THE BIG MAN AT BUSCH STADIUM. Alumnus Bing Devine, general manager of the St. Louis Cardinals, looks over a model of Busch Memorial Stadium, home of the colorful baseball Red Birds. See "Bing Devine," beginning on Page 40.
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Washington University Magazine is published quarterly by Washington University at 1201-05 Bluff Street, Fulton, Missouri 65251. Second-class postage paid at Fulton, Missouri.
POLITICS ’68: Year of Involvement

By DOROTHY BROCKHOFF
Office of Information

It would be a mistake to assume that politics is every student’s “bag.” Seymour Martin Lipset, a Harvard pundit, made this point last winter when he observed in Daedalus that the vast majority of those on university campuses are “apolitical.” According to his estimate the combined membership of the Young Democrats and Young Republicans at universities and colleges in this country is under 250,000, and the new-left Students for a Democratic Society (SDS) has only about 7,000 members. Perhaps it was these statistics which prompted a chancellor at a Big Ten university to conclude a few weeks ago that “Most of the time, most of the students go to class and are concerned with what most eighteen-year-olds are concerned with—dates and grades.”

But that’s not the “whole ball of wax” as they used to say on Madison Avenue. Lipset, for example, counted noses before McCarthy’s Children’s Crusade got going, and he seems not to have considered that a good many of today’s college students simply aren’t joiners. As for the anonymous college official—he sounds as if he were a fellow well past thirty doing his best to convince an anxious board of trustees that there aren’t any bearded radicals at dear old “State U.”

Nevertheless, few who make the college scene could honestly disagree with either Lipset or the Big Ten spokesman’s central thesis—namely, that the majority of students aren’t involved politically. But a substantial minority are! And this group makes all the difference! Their numbers may not be large, but their influence is great.

Within their ranks are different kinds of activists. There are the SDS’ers, for example, whose “targets,” as Look magazine pointed out recently, “vary according to the political climate of the campus as well as the relative sophistication of the student body.” Some of them press for reform of the university structure and curricula, while others advocate greater student participation in administrative affairs. Each chapter, according to Look, “has its own thing.” But this is not the kind of political activity which is the focus of this article.

Rather, the concern here is with those students who identify with one of the three major political parties and who are involved in this year’s election. These young people believe that the political system can be made to work. A great many of them don’t like the system, and many of them are dedicated to changing it, but what matters is that they haven’t given up on it.

Some of their fellow activists have. Tom Hayden, not long out of the University of Michigan himself and in the forefront of the melee at Chicago, spoke derisively of a portion of those who still support the system when he told a reporter before the Democratic convention:

“We are not concerned about who gets nominated. Nor do we believe, as many of the young, probably idealistic McCarthy people still do, that you can change the Democratic party by working inside it. We regard that approach as equivalent to a hippie saying that he can achieve his goal of abolishing money by getting more and more jobs in banks. Among his followers are those who could destroy the entire political process but they are unclear as to what they would substitute for it. Playwright Arthur Miller talked to a youthful militant from the University of Chicago during the Michigan Avenue demonstrations and asked, “What do you want?” There was no answer.

The Washington University students who speak in this issue know what they want. They have all been given equal time, or in this case, equal space, to express their views even though the candidates they support are not all widely or wildly admired on this campus. No one can say with certainty just who would capture a straw election here now, but last spring when the Washington University students were polled McCarthy won. The breakdown was as follows: McCarthy, 51.5; Rockefeller, 15.0; Kennedy, 11.3; Nixon, 7.7; Lindsay, 3.7; Johnson, 2.4; Humphrey (write-in), 1.6; Percy, 1.4; Reagan, Hofstad, Wallace, 1.1; King, .5; Hatfield, .4; other write-ins, 1.1; and Stassen, 0.

The McCarthy vote is significant because it was his candidacy which most young people, regardless of party label, agree really shook up a great many who had never before been “turned on” by politics. McCarthy’s victories in some of the primaries, due in large measure to his youthful following, demonstrated the strength of “student power” in politics. Both Humphrey and Nixon are now trying to harness it. College students can be an effective political force. People will listen to them. On the following pages four of them tell it “like it is.”
Active student participation in party politics this last winter was mainly centered around the campaign of Senator McCarthy. Tens of thousands of college students throughout the country turned from protests and demonstrations to grassroots political work for party candidates.
The late Robert Kennedy liked to quote Goethe, who said, "The future of a nation is to be found in the opinions of its young men—under the age of 25." By Goethe's arbitrary standards only one of the quartet of students speaking up here, 21-year-old Tim Barnhart, seems fated to become a shaper of this country's destiny. The rest, although still in their mid or late twenties, have had it according to Goethe who, we can only conclude, was a better poet than a prognosticator.

All of which is not to disparage the abilities of Barnhart, who might easily qualify as Young Mister Republican in St. Louis circles. A senior majoring in political science, Barnhart has headed several Republican groups in this area, and a few years ago was president of the Young Republicans at Washington University.

Of his ability, a colleague said: "Tim probably knows more about politics (political theory, political candidates and how the system is run) than almost anybody whom I've come across whether on the right, left or middle.... I predict that within twenty years he'll almost control the Republican party in St. Louis, possibly in Missouri."

Barnhart, the politician, is of the new breed of Republicans. He's earnest, polite, and above all determined. And right now his aim in life is to elect as many Republicans as possible in November. Like many of his fellow party members on campus, he is especially interested in politics at the local and state levels. "We believe in starting at the grass roots," is the way he put it, "and gradually working our way into positions of authority and leadership."

"This procedure," he said, "differs from what the McCarthy people did. They tried to take the party by storm and were rebuffed. We, on the other hand, believe in working our way into the party structure slowly. We're not in positions of leadership yet, but we do have influence. In the long run, I think we'll probably be much more successful in getting what we want."

Barnhart has been interested in politics ever since he can remember, and his party loyalty has never wavered. He supports the Republicans because he thinks that "They keep government close to the people where the individual can have a greater say in what his government does."

Before the Republican convention, Barnhart was for Percy, but now he's solidly behind Nixon. He's convinced that the Republican standard-bearer is better qualified than Humphrey. Says Barnhart: "I think that Nixon has had more executive experience—after all he was vice-president for eight years. He was given great responsibility by President Eisenhower and is well acquainted with the world's leaders. I think Mr. Nixon also has a point too," he continued, "when he stresses that his eight-year absence from public office has given him a chance to sit back and reflect on issues. Humphrey has been too busy to spend much time analyzing problems."

Barnhart fields questions confidently—and keeps his emotions tightly under control. Only occasionally does he betray impatience as when asked what kind of a Republican he considered himself. "I call myself a Republican, period. I don't like hyphenated terms. We started using them in 1964 and it helped divide the party. Reagan made a good point when he was here in January. He emphasized that four years ago we labeled ourselves as moderate-Republican, liberal-Republican, etc., when in reality we were 'sucker Republican.'"

Barnhart is reluctant to say much about the war in Vietnam except to express confidence in Richard Nixon's ability to handle it. He talks much more freely about law and order. "Nixon's been accused of being a racist, but that's a lie. He's campaigning on behalf of the forgotten majority or the silent majority and Negroes fall into that category. Most of them work hard for a living, and it doesn't do them any good to come home and find their homes burned to the ground by a bunch of noisy radicals. A crack-down on law and order will benefit them."

Barnhart believes that Nixon has the edge in the election, but he's concerned about the Wallace candidacy. He thinks, however, that in Missouri the Republicans will do well because "they have a tremendous ticket." This year he's working behind the scenes, but once he earns a law degree Barnhart expects to run for office himself. And there seems little doubt about who will win that election. Barnhart, who else?
B I L L K I N G is a Democratic precinct captain in Hadley Township, which is in Washington University's back yard. But he's as completely different from the old-style wheeler-dealer who used to dominate party politics as Lindsay is from Dick Daley. A 27-year-old graduate student in economics, he is co-founder of the campus chapter of the United Students for Humphrey-Muskie.

His response to questions is crisp, direct, candid, and cool. Above all-cool. But King is no iceberg despite his studied self-control. He feels strongly about a number of things. Last spring, he was a McCarthy supporter who worked assiduously for the Minnesota senator. His dedication carried him all the way out to the West Coast, where he and some other McCarthy enthusiasts fought a valiant but futile fight to take the thirty-sixth California Congressional District for their candidate.

This summer found him still rooting and working for the McCarthy cause, but since the Democratic convention he's come out for Humphrey. This switch in allegiance has not been easy, and it has been lonely. There are not many ex-McCarthyites out stumping for "the Hump."

"It took a lot of soul-searching," King confided. "But now that I've made the decision, I'm sure it is the correct one. I feel that if one is oriented toward the issues then one must support the candidate who most likely will solve the problems that surround these issues. Looking at the candidates, I believe the only one who has any chance of making any progress is Humphrey. Individuals among the dissident Democrats on campus either think they can start a fourth party or by defeating Humphrey take control of the existing party and lead it on to great liberal things. I think this is ridiculous because if the party loses to a more conservative candidate, Richard Nixon, for instance, it isn't going to swing to the left. It's not going to become more liberal. It's going to become more conservative. To accomplish anything you first have to get elected.... So I don't think any of the arguments about defeating Humphrey in order to take charge of the party have any validity."

King speaks with conviction about Humphrey but he does not gloss over his shortcomings. "Humphrey's background is exemplary—he's the Liberal's Liberal of the fifties. But when he became vice-president he did subjugate himself to the Johnson administration. In fact, many of us wondered if he were the same man. The second problem is his war policies, which tend to be a bit hawkish, although I believe he's more of a dove than either Johnson or Nixon. He's got these two strikes against him, but we must also admit that the Johnson administration did initiate important liberal legislation. It wasn't all funded, but that was largely a problem of the war and a problem of priorities of the Johnson administration. Given the constraints of the Congress it was working with, I think that it did a good job—not a great job—but a good job."

King continued: "I think that this is something that we Democrats should recognize—those of us for whom Hubert Humphrey is not the first choice. Perhaps Humphrey felt that his best hope for accomplishing something was to work with the administration, even if it meant subjugating himself to it. That's giving him the benefit of the doubt which I'm inclined to do."

K ing revealed that he felt McCarthy had let his backers down a bit. "I think he should have done a little more homework. He just didn't come out with enough creative programs and solutions." King, however, may be disappointed but he is not bitter. "I still think," he added, "that McCarthy was the best compromise. I mean no one is perfect."

And King recognizes that McCarthy accomplished much. "He got young people interested in politics. The job the college students did was just wonderful—they are tremendous workers. Because of his influence many people became active in the party." These things King knows and believes, but he refuses to speculate about who will win the election. "I'm just not good at that," he confessed.

King foresees no political future for himself as an elected official, but he does intend to continue working for the party. "It's very satisfying," he concluded.
HE SPEAKS SOFTLY and is given to ending his sentences with the gentle southern expression, ma'am, but George Gerling is neither timid nor shy. He is angry, however, about the temper of the times, and more particularly the state of this nation.

"Things are rather sad to say the least," he says—"there needs to be a general housecleaning," and Gerling believes passionately that Alabama's George C. Wallace is the man to do the job. The 25-year-old Gerling, a tool and diemaker who is an evening student at Washington University, is chairman of the North St. Louis County Young Americans for Wallace group.

Gerling sees law and order as the big issue in this year's election, with individual and state's rights also key factors in voters' minds. He blames the minorities for many of our problems. "The minorities," Gerling explained, "are getting the total voice, they are getting the total press. They're getting the total coverage, so consequently some of their views are rather slanted."

When asked to elaborate and explain who these minorities are, Gerling declared: "There are various minority organizations throughout the land—I mean needless to say I don't like to speak on race issues or anything of this nature because I think it is rather superfluous. This thing has been beat to death by people. I don't think we have any race problem in this country. I think we have a spiritual problem, rather than a race problem per se. It's just a general spirit in this land." Gerling voiced disapproval of the hippies, the Yippies, and anti-war groups, adding later that he was a bit hawkish on the war. The young Wallace supporter stated: "I mean reasonable dissent is something else again, but out and out subversion, that's a little different."

The election of Wallace, Gerling believes, "would instill a little fear in some of the rioters, and some of the people who flaunt the law and the police. Such people would know [with Wallace in the White House] that there would be reprisals made upon them if they [continued] to do such things as yank down a United States flag in a park in Chicago and raise a V.C. flag. I think," he concluded, "that they are going to find out that there were a few people hung for a lot less in this country."

Gerling stressed, however, that he had no fears that Wallace, in his zeal to wipe out disorder, would establish a police state. He expressed this conviction several times, adding forcefully, "I don't think that you are going to see SS Troopers walking down the streets... or coming to your door in their brown shirts and hobnailed boots."

When reminded that both Vice President Humphrey and Richard Nixon claim that they too are for law and order, Gerling retorted: "I won't interject a comment about Nixon but Mr. Humphrey has identified himself with the [Johnson] administration over the last four years. Now I don't really think a leopard changes his spots." Gerling emphasized that Johnson and Humphrey had six years to enforce their law and order and he made clear that he thought that they had failed.

GERLING EXPRESSED THE BELIEF that many voters feel that they had a personal voice in Wallace's selection, because he said, "Three million of us nominated him. We signed the petitions and got him on the ballot. People can identify more with George Wallace than with the other candidates."

Gerling voiced approval of Wallace's reported intention to ask Congress to repeal open housing laws, but denied that the ex-governor of Alabama was a racist. Indeed, he insisted that no one had personally confronted him with that charge during the campaign, although he had expected it.

The University College student scorned the idea that the House of Representatives might have to decide the election if neither Nixon nor Humphrey received enough electoral votes to win. "Mr. Wallace says he is in the race to win," he said. As for the Alabaman's chances, Gerling predicts that they are excellent. "The campaign is building day after day, week after week and the people are just coming faster and faster towards him." The future, he concluded, is bright for Wallace and his American Independent Party in contrast to the Democratic party, which he emphasized was "dying."
A newspaper correspondent recently wrote that a new political button "puts the [Democratic] dissidents' thinking in a nutshell." It reads: "Nixon's the one—Humphrey's the other one." There's a kernel of truth in the generalization, but it's an oversimplification because it implies that the dissenters are united in their opposition to the Vice-President.

And that just isn't so. Some do want Nixon to win because, as a national spokesman argued recently, "It will accelerate the trend toward [party] realignment." A big faction sees little difference between Humphrey and Nixon and intends to register a protest vote by writing in a favorite—in most cases, McCarthy. Others, nobody knows how many, are on the fence.

