “Women in Architecture” program, brought some 350 participants to the campus from all over the country. (In fact, even outside the country, including one participant from Sweden.)

The three-day symposium, held March 29-31, included workshops, discussion sessions, and special addresses by such nationally known speakers as Gertrude Lempp Kerbis, Chicago architect, and Regi Goldberg, a New York architect who is the founder of the Alliance of Women in Architecture.

A special conference on “Psychological Concerns of Professional Women” was held as part of the symposium. It brought to the campus such noted authorities as psychiatrist Bradley Soule, sociologist Whitney Gordon, and Kay Standley, Washington University alumna and psychologist.

The symposium opened with a bus tour of outstanding architectural attractions of St. Louis. The rest of the program was devoted to addresses, workshops, and panel discussions on architecture, on women in architecture, and on the role of the professional woman in general. From all reports, the addresses were provocative, the workshops productive, and the panel discussions profuse, provoking, and periodically profound.

We feel that we owe an apology to some of the readers of this magazine and its companion publication, the Washington University Alumni News. We hope that most of the readers have been receiving their usual single copies of both publications; we know that some readers have received two or more copies of each publication or both, and we fear that some readers may not have received any.

When a few justifiably irate readers began to write in to complain that they had received duplicate and even triplicate copies of the same issue, we checked with the University’s addressing division. The problem, we learned, is that the University is in the midst of converting its addressing to computer operation. When the conversion is completed, hopefully some time this summer, we are assured that each reader will receive one copy of each issue—no more, no less.

Streaking, the college craze of 1974, came to the Washington University campus early this spring, as it did to other campuses throughout the country (and not just to American campuses; it has shown up in Japan and Turkey, at the Academy Awards Dinner, and even at—or through—a precinct police station in north St. Louis).

The new streaking fad really didn’t get started at Washington University before it was nipped in the bud, so to speak. The first campus streakers appeared during an unseasonably warm period at the end of February. But then, March came in like a lion—or rather, like a polar bear. In early March, temperatures dropped almost to zero and the St. Louis area experienced a seven-inch snowfall. We won’t say that the unexpected spring blizzard put an end to streakers on this campus, but it certainly slowed them down.

FO'B
Fine arts students in Barry Schactman's figure structure class get down to the bare bones of their discipline. Drawing from the nude model is one thing, but these students are going one step further.