One of these is Ben Senturia, an amiable, scholarly graduate student in botany. The scion and namesake of a distinguished otorhinolaryngologist, young Senturia, just 25, is rapidly making a name for himself in St. Louis political circles as the leader of the dissidents at Washington University.

Actually, the group is not limited to this University's students, but includes within its ranks housewives, businessmen, faculty, and students from neighboring institutions, professional people, and almost anybody else who is politically concerned. At least that seems to have been the original intention at the first few organizational meetings when some who had supported Rockefeller and other Republican liberals earlier this year are rumored to have appeared. Now, however, Senturia, who is president pro tem of the group, reports that his constituents have agreed to call themselves "The Citizens for Democratic Politics" and to work for the election of four local contenders, including Jim Symington, a Congressional aspirant, and Tom Eagleton, a candidate for the Senate.

The majority of these dissidents were fervently pro-McCarthy. They are part of a national movement, commonly referred to as the new politics, which is, as Post-Dispatch reporter Richard Dudman observed recently, "looking beyond 1968 to 1972 when they hope to control the convention." That theirs is not an impossible dream is the nightmare of some of the party pros, including Dick Daley. For the McCarthy movement, despite the fact that it ran into trouble in Chicago, was, as Tom Wicker has pointed out, "the major shaping force of the 1968 Presidential campaign."

Those who were caught up in this phenomenon as Ben Senturia was have no intention of quitting now. He's unwilling to talk in depth about the organization he heads because he correctly points out that it is still in its formative period, but he is eloquent about why he became a McCarthy supporter. And what he has to say is important because his views are similar to those of thousands of other students who campaigned actively for the Minnesota senator.

"The thing that attracted me to McCarthy," Senturia began, "was that he represented a change from the old-fashioned system of selecting a candidate and of campaigning. Here was a man who campaigned on the issues and for principles. It seemed to me," he continued, "that he was honest and forthright. He didn't talk around the issues. He faced up to them. Certainly his stand on Vietnam was one of the reasons why I backed him. It was that, coupled with his honesty, which I admired most."

Senturia, however, is not blindly idolatrous. He thinks that McCarthy's pronouncement on Czechoslovakia was unfortunate, and he believes that the Senator made other serious mistakes during the final stages of his fight for the presidency. But Senturia went to Chicago and came back convinced that he would write in McCarthy's name for President. Now, however, he's not so sure. "Nixon and Agnew are scaring me so badly I just might wind up voting for Humphrey," he says. But he added: "My initial reaction is that at this point the presidency is of secondary importance. If we are to do as the professional politicians have suggested and get our noses dirty, then we have to get involved in state and local politics. We can't just be intellectual liberals who talk and don't act."

If Senturia and the rest of the dissidents stick with it then quite likely both the Democratic party and politics in this country will be vastly different in years ahead.
In this penetrating examination of the contemporary campus scene, Professor Levi attempts to distinguish and evaluate three types of violent student protest. A member of the Washington University faculty since 1952, he has won international recognition for his work in contemporary philosophy, metaphysics, and the philosophy of literature and political and social values.

VIOLENCE
AND THE
UNIVERSITIES

At the Cathedral of Notre Dame in Paris there is a 13th century doorway which has for a long time been shut off from public view. This isolation has sheltered one of Notre Dame's thorniest riddles: the meaning of the eight sculptured bas reliefs on the outer sides of this "Martyr's Portal." In the first half of the 19th century scholars engaged in lively conjectures about their meaning. One suggested that they undoubtedly represented some obscure miracle of the Virgin. Another surmised that they were episodes, again quite unexplained, from the life of St. Stephen to whom the major portion of the portal is devoted.

Then in 1869 Count Felix de Verneuilh proposed a shocking new interpretation. His exposition came to have the title "Life of the Students"—a title over which, compared to the martyrdom of a Christian saint, a mist of secularism and frivolity seemed to hover. Yet his analysis was substantial and, in the end, convincing. In his opinion the sculptures were meant to support a broad reform of student life—a didactic purpose entirely in keeping with church art. The two sets of four panels each—one on each side of the doorway—represent the opposed life of "good" and "bad" students. On the right side the former are to be seen—diligently studying and attending lectures, giving alms and demonstrating filial devotion, while on the left side are the latter, shown in the company of loose women, brawling, imbibing the medieval equivalent of marihuana, and running afoul of the university authorities.

Why this is part of the decoration of the Cathedral of Notre Dame is clear. It is the secular academic analogue of the last judgment, with the "saved" on the right and the "damned" on the left (make what you will of this symbolic modern political appropriateness), and if it could be viewed by Clark Kerr and Grayson Kirk, by Charles de Gaulle and Willy Brandt, it might afford the modest consolation of an ultimate historical retribution. Who knows if the sculptured portraits of Mario Savio or Mark Rudd, of Rudi Deutschke or Daniel Cohn-Bendit may not substitute for the figure of Judas in the last supper of the contemporary university?

What clinched the Verneuilh thesis was to ask what the teachers and students and administrators at the University of Paris had been doing in the years between 1260-1270. And here the story is very modern indeed. They were doing exactly what the teachers and students and administrators of contemporary Rome and Belgrade, Berlin and Paris, Berkeley and Columbia have been doing: protesting and objecting, intriguing and conspiring, and from time to time fighting violently among themselves and with the police.

There exists a remarkable series of documents witnessing the violence of the times in the form of sermons by the Chancellor of Notre Dame, Philippe de Grève. Of student excesses he wrote: "They meet at night,
armed, breaking into homes, taking possession of young girls, carrying off married women, forcing them to submit to the most criminal outrages, wounding and killing their husbands, and of the wife of one, alas, making the prey of all, as was seen just this past year. . . .” Perhaps the good burghers of Clayton and University City might well reflect that apropos of the university in their midst, “they never had it so good.”

Periodically, but especially during Lent when, it is rumored, abstinence sharpened tempers, Paris was the scene of explosive “town and gown” disturbances. An especially outrageous incident which took place in 1229 had fatal consequences for the evolution of the University. During the carnival season of that year some students entered a tavern in the neighborhood of St. Marcel, where, as Matthew Paris tells us, “they found abundance of good sweet wine.” A dispute arose with the landlord over the reckoning, proceeding rapidly from words to blows and, the innkeeper calling in his neighbors, the students retired severely beaten. But the next day the students returned with reinforcements, wrecked the inn, set the taps to running anew, and then, drunk on insolence and wine, sauntered into the streets to amuse themselves at the expense of the apprehensive citizens.

But they had not reckoned on the behavior of the savage police of a savage city, for hearing of the disturbance, Blanche of Castille (the Mayor Daley of her time) impetuously ordered out the royal archers under command of the royal provost. By all accounts, the punishment they administered was gratuitous and brutal. Many innocent students were killed and hundreds thrown into the Seine. The masters at the university closed the schools in protest, but the Queen-Regent denied their demand that the guilty parties should be punished. Teachers and students responded spectacularly by declaring the university permanently on strike and proceeded to abandon Paris for other universities as far afield as Toulouse and Oxford. The shutting down of the University of Paris lasted not two weeks as at the University of California in 1964, nor six weeks as at Columbia University this past spring, but two whole years, and was terminated only in 1231 by the urgent pleading and repeated intervention of Pope Gregory IX. Thus the origins of that legacy of violence which has re-emerged to plague the modern university.

Wherever there are students there are problems and historical perspective discloses some continuity in the basic reactions of men, but it does not follow that all ages are essentially alike. Violence in the universities has always been with us, and yet the crisis situations of mediaeval Oxford and Paris and Bologna were significantly unlike those of modern Rome and Berlin and Columbia. The older disorders were between student pranksters and townspeople, or between secular and ecclesiastical authorities for the ultimate control of the university future: above all they were sporadic and mutually independent. But the present outbreak of student discontent throughout the world has reached the proportions of an epidemic, its violence has not only served épater le bour-
I am elv es living in a society which neither commands nor deserves their respect, where specialization and bureaucratization of the industrial society has led to a virulence that the nauseating scenes of late-August Chicago had seen? There is the brutal, immoral, and senseless spectacle of the Vietnamese War, the imminence of the draft escalating the conflict between the generations, the defeat of humanitarian ideals, great poverty in the midst of plenty, ghettos of black hopelessness in the richest country in the world, a politics of joy engineered by the worst hacks on Madison Avenue, and a general crisis of honor and confidence—sometimes called the credibility gap—fed by cynical and calculating public figures seeking only money and power. But in this case the crusades led by Mario Savio and Daniel Cohn-Bendit are the oblique consequences of righteous anger kindled in the fusion of burning youthful idealism and moral nausea.

The questions remain. Why this world-wide student discontent? And why has it internalized itself within the relatively secure and innocent environment of the community of learning? The questions themselves may be deceptive. For it may be that the universal syndrome of violence and violent protest has different causes in Prague and Paris, in Belgrade and Berlin, in Berkeley and on Morningside Heights, and it may also be that the once secure and innocent environment of the university community is no longer either innocent or secure.

Social scientists compete with one another in providing multiple explanations of the causes of violent discontent. Is it the work of a group of young members of the middle class, well fed and relatively pampered, the first fruits of a generation of over-permissive and befuddled parents, unconsciously seeking the authority they have lacked, but ambivalently, so that they seek passionately to confront it, confound it, and if possible destroy it? In that case Grayson Kirk becomes the pompous, imperceptive, and not very likeable victim of Mark Rudd's Oedipus complex. Or is it against a real and fatal lack of moral guidance and of any constituted authority in the university as a unified and massive institution against which they construct around figures like Chairman Mao, Che Guevara, Ho Chi Minh, Paul Goodman, or Herbert Marcuse? But in that event it is really a disenchanted, declassed, and somewhat pathetic group of students who, drunk on insolence and Herbert Marcuse (the two are singularly alike) march out of the Auditorium Maximum of the Free University of Berlin with Rudi Deutscher and his Sozialistische Deutsche Studentenbund to assault liberal democracy with such eggs and tomatoes as they can commandeer on their way.

Or is it rather that those born after 1940, whether in the "free" world or behind the iron curtain, find themselves living in a society which neither commands nor deserves their respect, where specialization and bureaucratization of the industrial society has led to a virulence of self-alienation in man which even Marx could not have foreseen? There is the brutal, immoral, and senseless spectacle of the Vietnamese War, the imminence of the draft escalating the conflict between the generations, the defeat of humanitarian ideals, great poverty in the midst of plenty, ghettos of black hopelessness in the richest country in the world, a politics of joy engineered by the worst hacks on Madison Avenue, and a general crisis of honor and confidence—sometimes called the credibility gap—fed by cynical and calculating public figures seeking only money and power. But in this case the crusades led by Mario Savio and Daniel Cohn-Bendit are the oblique consequences of righteous anger kindled in the fusion of burning youthful idealism and moral nausea.

The explanations are multiple, but it is important to give them heed, for the responses which we make to the world-wide violent protest in the universities hinges in large part upon our general assessment both of the current social realities and of the motivations of those who lead the violent student assaults and who participate in them. Values are nourished on a diet of facts. My approach to violence in the universities is not that of a social scientist—it is that of a philosopher and a moralist—but since moral attitudes are contingent upon our perception of social reality, and are validated or destroyed by its impingement upon them, I think that our moral judgment must await the result of a more patient analysis and clarification.

Who are the students who participate in violent protest in American universities, and what are their moral credentials—the ideas and the grievances which motivate their violence? Tentatively I have come to the conclusion that there are at least three very different groups with profoundly different aims, and that although they frequently combine to stage sit-down strikes, confront administrators, and battle with police unwisely called to the campus, our assessment and our moral valuation must be vastly different as we pass from group to group.

There is, first, the hard core of radical students whose aim is nothing less than the destruction of the university as a prelude to the destruction of an unequal and an unjust society.

"There is . . . the hard core of radical students whose aim is nothing less than the destruction of the university as a prelude to the destruction of an unequal and an unjust society."
vulnerable to the concerted attack of their violent intentions.

At Columbia, Mark Rudd, president of the local chapter of SDS, in an open letter to Columbia President Grayson Kirk wrote: "If we win, we will take control of your world, your corporation, your university and attempt to mold a world in which we and other people can live as human beings. Your power is directly threatened, so we will have to destroy that power before we take over." Further, in an interview published in a recent issue of Partisan Review, when asked about his goals, Rudd said frankly: "Our original goals took into consideration the Harlem gymnasium, the Institute for Defense Analysis, and so forth, but they also had the purpose of raising consciousness concerning the structure of American capitalism. That, really is the primary goal of radicals engaged in this kind of issue-oriented struggle. . . . And the harvest of this planting will not be seen this year . . . not in ten years . . . but sometime in the future when this understanding of capitalist society bears fruit in a much higher level struggle. In revolution."

That this kind of activity is premeditated and conspiratorial there can be little doubt. The New Republic of May 11, 1968, reported: "Months before, at an SDS conference in Maryland, the decision had been reached to take physical control of a major American university this spring. Columbia was chosen because of its liberal reputation, its situation in New York, and the fact that it was an Ivy League school. SDS felt it was important at this time to disrupt a private, prestige, tactically vulnerable university." And, as Mark Rudd admits, the manifest aims of the Columbia rebellion were largely pretexts.

The New Republic continues: "The point of the game was power. And in the broadest sense, to the most radical members of the SDS Steering Committee Columbia itself was not the issue. It was revolution, and if it could be shown that a great university could literally be taken over in a matter of days by a well-organized group of students then no university was secure. Everywhere the purpose was to destroy institutions of the American Establishment in the hope that out of the chaos a better America would emerge."

What ought to be our reaction to violent acts of student dissenters of this type? The late Winston Churchill once said: "I have not become Her Majesty's Prime Minister in order to preside over the liquidation of the British Empire." Similarly, I do not believe that teachers and administrators who have devoted their lives to the cultivation of the mind, the transmission of the tradition of humane learning, and the education of the next generation propose to sit quietly while the entire edifice of higher education is pulled down by the forces of a sometimes conscientiousness, but dangerously misguided and fanatical youth.

As we have come to recognize through the unhappy events at Columbia, nothing is easier than for a group of determined students to take over a university which is, after all, no fortress, but an unguarded pasture for the life of mind, has no army, no police force of its own, and is ill-suited by the very nature of its institutional life for the rigors of violent combat and defense. The university has, of course, its own legitimate internal sanctions of discipline against lawlessness and impermissible acts: probation, temporary suspension, even permanent expulsion from the academic community, but these it has often seemed unaccountably reluctant to use. I think it will use them more frequently, more determinedly, and more responsibly in the days to come.

One of the most irrational and inconsistent demands of the leaders of the Columbia revolt was that after the shouting had died down no punishment or discipline should be exercised against them—"amnesty" was, I think, the word they used. And it indicated how egocentric and morally immature they essentially were, since even proponents of civil disobedience like Ghandi and Martin Luther King were prepared to accept the legal consequences of a profound moral protest. No university seriously interested in its own survival and mindful of its educational responsibility for the disciplining of lawlessness dare refuse its obligation to punish those who engage in the tactics of disruption, especially those whose very political philosophies commit them to acts of violence rather than the legitimate protest which seeks for adjudication through responsible democratic processes.

The escalation of outrage received in silence is a danger too enormous to risk, as we of the last generation have experienced it in the days of Nazi insolence before the invasion of Poland, when the provocations were continuous and no resistance was forthcoming. David Low, the great British cartoonist, caricatured this infamous patience in a cartoon of Neville Chamberlain, the British Prime Minister, saying to the German Chancellor: "Sir, you have starved my ancient mother, kidnapped my wife, raped my daughter, burned down the Houses of Parliament and sunk the British Navy, but beware, Herr Hitler, someday you will go too far."

I can see before me now the image of the tender-minded and perhaps conscience-stricken section of the Columbia faculty saying to Mark Rudd and his associates, and this time not hyperbolically, but in literal truth: "You have seized five university buildings, barring students and professors from holding classes without their vote or consent, you have broken into the offices of the President of the University, opening, ransacking, photographing, and making public his confidential files, you have held a college dean prisoner in his own office for over 26 hours, calling him to his face names unprintable

"No university seriously interested in its own survival and mindful of its educational responsibility for the disciplining of lawlessness dare refuse its obligation to punish those who engage in tactics of disruption..."
in the public press, you have burned the offices of three professors who have been unsympathetic to your strike, including the research notes of one of them which were the fruit of ten years of patient research, but beware, SDS, one day you will go too far!"

The second class of students who participate in violent protests is considerably larger, relatively unorganized, more heterogeneous and amorphous in its composition. It is made up of those who have a burning concern for such aspects of American foreign policy as the Vietnam War and our defense commitments around the world, as well as our ongoing internal social problems; justice for the black community, poverty as a specifically anchored disgrace, the pageant of American brutality and neglect in its many ugly guises. It is also composed of those who have concretely suffered from these evils—students anxiously awaiting a draft for a war to which they are profoundly opposed, black students feeling the burning injustices to their kind, representatives of dis-\q_herited and disadvantaged minorities of every stripe.

It is characteristic that at the Columbia uprising it was black students who alone occupied Hamilton Hall, re-christened it "Malcolm X Hall," and declared with quite unconscious humor that it was now finally a part of Harlem. When the leaders of this group of black commandoes were later interviewed, they said frankly that in their view the chief issue of the Columbia rebellion was neither student power nor world revolution, but simply the threatened building by Columbia of a Jim Crow gymnasium on public park land in the heart of Harlem. They opposed chiefly the flagrant use of Columbia's position of political strength to take advantage of the political powerlessness of the black community.

It is equally significant that when one of these leaders was asked: "In your view is the role of black students at a university different from that of white students?" he answered at once: "I would say that black students at this university have demonstrated that they view themselves essentially as an extension of the black community and that their primary identity is with the black community and not with the university community."

There is a sense, then, in which the bias of this second class of protesters against the university, as well as that of the first class is a protest from outside.

How are we to view the protesting acts of student dissenters of this second class? With considerable sympathy, I think, for in most cases their moral credentials are high. The Vietnam war is a dirty and immoral war and it is heartbreaking to any true American patriot, jealous of the reputation of his country and of its good name in its affections and in the sight of the world. The condition of our negro population and the way it has been deprived of economic opportunity and civil rights is a disgrace. The level of political morality and of simple honesty in speech and intention of those who govern our nation and who aspire to its governance is dangerously low.

Students of the present generation, as distinguished from those of a decade or two ago, have markedly political interests, and a reservoir of resentment against social injustice which, like a permanent floating libido is ready to be mobilized at any moment, on any issue, against any opponent who presents himself. Yet one cannot escape the conviction that these students of the second class are too ready on the trigger, too mindlessly committed to violent methods, too irrelevantly directed in most cases in expressing their anger within the university environment. They are like those foolish ones who have lost a dollar at night, and who look for it not where they have lost it, but under the street lamp where the light is better. Their grievances are real, but they are expressed at the wrong places—where the vulnerability is high and the defenses weakest, but not where the true blame and the true responsibility lies.

The last class of student protesters is enormous in number and is composed of almost all the undergraduates and graduate students in the school of arts and sciences. These are the 8,000 who sat down outside Sproul Hall at the University of California in 1964, the 4,000 who milled about in front of Low Library at Columbia last spring. These are the ones who initially are politically uninvolved, who stand curiously around the small group of militant protesters watching to see what will happen. Only in the face of truly monumental administrative unconcern or outside police brutality do they join the ranks of the violent minority. Why are they prepared to do so? Why is their loyalty almost never to the university as such? This class of third-act walk-ons (without a particle of disrespect), I shall call "the sheep."

Men live less by firm sensory reality than by images, by the pictures in their heads, and by the abstract concepts through which they interpret experience. In attending to the literature of violent student protest and to its rhetoric, I have been struck over and over again by the imagery which pervades this discourse. On last April 28 a large sign was to be seen over the balcony of Columbia's Mathematics Hall which read "Rudd Hall, Liberated Zone #5." Interviewed later, Rudd and his associates spoke of the university as an institution for the transmission of bourgeois and racist ideology.

Four years before at Berkeley, the leaders of the Free-Speech movement spoke of their university as a factory—a knowledge factory and a manpower factory, utilizing all the techniques of a computerized and a coldly impersonal science to separate, classify and process their human materials to serve the interests of the larger technological society. To be sure, in this latter case,
they were but taking their cue from their own Chancellor Clark Kerr who, in his famous Godkin Lectures at Harvard on "The Uses of the University" the previous spring, had noted the change of the older colleges into universities which were now but enormous corporations for marketing knowledge and skills, and had, he intimated, in the process lost considerable of their intellectual and moral identity.

It is obvious the behavior of students will be patterned upon the conception of the university which they hold, the conceptual model which they accept as genuine and valid. Naturally, if to you the university is the battleground of class war, you will find the manuals of guerrilla warfare of Ho Chi Minh and Ché Guevara supremely relevant, and you will convert Mathematics Hall into "Liberated Zone #5" as soon as you have the opportunity. Naturally, if you see the university as the skill factory of the technological society, you will resent the impersonality and unconcern of the professorial speed-up system, and you will resist with a slow burning resentment the attempt to turn you from a person into a thing—a mere educational commodity. Naturally, if you consider the university as the creature of the business establishment, as the selfish and unloving great modern corporation, you will see your chancellor as the tool of his conservative board of directors, and you will strike for better hours, better working conditions, and more privileges as if you were the 19th-century victims of a system of brutal child labor.

The rhetoric of student protest is pervaded by the imagery of the battlefield, the corporation, and the factory, but what is singularly absent is the imagery upon which I was raised, and which has never ceased from influencing my own conception of what education, both higher and lower, is all about. This is the imagery not of the gesellschaft but of the gemeinschaft, not the cold contractual association, but the intimate community of the teachers and the taught, the family of learning, where the school, like the real family, is the great social invention for the making of persons, the intellectual and moral community where the sexes and the generations live together in the harmonious atmosphere of a common intention and a common aim.

If this is crass sentimentalism, it is a kind for which there is real historic precedent and justification. For it represents the consensus of the longest segment of the tradition of humane learning. The affectionate analogizing of the university to the family has a venerable history. She is the "alma mater"—the nourishing mother—and her offspring is the "alumnus," in the original meaning of the Latin "one who is, or has been, nourished." From philology we may therefore learn that the essence of the university is the concept of "nourishment," and we may infer that most of its contemporary evils and misfortunes spring from the impoverishment or corruption of this pristine idea.

Thirty-five years ago Robert Maynard Hutchins, then President of the University of Chicago, delivered a lecture whose message was to be prophetic. His text and his title was taken from a line of John Milton: "The sheep look up and are not fed," and he used this text to illustrate the plight of students whose real needs for liberal and humane education were thwarted by crude vocationalism in the universities, the absence of properly equipped and dedicated teachers of the liberal arts, and the many impediments which a noisy and unenlightened business civilization had put in the way of the only kind of education worthy of a liberal democracy—one which should produce not technological trainees or narrow spe-

"... a rededicated faculty and wisely leading administration will do everything in their power to reduce the educational environment to manageable size, to promote fruitful interaction, and to make the campus, indeed, a family of learning."
Violence and the Universities

counter-revolt." He was right. Sooner than he thought. And closer to home than he ever dreamed. Ironically the counter-revolt commenced in his own back yard and brought about his own downfall.

There is an obvious correlation between violent student protest and a monstrous size, impersonality in human relations, student neglect, faculty self-centeredness, and administrative remoteness and Olympian grandeur. At Columbia too, the student body is enormous, classes are much too large, the faculty lives in Scarsdale or Queens and hardly knows the university as a place, a locale, a living environment, and Grayson Kirk, its president on whose board he sat, the President of IBM whose educational nest he feathered, and the Secretaries of State and of Defense.

Who can deny today that the university plays a somewhat different role in the family constellation? Somehow in this age of ambiguity and organ transplants, the university has changed its sex. It is no longer the "alma mater"—the nourishing mother—but the "nefarius pater"—the wicked father—and I am afraid largely for reasons which make the rhetoric of "factory" and "corporation" not so irrelevant after all.

In an article entitled "Universities as Big Business" in Harper's, James Ridgeway says: "The universities have been so successful in safeguarding their privacy—particularly with respect to their finances—that few people are aware of the extent to which the worlds of higher education, big business, and banking are linked through interlocking relationships among professors, college presidents, and trustees, industry and government, relationships whose chief victims are the more than six million students the universities are supposed to teach."

It is no new thing that a university must be related to its surrounding community, as a power station or an art museum are so related—as a center of light or a source of culture and aesthetic taste radiating outward. And it is natural that it should be supported by local wealth as an object of pride and respect, and not for reasons which are selfish and profit-seeking.

However, all of the economic relations of a university are not so innocent. Much of the income of Columbia comes from exploited slum property in the ghettos of New York and some of Harvard's from large holdings in Middle South Utilities Inc. whose constituent companies in Mississippi and Louisiana are allegedly managed by white racists and members of the Ku Klux Klan. Harvard undergraduates have in recent years repeatedly challenged the legitimacy of this income source.

To command respect, particularly from the young, the university must be like Caesar's wife—morally beyond reproach. What church worthy of the veneration of its members is built out of the profits from dope peddling and prostitution? Nor can a university claim to propose academic research and relevant and humane academic research, and the violent student protests will be gone with the wind.

I have attempted here to distinguish three types of violent student protest and to furnish, at least implicitly, a differential evaluation for each. For the first class, the hard core of radical students whose aim is nothing less than the destruction of the university—their violence should be dealt with justly but determinedly. Their aim is not improvement but disruption, and their offenses, if continuous, should be met with permanent expulsion from the academic community. For the second class, those who have a burning concern for social justice in general, or are members of militant minorities, we must say: We have sympathy for your motivation, but your acts are misdirected. For the university is not a political institution nor the underwriter of social policy at large. Your business here is learning in one of the few environments left in the modern world where such objectivity is possible, where freedom of expression and inquiry are actively encouraged, where rational debate is permitted to follow wherever the argument leads. Be thankful for your opportunity and take your violence elsewhere. Do not use it to destroy one of the few remaining centers of liberal democracy in the modern world.

For the third class, the vast majority, who feel rightfully that somehow the modern university has gone astray in its neglect of undergraduate teaching and student concern, we must be most attentive of all. For this is criticism from within, directed to the one thing which we within the university have the power to affect and to improve. Here we all have something at stake and a re-dedicated faculty and wisely led administration will do everything in their power to reduce the educational environment to manageable size, to promote fruitful interaction, and to make the campus, indeed, a family of learning.

How will the present violence terminate? Who can foretell? As Tocqueville said of the Revolution of 1848: "In a rebellion as in a novel, the most difficult part to invent is the end." In taking as my title "Violence and the Universities" I have been conscious of a certain quaint incongruity of two concepts which do not really belong together, of something like the paradox of the round square in mediaeval theological disputation. But that is because underneath I am convinced that the imagery of the battlefield, of the factory, of the establishment corporation have really nothing to do with the domain of liberal education. I look forward to a rebirth and a restoration—to the time when the university shall be once again in fact the community of scholars, the family of learning, the "alma mater"—nourishing mother of us all.
The turn of the twentieth century saw Washington University as a solidly established, much admired institution situated in the heart of downtown St. Louis. But how they scoffed when hardware merchant Robert S. Brookings, president of the University Corporation, announced that the University would move to a new location miles out in the country—even further from the levee than the site of the coming World’s Fair!

Brookings Hall, then known as University Hall, was constructed before the 1904 World’s Fair for temporary use by the Fair and eventual use as the central building of the new campus. Its site was a rolling pasture west of Skinker Road, then a muddy set of ruts that ran south from the new streetcar line. Design and construction of the new building was smoothly executed with only a few minor hitches. A controversy over building materials was settled when the University’s entire board trooped to the Vandeventer Avenue headquarters of the Pickel Stone Company to choose from several “mock-up walls.” Missouri red granite was a popular choice over brick. When a young member of the architectural firm appeared on the site in a white shirt to direct the endeavors of these skilled, experienced craftsmen, many stoneworkers threatened to quit the job—and a few actually did.

The elements were kindly disposed and work went rapidly, despite the tight architectural specifications. Stonemasons puzzled over the uneven dimensions of the octagonal towers (they are not true octagons but measure nine inches narrower through their north-south faces) and European stonecutters scratched their heads in wonder at gargoyles that did not carry water from the eaves in the traditional European fashion. Hundreds of interested citizens flocked to the site to view the vaulted ceiling of the main arch, a very difficult piece of stonework, rare even today in an age of reinforced concrete and other “modern” materials. A narrow gauge railway transported thousands of yards of earth to fill low spots on the site and the present “Hilltop” landscaping slowly took shape. Precious topsoil was nearly lost when well-meaning, but uninformed, volunteers began filling sandbags at the project to help stem the “June Rise” of the Missouri in ’02.

Despite these hazards and hardships, the buildings were ready for leasing to the Fair, bringing vital income to the University. Since that day, Brookings Hall has stood proudly facing the city where cynics once jeered at the idea of the young University moving out into the country.
The stone heads, figures and grotesques that festoon the Brookings walls are called, in the terminology of the stonecutter, "bosses" rather than gargoyles. Unlike true gargoyles, which are used to transport rainwater, the "bosses" serve no other function than to decorate the exterior of the already ornate building.
The building abounds with plaques and seals, such as this one just west of the main arch. Yet one of the mysteries of Brookings is the absence of seals and carvings in several areas. One niche, obviously intended for a small statuary group, has remained empty since the building's completion.
Attention to detail is a mark of good architecture and Brookings is a study in detail. The door pulls are a continuation of the building's basic form while interior doorknobs are decorated with stylized WU's, some green with disuse while others are polished brightly by being turned hundreds of times each day.
The lion fountain, a gift of the class of '09, has been known by generations of University students as the ashtray of the main Brookings arch. No one can remember when water last ran in the fountain, although students of the early sixties can recall the dentistry job done on the lion to remove chewing gum from his fangs.
Modern living requires certain alterations in the original design of any building. Brookings is no exception but even vinyl tiling and fluorescent light fixtures do not detract from the grace and beauty of the tower staircases. The tower room, once the assembly room of the campus, is now the home of alumni records, carefully filed on IBM punch-cards.
Alumna Sallie Squires was one of a group of Quaker volunteers who worked in Vietnam last year until the Tết offensive descended upon Quang Ngai province hospital. Coping with woefully inadequate facilities and overwhelmed with patients, Sallie's experience is summed up in her cry of "Children, children, children, all the world is made of children!"

In the Quaker Rehabilitation Center in Vietnam, teasing and laughter were essential therapy for both patients and staff. The forty-year-old patient at right had whispered loudly that she wanted money to go home. Some problems must be handled lightly.
QUAKER IN VIETNAM

The children straggle in to the hospital at the rate of about a dozen a day. They come carried by unknown refugees on improvised litters, astride the backs of mothers, huddled in the arms of an older sister or brother, hobbling alone on makeshift crutches, or led by the hand of a new friend.

They come, along with hundreds of adults, to camp in the dust of the compound that is Quang Ngai Provincial Hospital, 325 miles northeast of Saigon. They sit or lie or squat Vietnamese-style and wait. They wait to see what will happen. They sleep and eat there, waiting, because only there is there hope. From somewhere they have heard of a hospital where civilians are treated, and they, the war maimed and homeless, are wanderers who turn their steps will-o-the-wisp toward any goal.

They may wait days for a doctor or nurse to attend them, for the Quang Ngai Hospital is understaffed and overcrowded. It is the only civilian hospital in the province, where an already populous coastal plain has been flooded with 200,000 refugees. The hospital, south of the Demilitarized Zone, is in the midst of continuous warfare. Each of its 360 beds is shared by two, sometimes three, patients, for the hospital always has at least 600 patients and a stream of ill and wounded constantly flows into its courtyard and corridors.

A year ago a group of workers from the American Friends Service Committee quietly moved into the compound to take over a vacant building and establish the Quaker Rehabilitation Center. They had come at the invitation of the government to treat the amputee and the burn victims who sometimes came to the hospital and always left it with stumps of fingers, legs, and arms hanging limp and useless. Before the Quakers came, the hospital had no facilities for rehabilitation.

Among the Quaker volunteers—for no one at the center is salaried—who arrived to set up the center was Sara Janet (Sallie) Squires, a pretty, dark-haired Iowan who was graduated in 1963 from Washington University with a bachelor of science degree in physical therapy.

In the summer of 1967, Sallie, who is a Quaker, was working at the Methodist Hospital in Minneapolis when she received a letter from the Service Committee asking if she would join the project. The letter came at a time when Sallie was restless. "I had begun to realize that I couldn't be satisfied with looking on, with reading the newspapers and passively being a part of what was happening. I was eager to do something active to relieve the suffering of the civilians who were being overwhelmed by the war."

Like the sixteen other American, British, and Dutch volunteers who arrived in Vietnam in 1967, Sallie is totally opposed to war and to violence of any kind. In Vietnam the Quakers are responding to human need in suffering, as the Friends have responded for centuries.

In October, Sallie wrote: "Our Quaker principles are maintained when we are offered ammunition, guns, and sandbags for protection against mortal attacks. We have refused any weapons and have had no trouble to date. The military men do not understand us, but that's okay, our consciences do!" The Quakers have been asked to come in compassion and they have come, intending to stay until their long-range goals have been accomplished.

The oldest of the Friends programs at Quang Ngai is a day care center for refugee children which was established in 1966. It is the first of the Quakers' self-help programs in Vietnam. The rehabilitation center is the second. The seventeen-member staff came to treat the war's helpless and confused civilian victims and to train Vietnamese to treat their own. After less than a year at Quang Ngai the staff was designing and building nearly 200 artificial limbs each month and training the Vietnamese in the art of limb-making and fitting. Daily the three physical therapists were treating about sixty patients and teaching the Vietnamese as they worked. The Têt offensive caused the Quakers to close down the center. Sallie explains that the decision to pull out temporarily was the group's own decision "because we could not carry on our service."

The prosthetist and his twenty trainees were the first to return to Quang Ngai. Most of the rest of the staff will return this fall. Sallie, however, at present will not rejoin the staff. She has come home to Ames, Iowa, where she is
QUAKER IN VIETNAM

The major causes of injuries treated in the Rehabilitation Center were directly war-connected—civilians wounded by gun shots, hand grenades, mortar shells, or land mines. In a brief note in a scrap book Sallie kept she wails "Children, children, children. All the world is made of children!" Half of the center's patients are children, as Sallie muses "perhaps because they survive. Perhaps people bring children because there is hope for them." A Quaker Service report indicates that more than a third of all the refugees pouring into Quang Ngai Province are between the ages of three and seventeen.

Dorothy Waller, a co-worker of Sallie's, wrote from Quang Ngai shortly after their arrival: "I wish you could see the X-rays of these fractures. In the States we would see a fracture of these magnitudes maybe once every three months or so. Here, they come in multitudes daily—by lambretta, by pony cart, by cycles, and in the arms of their frantic families."

She told of the first amputee to begin the training program they had set up—a 16-year-old boy, hit by artillery fire, who had lost his left leg and fingers on his left hand and had a deformed right ankle. "Last week when I was making a survey of amputees I noticed him walking all over the ward and upon the stairs on his knees. . . . He was discharged from the hospital some time ago but keeps coming back from wherever he has holed up and is right on deck in the ward each morning. This may be the only place the poor lad can find anything to eat."

Seventy-five per cent of the patients treated by the physical therapists were amputees. "They were victims," Sallie says, "of either wounds or infections. There is so much disease—a lot of polio—and filth. We treated some burns, most caused by the native stoves which explode. We saw very few napalm victims; most of these never reached us."

Once the center was established, the patients came because they had heard of the presence of the people who made limbs. Occasionally a patient would be referred by a military medic or brought in by a G.I. who had found him in need.

If a patient was brought in by family members, the family would often stay, camping in the courtyard or the corridor, cooking scented meals on the little portable stoves. If the family had somewhere to stay, such as with friends in the city, the patient would become an outpatient so that the hospital bed could be used for a newcomer.
Often, however, children had no one with them. They would wander in alone or with a group of refugees who had found them in the rubble of a demolished village or home. Often they were orphans, some were nameless. For them and for homeless adults, the center is beginning to build a ward to house them during their treatment in the center.

In a letter home in November, Sallie wrote of a 13-year-old boy, Nguyen Si. "Less than a week ago he suffered a traumatic amputation of his middle finger and fractured ring finger; shrapnel freckles dotted his palm. He sat there soaking his hand in a basin of warm water and Wescodyne... never a whimper, cry of pain or a mumbled moan. Suddenly I became acutely aware of the government, the government is not the people and they have no family left." We read statistics and accounts of people killed, displaced, and wounded. Somehow the paper, the ink, the words lack the tremendous impact that this child had on me in a few seconds—his mangled hand, his frightened face, his bleak voice. And there were hundreds of others in the same dismal existence!"

Although the Quakers came at the invitation of the government, the government is not the people and they were greeted with hostility—open and passive. Sallie says, "To the people we were white men. We looked like the men who had brought the destruction. Their distrust was open. But at first the Vietnamese doctors in the hospital were passively hostile. They would not write orders for a patient to be sent to therapy. We went through the wards, looking at patients, picking out those who would be candidates for rehabilitation. We wrote our own orders and took them into therapy. Now all of the hospital doctors write orders."

The original Quaker team included one physician, one nurse, a prosthetist, a medical-social worker, and three physical and two occupational therapists. In a little more than a year the center has added fifty-five Vietnamese trainees to the staff. They are being trained in limb-making and fitting. The center has no orthopedic surgeon, which it badly needs to treat some of its wounded. The hospital, itself, has none, although half a dozen physicians—Vietnamese, American, and Canadian—are provided for the Quang Ngai Hospital staff through one international and several American relief programs.

Sallie relates her coming to Quang Ngai after a few weeks of orientation that included a 50-hour Berlitz language course. "Despite the training, all of the patients looked the same and all of their names sounded alike. The wounds were impossible to imagine or describe. Even in the hospital it was impossible to maintain any kind of sanitary standards. The wounds I saw in a week would make most Americans go hysterical from the pain."

"But after a while the strangeness vanished. Each patient took on an individual character. It was often the children who could pick up our terrible Vietnamese who would act as interpreters. And as they watched us, our patients would begin to help one another."

Sallie tells of one small, fragile 12-year-old boy who had lost his left leg at the hip when he innocently wandered on to the site of a land mine. He was brought from his village by an American helicopter crew who had heard the Quakers were working with amputees. "When I first saw him, he was hobbling around on a stick with a little branch 'Y,' wearing a tattered old straw hat. He was frightened and bewildered at first, but once he was at home we found that he was a lovely, merry child, despite the terrible trauma he had been through. His name was Huynh Phan, so I nicknamed him Huck Finn."

Sallie and the staff found that the child had good range of motion in his hip and started him on a physical therapy program designed to retrain and strengthen his muscles. Because a shipment of artificial joints had been delayed for months, Huck was fitted with a temporary unjointed limb and Sallie taught him to use the leg to move around, first in the center and then outside in sand and mud and over rough terrain. As he became mobile again, he began to turn up at the elbow of a staff member with a ready hand to help and an easy smile.

When he was familiar with the new leg, Huck was sent home with instructions to return after Tet, when his permanent limb was to have been ready. If he returned then, he must have been met by closed doors. But Huck's story is not ended. Sallie believes one day word will reach his village that the Quakers are back and that the tortured stream of children and adults that feeds the sea of humanity confined in the Quang Ngai Hospital compound one day will include one dark-eyed, dark-skinned, broad-grinned youngster nicknamed Huck Finn. "You realize," she says, "that you couldn't have been paid to work in Vietnam; that there had to be other rewards. And there were. Huck was one of them."
Virginia Minnich of the hematology division, whose recent research has shown prevalence of clay-eating and its association with anemia.

Dr. Carl V. Moore, chairman of the Department of Medicine.
Dr. Carl V. Moore of Washington University, a pioneer in the study of iron-deficiency anemia, organized the School of Medicine’s hematology division in 1938. Since that time University hematologists have made many outstanding contributions to improved understanding of the blood and in the treatment of blood disease; to describe all the significant achievements would require numerous articles. This article outlines more recent research on iron-deficiency anemia and inherited anemia. Both illnesses are major health problems in the United States, as well as in so-called underdeveloped nations.

By ROGER SIGNOR

ANEMIA: World-Wide Health Problem

The advertiser who drones on about “iron-poor blood” sounds especially quaint in suburbia, land of the opulent supermarkets.

But hematologists—students of that wondrous substance, blood—have good reason to believe that iron-deficiency is the major cause of anemia among affluent Americans, as well as among people with the lowest incomes and most meager food budgets.

Leading hematologists such as Dr. Carl V. Moore, chairman of Washington University’s department of medicine, estimate that at least 100,000,000 persons in the world are ill from iron-deficiency anemia. It isn’t a dramatic illness, but it keeps people functioning at subnormal levels. In the United States, from 10 to 20 percent of all women of child-bearing age are iron-deficient; in areas such as the Far East, where medical care is very limited, the incidence of iron-deficiency in this group may be as high as 50 percent.

Current statistics on nutritional needs in this country are almost nil, and, therefore, hematologists don’t know the specific iron needs of special groups. It wasn’t until two years ago that pilot nutritional surveys were begun to pinpoint nutritional needs of low-income groups.

When Dr. Moore headed the Department of Medicine’s hematology division, he and his associates launched the first definitive study to show how much iron is actually absorbed from various foods. This work was summarized in reports published in 1961 (The Harvey Lectures, Academic Press) and in 1964 (Stratton Lecture, International Congress of Hematology, Stockholm). The experimentation was done by Dr. Moore, Dr. Reubenia Dubach, Dr. Elmer Brown (present head of hematology), and Virginia Minich. It was the first research to provide a sound basis for dietary recommendations on iron needs in normal people, and in pregnancy or other special medical problems such as bleeding due to an ulcer.

Iron-deficiency is readily managed by physicians, who have been equipped with basic data by medical researchers. But special groups of people may be unknowingly harming themselves through their dietary habits. Many housewives obsessed with stringent diets, for example, may be getting insufficient iron. Their problems seem rather less urgent, however, when one considers environmental factors in other groups of people.

One such factor may startle some Americans who take their plentiful diets for granted. It is the reality, known to medical authorities for some time, that many children and women eat dirt, clay, plaster, or consume large quantities of cornstarch, among other unnatural dietary habits. Recent research at Washington University has provided documentation that the habit is more widely practiced than commonly believed.

It is almost always found among women and children who live in impoverished areas, both in the United States and in so-called underdeveloped nations. The clinical term for the habit is “pica,” which is derived
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from the Latin word meaning magpie. And, not unexpectedly, it is frequently associated with iron-deficiency anemia. Clinicians have suspected for many years that substances such as clay and dirt may themselves cause iron deficiency, but no systematic study was done to determine whether this was true until Virginia Minnich of the hematology division recently undertook such a task with the help of Turkish researchers.

Miss Minnich's project was launched four years ago when she was in Ankara, Turkey, helping to set up a hematology laboratory at the University of Ankara. Her assistance had been sought by Dr. Ayhan Okcuoglu, now professor of pediatrics at the University of Ankara, who became friendly with Miss Minnich when Dr. Okcuoglu was completing her residency in pediatrics at St. Louis Children's Hospital.

While working in Ankara, Miss Minnich saw many mothers from nearby farming villages who brought their children to the University pediatrics clinic with the complaint that their children could not be broken of the habit of eating dirt and plaster. In Turkey, plaster is essentially dirt covered with a simple, non-toxic whitewash. According to the mothers, their children would often tear out large sections of walls in their huts to get at the plaster. This was not news to Miss Minnich, as she had heard of this habit from her Turkish friends, and had read reports of similar habits among ghetto children in the United States.

A typical child brought to the clinic with this symptom was Demirel Berkel, age six. She was underweight and pale. Tests showed that she was markedly deficient in iron. Demirel was hospitalized for several weeks, placed on a balanced diet, and given an iron supplement. During her first days in the hospital, Demirel still wanted to eat dirt. But after she was cleared of her iron-deficiency she completely lost her appetite for dirt. She returned to her village, where her diet was limited, but did not resume her habit of pica. "Here was a research problem staring us in the face, so we began tests of these children," Miss Minnich said.

Tests of ninety-four children from Demirel's region indicated that the dirt-eating was linked to iron-deficiency anemia: forty-one out of sixty-six children with the habit were found to be iron-deficient, compared to only three out of a control group of thirty-two children (who did not eat dirt). After children such as Demirel were cured of anemia, they rarely returned to dirt-eating. Miss Minnich and her associates made this observation after they had visited various Turkish villages.

A second study of pica had taken them to the farm villages. They examined Turkish women who eat clay, a habit also widely practiced in Turkey, which adults find socially acceptable. (It is a form of pica also widespread among black women in the United States.) In Turkey, clay is a common household item, used for washing clothes and shampooing hair. Throughout the day, women pop small chunks of this talc-like clay into their mouths. Some of the women claim they do it because of "nervousness," indigestion, or from habit simply acquired by mimicking their mothers.

Mayors in the villages were most cooperative in the research on clay-eaters. The mayors broadcast appeals to clay-eaters to "come and get blood tests." These announcements were made at the village mosque through loudspeakers, which normally were used to broadcast tapes of prayers to the villagers. The women volunteered for tests with no compunctions. The researchers found that anemia was more than twice as prevalent among clay-eaters than among women who had never eaten clay. (All of the research into pica was somehow squeezed into the schedule for organizing the University of Ankara hematology laboratory, which subsequently was named in Miss Minnich's honor by her Turkish colleagues.)

In 1965, Miss Minnich returned to Washington Uni-
Red blood cells with "targeting" effect from the presence of Hemoglobin C, one of numerous inherited anemias being identified.

versity and immediately began a project to determine whether the clay directly blocked iron-absorption in the body. In addition to Turkish clay, she obtained samples of clay that were known to be eaten by black women in Georgia and Mississippi. Medical students from these states dug the samples themselves from the clay banks used by the clay-eaters.

It is known by several physicians that there are clay-eaters in the St. Louis area, but Miss Minnich could not find where the clay was obtained and St. Louis clay was not included in the test.

A FOURTH TYPE of clay from New Mexico was included in the test because of its unusually hard, acid consistency which Miss Minnich wished to compare with the other softer, alkaline types. Miss Minnich and twenty-four fellow University staff members then proceeded to test the effects of the four types of clay on iron absorption by using themselves as guinea pigs. They ate five grams (about one teaspoon) of clay, then five minutes later took radioactive iron. The iron level in the subjects' waste material was then measured with a radioactivity detector. It was established that the alkaline Turkish clay was the most effective in blocking iron absorption; that Georgia and Mississippi clay also blocked absorption to a lesser extent; and that the hard, acid New Mexican clay had no significant iron absorption effect. A second test was run as a check on the validity of these data. It was done with volunteers who had iron-deficiency because such individuals absorb iron much more readily than normal people. Miss Minnich gave five iron-deficient volunteers samples of the clay. In each person, the clays from Turkey, Georgia and Mississippi also blocked iron absorption significantly.

Because of the many variables and difficulty in getting thorough information about child dirt-eaters, Miss Minnich points out that in this form of pica one can only deduce that the habit probably contributes to iron-deficiency anemia. But the more detailed data gathered on clay-eaters, strongly implicate the habit as a cause of iron-deficiency anemia in many women.

In another phase of the clay research, Dr. Lawrence Wilding, associate professor of agronomy at Ohio State, collaborated with Washington University's hematology group by doing analyses of the clay samples to identify the chemicals that interact with iron to bring about the absorption effect. In general, he verified what he and Miss Minnich's group had guessed: that calcium and magnesium in clay (or dirt) are the critical elements. These chemicals are replaced by iron in the clay compounds, thus putting the iron in an insoluble form which the body does not absorb.

Compounds of magnesium are used in various antacid preparations for indigestion, so Miss Minnich gave four of her associates magnesium and iron to see what would happen. In each person, one-half gram of magnesium (the amount in a typical antacid dose) blocked iron absorption completely. Miss Minnich now plans to test the effects of various antacids themselves. If certain antacids do block iron absorption to a high degree, they could present serious problems if taken by pregnant women or individuals with bleeding ulcers. Such individuals develop iron-deficiency and must take iron supplements; they also frequently take antacids, either with the iron or for digestive upsets.

Iron needs in such patients and in normal people, as mentioned earlier, were first clarified by Dr. Moore's group in a series of clinical studies from 1939 to 1964. It has been estimated that about six milligrams of iron is consumed per 1000 calories in an individual's normal diet, but before the Washington University tests no one knew how much of that iron was absorbed by the body. The problem has been to trace iron after it had been ingested in its natural state in food. In one phase of the
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studies, the hematologists used radioisotopes of iron, which were introduced into vegetables through nutrients in hydroponic gardens. These gardens are large tanks in which the plants’ roots are suspended in and fed by aqueous solution. They are relatively simple to maintain, and Dr. Moore and Dr. Dubach set up hydroponic gardens in their own homes.

The University project also secured radioactive eggs and chickens through the cooperation of theRalston Purina experimental farm, where chickens were injected with radioactive iron. Another food source was theAnheuser-Busch experimental bakery, which cooperated by helping to produce iron-tagged bread. Then, carefully controlled diets of iron-tagged eggs, chicken, vegetables and bread were eaten by hematology staff members and volunteer patients who had received treatment for iron deficiency.

The research revealed that people without iron-deficiency absorbed on the average only five to ten percent of the iron in the food. The iron-deficient patients absorbed about twice as much, which nonetheless did not come close to compensating for their deficiency. General diet recommendations subsequently drawn up by an American Medical Association committee were based largely on the Washington University findings.

A much wider variety of foods should be tested, however, Dr. Moore emphasizes. Studies also are needed to pinpoint the effect of several changing aspects of our environment on our iron supply. For one example, Dr. Moore points to the absence of iron cooking utensils in contemporary society. Iron cooking pots, former old standbys in both homes and in food processing plants, used to contribute significant levels of iron to diets in this country. Now these utensils have been largely replaced by aluminum and stainless steel ware.

While America has been eliminating iron sources by tidying up cooking methods on the one hand, it has been spewing a wide variety of contaminants into the environment on the other. Professor Brown said, “These contaminants probably are causing a lot more trouble than we realize.” “It is quite possible that they may be damaging bone marrow, the site of red blood cell production, and, in turn, contributing to anemia, among other diseases.”

To understand how subtle factors may be interfering with biochemical processes in the body, it is necessary to pinpoint the precise nature of these processes. Much of current research in the hematology division is at this basic level. Dr. Brown, in addition to his administrative and teaching duties, has done outstanding work; one recent achievement was that of defining the mechanism by which cells in the intestinal tract actually take up iron and transport it into the body. In a current project, Dr. John Vavra, for example, is studying factors that control the formation of hemoglobin as it develops within the red blood cells. This is the kind of exploratory work that must go on before potential practical applications can be made in the future.

“In my early days in hematology, I saw great progress in the anatomy and pathology of blood disease,” Dr. Moore said. “The lesions in disease so beautifully described then were the more gross events such as clots in blood vessels. Now, much more subtle lesions, such as the abnormal lack of a protein or an abnormal gene, are being described.”

Anemias may be inherited, that is, passed on from parent to child by way of an abnormal gene. Such a malfunctioning gene may affect the production or formation of hemoglobin molecules. These molecules are the main components of red blood cells and give the cells and the blood its red color (“hemoglobin counts” are based on the varying intensities of this pigment).

Iron takes part in biochemical events outside hemo-
globin to help all cells function, but the iron in the hemoglobin molecule plays an exquisitely critical role. Hemoglobin uses iron to perform its primary role of transporting oxygen in the body. Each hemoglobin molecule has 10,000 atoms of hydrogen, nitrogen, oxygen, and sulfur, plus only four atoms of iron. The iron is at the center of a small group of atoms that give the molecule its ability to combine with oxygen and thereby enables oxygen-transport throughout the body's tissues to sustain life. In order to function chemically—that is, pick up oxygen, transport it and release it—the molecule must be very precisely constructed and retain a special configuration in space. If some slip-up is made in hemoglobin construction, the molecule's shape will be affected and it will not function properly. In the 1950's it was found that the underlying lesion in "sickle cell anemia" was one abnormal chemical unit, an amino acid, among thousands and thousands of such units in the basic structure of the hemoglobin molecule. This brought about a "sickle" shape in red blood cells, whose malfunctioning is fatal without extensive treatment. Sickle cell anemia is prevalent among black Americans and Africans. Three decades ago, it was thought to be the only inherited anemia.

In recent years, however, many such "hemolytic anemias" have been traced to defective genes. A former Washington University hematologist, Dr. Amoz Chernoff, now of the University of Tennessee, and Miss Minnich did pioneering work in Thailand in identifying an abnormal hemoglobin called Hemoglobin E. This abnormality can contribute to serious anemia if it occurs in combination with other inherited illnesses common in Southeast Asia, such as "Mediterranean anemia." In Thailand alone, an estimated 322,000 people, one-tenth the population, are ill from genetically caused anemias.

In the United States, only iron-deficiency anemia and anemia associated with various infections rank ahead of inherited anemias in numbers of people afflicted. In a series of tests in St. Louis by Chernoff and Minnich, it was determined that roughly 600 Negroes, or one out of every 455, were ill with sickle cell anemia. Another one in 5300 is ill with a combination of sickle cell and Mediterranean anemia, which is somewhat less severe. Transfusions, which are the principal treatment, have improved the limited life span of these patients. Such anemias are especially painful in childhood and severely tax family and community resources. Dr. Hugh Chaplin, among others, has done considerable work at Washington University in refining transfusion techniques and in directing clinical programs.

Inherited anemias incapacitate millions of people in Asia and Africa, and many thousands in this country. The best current medical hope is to develop extensive clinics to detect individuals who carry sickle cell and other traits, and to offer genetic counseling to prevent disease.

In nutritional diseases such as iron-deficiency anemia, there is highly effective treatment which could be extended to many people who need it. But first, community-level studies must be done to define the specific needs and, hopefully, prompt action to provide treatment.

In a long-range view of improved treatment of anemias and all blood disease, hematologists feel that there also must be an intensification of basic research.

As president of the International Congress of Hematology which met in New York in September, Dr. Moore welcomed hematologists from around the world and briefly reviewed progress in treating various blood disorders. Then he referred to an apparent "slow-down in current therapeutic applications."

"That certainly is not because we are insensitive to the need to translate discoveries into better ways of treating patients," he said. "But, it seems to me, we are on a plateau, waiting for those crucial scientific advances yet to come, that will make new therapeutic triumphs possible."
There have been profound changes in engineering education in recent years. Washington University's revitalized School of Engineering and Applied Science is giving today's students thorough grounding in mathematics and the basic sciences and introducing them to the latest theories and techniques in such fields as computer science, electronics, and biomedical engineering.

ENGINEERING RENAISSANCE

By KING McELROY

Office of Information

ENGINEERING EDUCATION at Washington University is as old as the University itself. For many years the reputation of its School of Engineering was built upon the performance of its many successful graduates working in the St. Louis industrial community. The school, under the leadership of Dean Alexander S. Langsdorf, had played a dominant role in the community for many years and when Langsdorf retired as dean in 1948, the school's future in the community seemed assured.

However, in the late 1940's and early 1950's many forces were set in motion which would have profound effects on higher education and which would, in time, have severe repercussions on the school.

Following World War II, public attitudes toward higher education underwent major changes, and state legislatures across the country responded with massive public funds to enlarge and improve state institutions. Concurrently, the costs of higher education began to rise at a rate much faster than most services, products, or wages. As a result, private institutions began a series of tuition increases that is still continuing.

As these processes continued, economic factors became increasingly important in the process by which young St. Louisans, embarking upon engineering careers, chose their schools. Gradually the University's School of Engineering began to lose to the state institutions a significant part of its traditional local constituency and the future of the school which had looked so assured in 1948 was increasingly open to question.

By 1960 it was obvious that the large numbers of engineers needed by our expanding technology would have to be trained in public institutions and the role of private engineering education would have to be more selective and specialized. Educators at private universities throughout the country attempted to redefine the specific role that engineering education should have.

At Washington University it was realized that if the engineering school were going to survive it would have to serve a national as well as a local constituency. Moreover, the University could not hope to compete with public institutions in all technical areas. With the increasing emphasis on graduate engineering research and instruction, it would have to develop a strong capability in this area as rapidly as possible.

While the general directions in which the school had to move were generally recognized by the early 1960's, many difficult problems had to be overcome before the necessary changes could be made. By 1964 the school's undergraduate enrollment had dropped dangerously low. The school had only a meager amount of outside financial support for graduate research and education. In fact, a visiting committee of engineering educators stated that outside support should be ten times larger than it was. The existing faculty, many of whom had not been interested in research, were at an obvious disadvantage in obtaining funds for graduate research and education in the competitive atmosphere of the various funding agencies. Furthermore, because of the seriousness of the position of the school and its many problems, there were some severe morale problems within the faculty.

Dr. James M. McKelvey, alumnus and chairman of the Chemical Engineering Department, was thrust into the crisis when he was named dean in 1964. Since that time, the school has stopped its downward spiral and has gone the other way. It has earned a national reputation for engineering research. Dean McKelvey, more than any
At the electron microscope is a vital tool of the Materials Research Laboratory. Left, Professor A. T. DiBenedetto, director of the laboratory, and John L. Kardos, assistant professor of chemical engineering.

ENGINEERING RENAISSANCE

single person, is credited with boosting the school to national prominence.

Briefly, here's what Dean McKelvey has done. He created a new administrative organization, in which responsibility is now vested in five department chairmen, three laboratory directors, and a director of continuing education. He appointed new faculty members to meet new research needs and filled vacancies created by resignations and retirements. Two-thirds of the present faculty have been appointed in the last four years. He instituted the Langsdorf fellowship program and assigned an assistant dean full time to student recruitment, with the result that freshman enrollment has increased steadily. Each year more and more freshmen come from outside the metropolitan area. Last year, 61 percent of the freshmen were out-of-towners.

Financially, the school has tripled its expenditures and income since the 1964-65 academic year. Total expenditures amounted to about $4.7 million the past fiscal year, compared to $1.5 million in 1964-65. Federal funds for research have jumped almost tenfold, from $242,000 in 1964-65 to an estimated $2,380,000 during the past year.

What has attracted top students to the school has been research-minded faculty members who are in tune with modern engineering techniques. Dean McKelvey is responsible for recruiting many of these new professors. "I'm not sure I know how to convince top quality people to come to Washington University," he said, "but I've tried to tell them how our aspirations for the school would complement their own professional goals and ambitions."

Not so many years ago, today's engineering would have sounded more like science fiction than fact. The new engineering covers such fields as high performance composite materials, biomedical engineering, computer science, lasers, microwaves, integrated circuits, and air pollution. If faculty members are not conversant with research going on in these and other new and exciting fields, they find it increasingly difficult to capture the attention of the brighter students.

While the federal government is the major source of research support at the University, Dean McKelvey believes many universities have overlooked the possibilities of increased interaction with industry and the stimulating effect industry can have on graduate research.

It was not so many years ago that engineering education and engineering practice were separated by a chasm of misunderstanding and distrust. But Dean McKelvey has strongly supported industry-University cooperation. One of the most significant developments has been the collaboration of Washington University and Monsanto Company in a joint venture to discover and develop new composite materials.

The University-Monsanto program is one of the first industry-university projects of its kind in the country. The Advance Research Projects Agency, which sponsors the research, hopes that professors, graduate students, and industrial engineers can develop composite materials more quickly by pooling their knowledge. The educational benefits for the University include a better-informed faculty and graduate students who are familiar with industrial methods before they receive their diplomas. Of course, Monsanto benefits, too. Its scientists profit from the interaction with the academic community and with the bright, young, imaginative minds of the students.

Professor A. T. DiBenedetto, director of the Materials Research Laboratory, said: "Man has moved from the Steel Age into an age of whole families of synthesized materials. One such group, called composites, combines substances in order to produce a product that has totally different properties from the original pure components. A well-known example is fiberglass material in which individual glass fibers are embedded in a polyester. Such combinations are often lighter and stronger than their original components."

Professor DiBenedetto explained that new materials being developed for aircraft, space vehicles, and building construction have important implications for the comfort and well-being of our society. "We are building a whole family of new high-performance materials," he said. "They will be lighter, more flexible, and cheaper than those we now use. Vehicles made of them can run more cheaply and on less power because it will take less energy to propel them."

In the Department of Applied Mathematics and Computer Science, Leon Cooper, the chairman, is prepared to bet "any amount of money" that within fifteen years many homes will be equipped with a computer to control light and heat, wash and dry clothes and dishes, and even cook the meals. "The computer already controls the climate in some office buildings in New York City and completely operates some chemical plants," Professor Cooper said. He predicts that computers some day will be run by giant utilities such as those that provide the nation's gas and electricity. "Just as we now pay gas and electric bills," he said, "we'll pay for the amount of time we use on the computer."

Perhaps then, instead of just gas and electric meters, the utilities will also install computer meters. The next step will be robots to read the meters. "All right," you say, "Stop! This is getting out of hand." But Professor Cooper says, "I'm not so sure it is. Today, right now, engineers are thinking about these problems. They're writing books about how these problems can be solved. When I see how far we've come in such a short time, I'm not surprised at the breakthroughs that occur. In fact, my predictions may turn out to be too conservative."

When Professor Cooper graduated from the Washington University engineering school in 1951, he never...
dreamed he'd be making such predictions. The department he heads didn't exist then. "In 1950, there were maybe three computers in the country," he said. "Now there are 50,000 and the age of the computer is just beginning."

Robert Mains, chairman of the Civil and Environmental Engineering Department, said the computer helps civil engineers solve mathematical problems in seconds that would take years if they had to work them by hand. His specialty is shock and vibration within the field of structural dynamics. "Twenty years ago," he said, "when we built a bridge, we had to analyze simplified models of the structure because of the limitations of hand calculation. We frequently used 'iteration' or 'relaxation' methods and applied these to everything from water distribution systems to railroads and highways. Today we do nearly everything by computer. What used to take a month by hand, I can do in a day. I am an effective fifteen-man office force as long as I have a computer."

So important is the computer to today's engineering that all engineering freshmen take a computer programming course. Some students also take an engineering problems course taught by Wallace Diboll, associate professor of mechanical engineering. "The course forces the students to look at problems that are susceptible to engineering analysis," Diboll said. "In almost all cases, the students suggest problems which originate from their own experience." For instance, one student worked out a solution to a problem plaguing the Parkway School District in St. Louis County. He computed from population predictions and other real estate data where the junior high schools in the district should be located. Another student designed an electric tuning device for an orchestra. A third student designed a coil spring for railroad cars.

The students do get a taste of the practical as early as their freshman year. Yet the chief emphasis in engineering education today is away from practical technology and toward general theory. The technology will change, but the theory will not become outdated in this rapidly changing world.

A background in mathematical theory is much more important for the engineering student than ever before. While in the past an engineer probably wouldn't have to go beyond elementary calculus, today's engineer must solve complex differential equations. Although engineering students studied various technological processes in past years, the value of such courses now is being questioned. Eric Wegner, chairman of the Department of Chemical Engineering, said, "We're trying to develop a student's analytic power rather than cram his mind full of facts."
However, students who have concentrated on engineering theory get the feel of the design process in a senior course taught by Professor Buford Smith and Monsanto engineers. The students are presented with actual engineering problems from the company's files and must design a system to solve the problem. Professor Smith compiles the solutions into a casebook that forms the basis of a short design course for university teachers. The course, supported by the National Science Foundation, acquaints forty design teachers with the resource materials developed at the University in cooperation with Monsanto. The last course was conducted early this fall at the University's Bromwoods conference center.

Many changes in engineering education have been brought about by discoveries in electrical engineering. Dean McKelvey recruited Professor W. S. C. Chang to head the department which, under his leadership has developed a wide range of research interests, ranging from integrated circuits to engineering biophysics. Professor Henry Guckel and a team of technicians are making integrated circuits in a dust-free "clean room" in the subbasement of Crow Hall. They are trying to make new and different electronic devices and also to improve the design of existing devices.

In another laboratory, Russell Pfeiffer, chairman of the Advisory Committee on Biomedical Engineering, is analyzing the electrical properties of the auditory nerve. Special equipment produces a controlled signal which is sent to the ear of the subject in a soundproof room. A microelectrode placed in the auditory nerve picks up nerve-electric activity which is sent to the computer for analysis and storage for future study.

In a third laboratory, graduate students are studying the characteristics of a very fast optical pulse in a large laser and the microwave demodulation of light. The latter study is part of an attempt to use a laser beam to transmit many television channels simultaneously.

Dean McKelvey has fostered this interest in biomedical engineering. Just last summer, he appointed Dr. Salvatore Sutera, formerly executive officer of the Division of Engineering at Brown University, as chairman of the new Department of Mechanical and Aerospace Engineering. Dr. Sutera, widely recognized for his work in biomedical engineering, has been concerned with the application of fluid dynamics to problems of blood circulation.

This fall, several undergraduate students began a new type of pre-med course in the engineering school. While their ultimate objective is to become physicians, most are oriented toward a research career and have a strong affinity for the physical and engineering sciences. Dean Mc-
Exciting new area in electrical engineering is the field of integrated circuits. Here Professor Henry Guckel works with an experimental circuit in a special dust-free "clean room."

Professor Russell Pfeiffer, chairman of the Advisory Committee on Biomedical Engineering, is currently investigating the electrical properties of the auditory nerve.
Kelvey said, "While we do not expect this program to attract large numbers of students, it does hold great attraction for a rather special class of student. Our discussions with medical school people showed enthusiasm on their part for opening new and non-traditional routes to medical education. We will be watching this program with a great deal of interest."

The rapid advances in technology which have changed the complexion of undergraduate education in the School of Engineering have also been a major factor in the establishment of a new division of engineering education which addresses its concern to keeping the professional engineer abreast with his times. When Dean McKelvey assumed his new duties, the school had no formal program for continuing education in engineering. Within a few months, he has established the Institute for Continuing Education in Engineering and Applied Science.

"An engineer can start becoming obsolete three or four years after graduation," Dr. Gerald Esterson, Institute director, said. "Even before he graduates, he will find the curriculum has changed. If he lets ten years go by without taking additional courses, he will find that much of what he knows is obsolete and not relevant to current problems. Our responsibility at Washington University is to keep this from happening."

The Institute offers a wide range of night courses, seminars, and workshops. Engineering executives who have trouble communicating with their research scientists often find they need only an Institute short course on the new developments in their field. Most engineering-based firms have specific policies involving continuing education for their employees. Sometimes companies will pay the entire cost for employees, or at least a large percentage.

After Dean McKelvey had been on the job a few months, the problems of increasing undergraduate enrollment became apparent to him. "This was a critical area for the future of the school then and it still remains a critical area today," he said. "We're competing for the same students as Rice, MIT, and Cornell. We don't have as much scholarship money as those universities and our engineering school is not so well known nationally."

To help recruit the top undergraduates, Dean McKelvey started the Alexander S. Langsdorf Engineering Fellowship competition. Each year four high school seniors are awarded the fellowships in a competition that draws applicants from every state in the Union. "The Langsdorf competition gets our name before thousands of high school counselors and students throughout the country," the dean said. "About one hundred high quality students compete for the fellowships. Those students who don't win the fellowships at least learn something about the University's engineering school."

Dean McKelvey praised the work of Assistant Dean Harold P. Brown in recruiting students. "There is a personal relationship between Dean Brown and the students," he said. "The students aren't just application blanks in a folder in someone's office. It's amazing, but he knows many personal details about 400 students who are trying to enter the school."

As another aid to recruiting undergraduates, the school is experimenting with an Engineering Practice program. This is a five-year work-study program in which the students work in the summer and part-time during the regular school year for a local engineering company. The student pays tuition for the first year and the company picks up the tab for the remaining four years.

Although most engineering school activities are conducted in the Urbauer, Sever, and Cupples II engineering buildings, the school has offices and laboratories in a number of other buildings on campus. "We even rent laboratory space at the Monsanto Research Center," Dean McKelvey said.

Bryan Hall, a new laboratory building, will provide headquarters for three engineering departments to alleviate some overcrowding. The five-story structure, now under construction, is expected to be completed late next year. "With the increase in the number of graduate students, more space is absolutely essential," the dean said.

Dean McKelvey recently outlined some of the future goals of the school. He hopes to have a freshman class of 200 by 1970. There are 150 freshmen now. He wants to increase the full-time graduate student enrollment from 250 to 300, while retaining the part-time graduate student enrollment at its present level of 200. As far as the curriculum is concerned, he plans to establish a graduate program in international development technology leading to a master of science degree for students interested in the technological problems of developing nations.

Another goal is to establish an interdepartmental program in environmental engineering and science. A University committee has recommended this program to bring engineering, medical, and botanical disciplines to bear on problems of the urban environment. A director for the program is being sought.

Summing up the school's total effort over the past four years, the dean said, "With the successful completion of the first phase of its long-term development program—the recruitment of a new research oriented faculty, the planning of a new building and the start of construction, and the expansion of the undergraduate and graduate student bodies—the school has developed considerable momentum in its thrust for academic stature and excellence. Maintaining this momentum will be particularly difficult because of the stringent financial position of most of the federal funding agencies; but the school must maintain it if it is to achieve its goals."
Alumnus Bing Devine began his career helping out in the St. Louis Cardinals' office when he was still an undergraduate. Today, he is General Manager of the National League Champions.

BING DEVINE

In 1964, the St. Louis Cardinals won their first National League Pennant and World's Championship in eighteen years. Unfortunately, the man who did the most to build that championship team wasn't around for the payoff. This year, Alumnus Vaughn "Bing" Devine was back with his St. Louis Cardinals to see them win their third pennant in five years and battle the Tigers to the wire in the World Series.

When the Redbirds won that '64 championship, Bing was in New York as general manager of the Mets and in 1967, when they did it again, he was still with the Mets. Just before the Cardinals made their dash for the '64 pennant, they fell into what turned out to be only a temporary losing streak, but an impatient management fired the general manager. In late 1967, when Stan Musial decided to step down as general manager to devote his time to his numerous business interests, the same management had the wisdom and the grace to ask Bing if he wanted the job back again.

So, in late 1967, the man who had laid the foundations for the "new Cardinal dynasty," the man who had been named Major League Executive of the Year in 1963 and 1964, the man who had been fired by the Cardinals in a moment of premature panic, came back home. In a game where statistics are cherished, Bing Devine had set a major league record all his own: he became the first man in major league history to be rehired as general manager of a team after being fired from the same position.

Bing Devine began his lifelong involvement with the St. Louis Cardinals as a member of the Knothole Gang, the kids who were let in free to sit in the bleachers at Sportsman's Park to cheer on Dizzy Dean and Ducky Medwick and the other heroes of the Gashouse Gang era.

When he was still an undergraduate at Washington University, Bing began working in the Cardinal office between semesters, as a messenger boy, office boy, and Cardinal General Manager Bing Devine in a typical scene: deep in conversation with one of his ballplayers. The player is Mel Nelson, rookie pitcher.
part-time statistician. Bing played baseball in those days, too. He pitched on the Bear varsity team and compiled a creditable record, although he is better remembered on the Hill as a short but determined member of the basketball Bears.

After graduation in 1938, Bing began working full time for the Cardinals in a variety of office jobs. Two years later, at age 24, he was sent to the Cardinal farm team at Johnson City, Tennessee, as business manager. Like most executives on a Class D ball club, Bing performed a multitude of jobs with Johnson City, even filling in from time to time at second base. Looking back on his playing days in organized baseball, Bing says, "The less said about my performance on the field the better."

Except for a three-year interval in World War II with the Navy Fleet Air Wing, Bing remained in the Cardinal minor league organization until he was brought back to the home office in 1956. A year later, he succeeded Frank Lane as general manager and began laying the foundations for the Cardinal championship teams of the sixties.

The job of general manager of a major league baseball club requires a wide and wildly varied assortment of talent, background, insight, and plain energy. The man in the job is the chief executive officer of a vast enterprise, involving not only the parent club but the entire farm organization. He must have a good business sense and financial acumen, a flair for public relations, and a special and rare ability to judge baseball talent and to know how to build and maintain team confidence and morale. Vaughn "Bing" Devine, a quiet, retiring, serious businessman in an exciting business, combines all of those varied attributes.

Most, if not all of a general manager's working life is spent talking to people: to the owners and to the field manager; to department heads and coaches and scouts; to other baseball executives; to reporters and interviewers; to the fans; and most important perhaps, to the players.

Other members of the Cardinal organization and other baseball people point out one very important characteristic of Bing Devine: he not only talks, he listens. Bing runs the Cardinals, but he'll listen to the other members of the organization from the field manager to the groundskeepers. At a typical Bing Devine staff meeting of key personnel, Bing lets everyone have his say and listens to everyone. He makes his own decisions, but he respects the opinions of the experts he has assembled around him.

Throughout the year, Bing is as busy as a catcher fielding a squeeze bunt with the bases loaded and two out. He arrives early at the Florida training camp in the spring and is involved every day through the long 162-game season. At the end, there is the World Series, whether his team is in it or not. Then there are major and minor league meetings, the instructional winter leagues, promotional tours, scouting reports, and of course, the intricate player contract negotiations that can drag on for months. Finally, it's March and time for spring training, and the whole cycle begins again.

During the regular season, Bing keeps regular hours at Busch Memorial Stadium. He reports in early every morn-

The general manager chats with Orlando Cepeda, the Cardinal first baseman who was unanimous choice for Most Valuable Player in the National League in 1967.
One of the prime reasons for the Cardinals' success in recent years has been the close working relationship between the field manager, Red Schoendienst, and General Manager Devine.

Among the most important deals Bing Devine ever made for the Cardinals was the one that brought hard-hitting, fleet Lou Brock to the Redbirds from the Chicago Cubs.
Serving as general manager of a major league baseball club is a demanding executive job. Here, Bing confers in a regular staff meeting with the heads of key departments.

Two long-term members of the Cardinals organization in a radio interview at Busch Stadium: Bing and Harry Carey, who has been announcing Cardinal games for more than twenty years.

When Bing returned to the Cardinals, he succeeded Stan "The Man" Musial, who left the general manager's job to devote more time to his business interests.
ing to confer with his staff or with Manager Red Schoendienst, or to talk over a problem with the head groundskeeper or the ticket office or a slumping outfielder. He must also keep in constant touch with the minor league clubs and with the scouts throughout the country.

Now that most games are played at night, Bing grabs a bite in his office or at the stadium restaurant at the end of the day and then watches the game on the field. Bing likes to keep moving during a game. In the course of nine innings, he may watch the action from the owner's "Redbird Roost" in the upper deck, from a field box behind the Cardinal dugout, from the pressbox with the writers and announcers, or just walking around the stadium.

Normally, Bing does not accompany the team on the road. During the season, he tries to see at least one game in each National League park, but usually he stays in St. Louis, keeping one eye on the current Cardinal teams and the other on the Redbird teams of the future he is helping to build. When he feels like a change of pace, Bing will watch two other major league teams play, or drop in at a college or high school game to scout potential talent.

Bing's chief role, like all general managers, is player personnel—present and potential. It is the general manager, working with his staff, who signs promising young players, brings up players from the minors, makes trades with other clubs, and negotiates player contracts.

The shrewd deals Bing Devine has made with other clubs have been credited as the main reason for the recent resurgence of the Cardinals. It was Bing who brought to the Cardinals such outstanding players as Curt Flood, Lou Brock, Dick Groat, Bill White, Julian Javier, and Johnny Edwards.

In spite of his busy schedule, Bing Devine finds ample time for his family. There's his wife Mary, whom he met on that first assignment in Johnson City, Tennessee, and his three daughters: Mrs. Joane Schaumburg; Janice, now at the University of Arizona; and Jane, age 13. The Devines are a close-knit clan. When Bing was offered his old job back with the Cardinals, he was unable to accept immediately. "First," he said, "I'll have to see how the family votes." Happily, the Devines voted unanimously to return to St. Louis.

Shortly after Bing left the Cardinals in 1964, Janice Devine, unknown to her dad, wrote a letter to Cardinal President Busch. In her letter, Janice assured Mr. Busch that the Devines understood why the decision was made to remove her father as general manager and that they harbored no ill feelings.

Janice's final paragraph in her letter to Mr. Busch is a good one for any comment about Bing Devine. She wrote: "I wanted you to know that the Cardinals have always been Dad's first love."
One of the most devastating earthquake sequences ever known on this continent hit the New Madrid, Missouri, area some 150 years ago. Research by Washington University scientists has revealed that violent shocks have been occurring in the area for thousands of years and may come again at any time. Using the area as a laboratory, Dr. Mateker and his colleagues are hoping to develop a reliable earthquake warning system.

EARTHQUAKES IN MISSOURI

By EMIL J. MATEKER
Associate Professor
of Earth Sciences

EARTHQUAKES ARE ONE of the natural hazards with which man must live. They are world-wide in distribution, vary enormously in intensity, and can cause tremendous damage and loss of life. To the public, they are mysterious events that occur without warning. It has been possible to develop warning systems for typhoons and hurricanes, and with somewhat less success, for tornadoes, but earthquakes seem to strike completely with no forewarning.

The science of seismology, concerned with all aspects of earthquakes, has as a natural goal the development of methods of predicting their occurrence and warning against them. Today, earthquake prediction is only a goal, but the state of the art has taken such a great leap forward during the past decade that it is possible to envision its becoming a reality. The Japanese have been engaged in prediction studies for several years with minor successes, and recently a ten-year study plan has been proposed to Congress to develop earthquake prediction criteria for the California region, one of the most active earthquake areas in the world.

Although earthquakes are world-wide, they do not occur everywhere in the world. They are normally associated with the so-called "earthquake belts." One such belt rings the Pacific and includes the California and Alaska regions. The wide distribution and the difference in the geology of the regions involved suggest an immediate problem for the development of prediction techniques. Each area has its own earthquake characteristics and it is doubtful that criteria developed for one area would be applicable to another.

Most people think of Japan or California when earthquakes are mentioned; it is rare indeed when the term conjures up Missouri. Yet, one of the most famous and devastating earthquake sequences ever known on the North American Continent was the New Madrid Earthquake, named for a town in southeastern Missouri. The New Madrid Earthquake exceeded in severity the great disasters in San Francisco in 1906 and in Alaska in 1964 and continued for a period of more than a year. In fact, mild earthquake activity continues in the area today and is the subject of a research program that has been underway in Washington University's Department of Earth Sciences since 1965.

New Madrid is located on the north bank of the Mississippi, about 150 miles south of St. Louis, on the flood plains of southeast Missouri. The river changes its direction often in this area and the town is located on an east-west bend that separates a section of Kentucky from the "mainland," making it necessary to enter it from Tennessee. Part of this undulation in the river is due to changes in its course produced during the earthquake.

The New Madrid earthquake sequence began without warning during the early morning hours of December 16, 1811. The number of shocks, the continuity of the disturbance, the area affected, and the severity of the sequence surpasses any recorded earthquake in the history of the North American Continent. Fortunately, the region was sparsely populated at the time. New Madrid consisted of approximately 200 families and Little Prairie (now known as Caruthersville) numbered about 100 families. Because the area was largely wilderness, relatively little attention was paid to the earthquake at the time and published accounts are few and incomplete.

Geologist Myron L. Fuller, who carried out the most
One of the more dramatic results of the New Madrid earthquake of 1811-12 was the creation of Reelfoot Lake in eastern Tennessee. An area ten miles long by three miles wide sank twenty feet. Rising waters submerged a forest and made the lake.

comprehensive surface study of the area of disturbance, wrote the most complete and lucid description of the event. According to Fuller, the people of New Madrid were awakened around 2:00 a.m. by the groaning, creaking, and cracking of the timbers of their houses and cabins, by the wild movement of furniture, and by the crashing of chimneys. They rushed to the streets and were unable to return to their homes throughout the rest of the night and most of the next day because of repeated shocks. Soon after daylight another shock fully as severe as the first, but preceded by a low rumbling noise, rocked the region. The people observed that the ground rose and fell much like the long, low swell of the sea. Landslides swept down steep bluffs and some areas were uplifted and others sank and were flooded with water rising from fissures in the ground.

The Mississippi also was significantly affected as great waves were created. The water returning to the river broke off thousands of trees, high banks were caved, and whole islands disappeared. As the day wore on, the shocks continued but gradually diminished in intensity. Less frequent shocks continued until January 23, when another shock similar in intensity and destructiveness to the first occurred. Two weeks of quiescence followed the aftershock sequence. Then on February 7, several very severe shocks were felt, the last as large or larger than any of the previous ones. The earth vibrated continuously for several days. For approximately a year small shocks occurred every few days.

The earthquake sequence produced a significant change in the physiographic features of a sizable area. The area of major disturbance (see map on page 51), which was characterized by uplifted regions, sunken areas, fissures, sinks, sand blows, large landslides, and widespread destruction of houses, extended a hundred miles from Cairo, Illinois, on the north to Memphis, Tennessee, on the south, and approximately fifty miles east-west, which encompasses an area of somewhere between 3000 and 5000 square miles. Small disturbances, such as caving of banks and some fissuring, and minor structural damage extended from Herculaneum, Missouri, on the north to the mouth of the Arkansas River, approximately 100 miles south of Memphis, on the south. This area is largely confined to regions within fifty miles of the rivers.

Perhaps more startling is the fact that at such distant locales as Detroit (600 miles) and Boston (1100 miles), the larger shocks were felt without the aid of instruments. Fuller estimated that a total area of one million square miles, which is half of the continental United States, was so disturbed that the vibrations were felt without the aid of instruments. The great Alaskan earthquake of 1964, which produced significant surface damage in many areas of Alaska, was not felt without the aid of instruments over such an area, although many bodies of water were so disturbed that people as far away as Texas noted the effects.

The exact number of lives lost during the sequence is unknown but it was relatively small. Only one life was lost in New Madrid and no loss was reported in Caruthersville. This was due to the few inhabitants and the nature of the houses, which were mostly log cabins able to flex without caving. Contrast this to the 10,000 lives lost in Caracas, Venezuela, from an earthquake in 1812, most of them lost as a result of crumbling brick walls. The recent Iran earthquake took more than 8000 lives. There was probably much loss of life on the Mississippi River, however. Many of the islands that disappeared were known to be inhabited, largely by river pirates. Numerous boats were sunk or overturned and some crewmen were never found.

A logical question to ask is: was this sequence a freak event or is the New Madrid area part of one of the "earthquake belts"? Of even more interest to those now
living in the area is the question of whether there will be another large sequence like that of 1811-12. This leads, of course, directly to the problem of earthquake prediction. However, without recourse to a consideration of the prediction problem, one might get some insight into the second question from a consideration of the first and by seeking evidence of a prior history of earthquakes.

There are written records, Indian legends, and geologic evidence to indicate prior activity. Three earthquakes were reported in the same area between 1776 and 1795. The Indians of the Mississippi Valley had a legendary tale of a great earthquake in the same area. More significant are the records that can be found in the surface geology and topography. Fuller has described surface cracks as large as those opened by the 1811-12 sequence with trees at least 200 years old growing on the bottoms or slopes. This would suggest that within the two to three hundred years before 1900, one or more earthquakes took place with intensity at least as high as those of the 1811-12 sequence. There also is evidence of faulting in the youngest rocks of the region. This faulting is of such a nature that it could not have been part of the earthquake sequence of 1811-12 nor even of a few hundred years earlier. This suggests earthquake activity of significant magnitude over the past several thousand years.

**The area is still active.** Approximately one hundred earthquakes have been reported there since the 1811-12 sequence. The most reliable index, however, is the activity reported since seismograph stations have been installed by the Department of Geophysics at Saint Louis University. With data from these stations, the epicenter (the location on the earth's surface above the center of the earthquake region) can be reliably located. Recording over the past twenty-five years shows that most of the local earthquake activity occurred in the New Madrid area. Thus, the geologic, written, and seismic records all show that the same area has been more or less continuously active for a long period of time. This suggests that the sequence of 1811-12 was not a freak event—and that it is conceivable to view the future with a good deal of suspicion. This is not to say that a sequence as destructive as the New Madrid earthquake will happen again; but, there is no evidence to show that it is unlikely.

Because the area under discussion can be considered as an active region, it is interesting to address ourselves to the question posed earlier and see if it belongs to an earthquake belt. A map of the epicenters of the larger earthquakes through 1962 was plotted by the U.S. Coast and Geodetic Survey. A modified version of the map is shown on page 51. The New Madrid sequence is indicated by the solid triangle in southeast Missouri. Careful study of this map leads one to believe that several trends are evident. One trend is north-south from western Montana through Utah and into Arizona. The large triangle represents the famous Hebgen Lake earthquake of 1959. Moving to the east we note approximate north-south trends extending from northern Kansas into South Dakota and from the vicinity of St. Louis into Wisconsin.

The earthquakes in southeastern Missouri appear to fall on a line of epicenters that extend into the St. Lawrence Seaway. There appears to be another alignment through the eastern portion of the United States from North Carolina into Maine. One can also visualize an east-west alignment through the southern portion of the United States from the Texas panhandle to the east coast, perhaps including the Charleston, South Carolina, earthquake of 1856, shown by the large triangle.

If we consider only those alignments east of the Rocky Mountain area, some can be correlated with known regional geologic features. For example, the alignment along the east coast of the United States corresponds with the Appalachian mountain trend. This type of correlation with major geologic features does not exist for the trends through St. Louis and southeast Missouri. In fact, the trend from southeast Missouri to the St. Lawrence Seaway cuts across several major geologic features. It is well established that earthquakes in the more active regions of the world are associated with major geologic features—for example, the California earthquakes are associated with the San Andreas Fault, which is clearly visible on the surface, and other major faults; the island systems, such as the Aleutians, Japan, and others reflect major weaknesses of the upper part of the earth and have many earthquakes. The apparent lack of correlation of the earthquakes of the southeast Missouri-St. Lawrence Seaway axis could be significant and suggest that they are not part of a trend, but isolated segments of activity.

If one is to predict earthquakes, it is essential to understand the relation of their occurrence to geology. This relationship is one of the significant aspects of the California earthquake system. We know a great deal about the correlation with geology and can actually observe the slow movement along the major faults, such as the San Andreas.

If we are to develop an understanding of the earthquakes of the southeast Missouri area, we must determine their relation to the geology of the upper part of the earth. The upper part is essential because the earthquakes of the area occur between the surface of the earth and a depth of approximately fifteen miles. Washington University scientists have been engaged for the past three years in a research project to develop this understanding, and, hopefully, to give some idea of whether the earthquakes of southeast Missouri are related to a major region of weakness in the upper part of the earth extending into the St. Lawrence region.

The approach that we have used is to try to learn the details of the geology of the upper fifteen miles of the earth. To do this, we need to make use of indirect techniques, because as yet it is not possible to drill to those depths, and even if it were, the cost of enough holes to determine the details required would be astronomical. Consequently, two approaches are used, each of which can be pursued independently until sufficient data are available to fuse them.

One approach is to make a detailed study of the geology of the area from surface rock outcrops and data available from wells drilled for water and mineral exploration. This study must be carried out over a large area that includes most of Missouri, southern Illinois, eastern Arkansas, western Kentucky, and western Tennessee. Particular emphasis is placed upon determining a detailed picture of the structural geology of the area and its evolution. This
approach yields detailed information about faults and other structural features in the upper one to two miles of the earth, but it is necessary also to determine how the geologic features near the surface relate to those deeper in the earth where earthquake sources are located.

The latter information is derived from application of geophysical methods. In the problem under study, emphasis has been placed on the use of a gravity method and a magnetic method. In the former, a highly sensitive instrument, a gravimeter, is used to measure very small differences in the gravitational field between any two points on the earth's surface. In the latter, two techniques have been utilized—one involves a similar measurement for the vertical intensity component of the earth's magnetic field on the surface of the earth; the other is to trail a magnetometer behind an airplane and continuously measure either the total intensity of the earth's field at flight elevation or to measure differences in this field.

Both the gravity and magnetic methods yield field data that can be translated into geologic information. The quality and accuracy of the translation depends upon many factors and it is important to realize that more than one interpretation of the data is possible. However, having duly noted that the techniques are not unique, let us assume that we can limit the possible solutions to one or two that have real geologic significance and proceed to our problem. Before discussing how these data reveal geologic information, it is interesting to note the sensitivity of the instrument. For instance the gravimeter used in this survey is capable of measuring one part in ten million of the earth's gravity field. This is equivalent to the change in gravity that one would encounter by going up approximately one-tenth of one foot in elevation.

It has been stated that these methods can be used to obtain information about the geology of the earthquake region. How this is actually accomplished is not important here but it might help to give some insight into why it is possible. Consider only the gravity method. We know the value that the earth's field should have at every location on the earth's surface. Because the distribution of rocks in the earth is not uniform and because the density of the rocks in the non-uniform distribution differs, there is not a uniform distribution of mass. This non-uniform mass distribution produces deviations from the theoretical value. By determining the distribution of these deviations it is possible to relate them to the depth and nature of the rock distribution that produced the deviation pattern. Careful analysis of the changes in the earth's gravity field can give information about the location, direction, depth, and magnitude of geologic faults in the upper earth.

The geologic and the geophysical studies have progressed to the stage where we have been able to put together an interesting picture of the subsurface geologic structure in the southeast Missouri earthquake region. The details of the fault trends have been synthesized and superimposed on the aerial outline of the major and minor regions of disturbance of the 1811-12 earthquake sequence. With respect to the major region, we note that it falls nearly within two large northeast trending faults which border a large downdropped block. One of these faults borders the eastern portion of Reelfoot Lake, which was created in the New Madrid earthquake. This is the only subsurface fault on which there is sufficient detail to know that it has been active in recent geologic time.

The data on this figure also show that there is a very strong northeast fault trend which extends to the eastern border of the mapped area and aligns with the trend shown on the earthquake epicenter map between southeast Missouri and the St. Lawrence Seaway.

North of New Madrid a fault is shown that trends to the northwest. This is also a major fault that parallels a major geologic feature, known as the Pascola Arch, that is very old. We know from studying the geologic evolution of the area that the Pascola Arch was active in the geologic past, having been raised several thousand feet. Our data suggest that the northeast trending features are much younger than the northwest.

The presence of these two trends in the same area may explain why the earthquakes can be so intense in this region. The intersecting trends have produced an upper portion of the earth that is composed of relatively small blocks. It is far easier for the upper part of the earth to adjust to forces tending to disturb its equilibrium in an area composed of relatively small blocks than it is in an area that is not so composed. This, coupled with the fact that the area around New Madrid is part of a large region extending to the Gulf Coast that is slowly subsiding, and the area immediately to its northwest, the St. Francois Mountain region, is slowly rising, makes it an extremely mobile region. Our geologic and geophysical studies indicate that this mobility is in part related to the nature of the rocks composing the upper part of the earth immediately below the sediments.

Although our results are still preliminary, there is evidence in the geophysical data to suggest that the New Madrid earthquake region is part of a major trend through the northeast, as indicated on the earthquake epicenter map. However, the geologic and geophysical data also suggest that it may be more active than some of the other portions of the trend because of current subsidence of the Gulf Coastal Plain and the rise of the St. Francois Mountains, and because of the block-like mosaic due to the intersection of subsurface lines of weakness that extend deep into the upper part of the earth.

There is no evidence to suggest that the adjustments which produced the New Madrid earthquake are completed; on the contrary, all available evidence indicates that they are continuing. It is hoped that the research techniques being employed by Washington University scientists will provide valuable clues about the extent and magnitude of these changes deep within the earth. Subtle differences in the readings obtained of the earth's gravity and magnetic fields, coupled with seismological and geological information, could some day enable scientists to predict exactly when major disturbances will occur and to estimate their magnitude accurately.

The area devastated in 1811-12 is no longer a wilderness and another earthquake of the same magnitude would be a major catastrophe. It is imperative that research continue toward the ultimate objective of developing a reliable earthquake warning system.
Map in upper left shows the area affected in the New Madrid earthquake. At upper right are shown known and inferred faults in the area. At left, epicenters of recent major earthquakes plotted on a map of the United States.
After eighteen years as the top civilian employee of the Army Corps of Engineers at Cape Kennedy, Alumnus Ed Bramlitt can relate a wealth of experiences that truly qualifies him as a . . .
SPACE AGE PIONEER

By JAMES P. PATTERSON

THE CAPE—it was Cape Canaveral in 1950, today it is Cape Kennedy—is the most predominant feature of Florida’s East Coast. It juts southeasterly into the Atlantic and on a map it faintly resembles George Washington’s nose in profile.

Back in 1950—the pioneer days of space for the United States—Cape Canaveral was a desolate stretch of mosquito-ridden beach known mainly to historians as a graveyard for Spanish plate ships.

Today, the same spot is still a desolate stretch of beach. But there is a difference. It is hallowed ground and belongs as much to American history as do some other famous chunks of acreage in our country—Plymouth Rock, Bunker Hill, Gettysburg, or Kitty Hawk.

Like huge steel praying mantises, the gantries and launch towers of past space shots dot the flat skyline of the Cape. Signs of a military nature punctuate the drab endlessness of the scrubby brush that is the Cape’s only vegetation. To the north rises the Vehicle Assembly Building, one of the world’s largest structures and the birthplace of America’s “man on the moon” efforts.

The Cape is a bustling place—a far cry from the sleepy Florida beach of eighteen years ago.

AN INDIVIDUAL who makes this short chapter of American history become very much alive is still working at the Cape, just as he was in May, 1950, when he was one of the first three Army engineers to arrive at the would-be rocket launching site.

E. R. “Ed” Bramlitt, a Washington University alumnus, is the Executive Assistant to the District Engineer, Canaveral District, U.S. Army Corps of Engineers. As a civilian employee of the Corps, Bramlitt has become a well-known personality among space officials, the Cape Kennedy press corps, and the army of contractors and construction workers that has helped build the fantastic space complex that thrusts into the Atlantic.

Ed’s arrival at the Cape in 1950 followed a series of projects with the Corps of Engineers, which he joined in 1938. His experience in engineering and business—he switched his major from engineering to commerce while at the University—led him from flood control projects in
Oklahoma to navigation and more flood control projects in Florida.

In 1940 Bramlitt was sent to the Corps' Miami Beach resident office, where in late 1941 he enlisted in the Navy. His three-year tour with the Navy was aboard what he jokingly refers to as the "S.S. Dupont, 12th deck," actually the Navy's Dupont Building just a few blocks from home and his former Army job in Miami Beach. At the end of the war, Bramlitt thoughtfully volunteered to be the last man mustered out of the unit since he was already living at home. His scheduled release from active duty was postponed for several weeks more because of an ill-timed hurricane that struck the Miami Beach area.

Following the war, a number of projects in Florida added to Ed's experience and reputation in dealing with the civilian contractors who build the Corps of Engineers projects.

When the word came down from Jacksonville in late 1949 that there would be a rocket-launch pad project started at Cape Canaveral, it was natural that Ed Bramlitt would be one of the three Corps men given the assignment.

The original project—the construction of four launch pads, service tunnels, and facilities, and two launch control blockhouses—was estimated to run approximately eighteen months. The Army Ballistics Missile Agency in Huntsville, Alabama, was eager to launch its first rocket, a WAC Corporal riding on a captured German V2 rocket booster, in July of 1950. The Corps built the original Cape launch pad for that first shot in forty-five days, and completed the access road, tunnels, and blockhouse in sixty days, in time for the first shot.

The pioneer days at the Cape were not without hazard and hardship for the Corps of Engineers crews. "Every man on the survey team carried a snakebite kit," Bramlitt recalls, "but we have so far avoided a single case of snakebite in eighteen years of work at the Cape."

Mosquitoes were perhaps the biggest problem. "They hung around you in clouds," Bramlitt said. "We all used insect repellent. And visitors to the site got sprayed with a spray gun. The Air Force constantly sprayed the whole area from a converted B-17."

"I don't know how true the stories are," Bramlitt added, "but several of the early shots were supposedly scrubbed because the mosquitoes in the blockhouse were so thick that the technicians couldn't concentrate on their instruments."

Bramlitt recalls, "The first pad, actually Pad No. 3 instead of No. 1, wasn't much more than its name—a flat concrete pad with some tunnels running from it to a small blockhouse."

Visiting Pad No. 3 with Bramlitt today, one discovers the accuracy of his description. It is a 100-square-foot flat
chunk of concrete, much like a small section of a super-market parking lot. A scorched and stained ring at the pad's exact center attests to America's baby-step into space with a captured German missile and a relatively unsophisticated WAC Corporal rocket.

Resembling a relic from the Maginot Line, the tiny blockhouse sits approximately a hundred yards off, a distance that looks dangerously close to the casual viewer.

Approximately seven miles to the north of Pad No. 3 is America's newest and most sophisticated launch area, the National Aeronautics and Space Administration's Complex 39, from where three astronauts will soon be launched to the moon.

Complex 39, like the Air Force's launch installations at Cape Kennedy, was constructed under supervision of the Corps of Engineers. It includes two gigantic launch pads situated a quarter of a mile from the Atlantic and, about three miles inland, the Vehicle Assembly Building (VAB) which briefly held the title of "the world's largest building."

The VAB's claim to "world's largest" has recently been surpassed by a Boeing Company building with even greater volume, but the 52-story structure brings a gasp of awe from every visitor who walks into its cavernous interior. Inside, the VAB Saturn V rockets and their Apollo spacecraft are assembled vertically on Mobile Launchers which stand 446 feet high, ten feet shorter than the building's doors. Each Mobile Launcher and rocket is moved from the VAB to one of the two Complex 39 launch pads by a four-track crawler tractor, an impressive device by itself, as it weighs 5.5 million pounds. The Crawler, with Mobile Launcher and rocket loaded, has a top speed of one mile per hour as it moves from the VAB along the crushed gravel crawlerway to the launch pad.

Complex 39 also has a blockhouse, more grandly named the Launch Control Center, which sits more than three miles from the launch pad area. Compared to the tiny blockhouse at Pad 3, the Launch Control Center looks like a modern office building. Launch crews can forget about mosquitoes and other natural problems as they control all launch activities from four vast air-conditioned rooms located on the third floor of this structure.

With Complex 39 virtually completed and now operational, the future role of the Corps of Engineers at the John F. Kennedy Space Center is cloudy. The Vietnam war has definitely slowed down activity at the Cape.

But this is situation normal for Ed Bramlitt. When the Corps completed the original launch pads in 1950, it looked as if the project might be drawing to a close. But the Korean War required repairs to the airplane runways at nearby Patrick Air Force Base, and the Corps personnel stayed on for this project. Ed remembers that the run-way work blended right into the next step of the space program, which was the development of Intermediate Range Ballistic Missiles and then the later Intercontinental Ballistic Missiles. Both of these programs required construction of new launch complexes at the Cape.

When NASA acquired 88,000 acres of land on Merritt Island in 1962, Ed Bramlitt and the Corps of Engineers realized that bigger things were in store for the Cape.

In the early days, the engineers and survey crews lived in Cocoa Beach, some twenty miles away. They had to fuel their own vehicles in Cocoa as there were no motor pool facilities at the Cape, and life was relatively rough.

"There's one old saying around here," Ed drawled with a wry smile, "Everything is twenty miles away from everything else." That was true in the early days and perhaps more true today. Bramlitt can easily drive more than 200 miles in a single working day and never leave the project site.

The Kennedy Space Center has drastically changed the surrounding countryside. Cocoa Beach in 1950 was a sleepy coastal town with a population of 250. Today it is a city of more than 10,000 with more Ph.D.'s per capita than any other city in Florida. Brevard County's population boom—from 20,000 in 1950 to its present 250,000—has made it a major factor in Florida politics.

If the responsibilities of his job weren't enough to keep Ed Bramlitt busy, his interests in civic and public service comprise a full schedule. Throughout the years he has been associated with many professional and civic organizations. He is also a vestryman of his church.

Ed Bramlitt is an old timer in a young science. He has been witness to spectacular successes, such as John Glenn's first orbital mission, and national tragedies, including the fiery death of three astronauts on the launch pad last year. His list of stories and tales—there is a difference—is endless.

He recalls an incident when a rocket launch was scrubbed and liquid oxygen was pumped from the rocket into a nearby pond which served as the home of an alligator which refused to move off the premises. The result of the mixing of liquid oxygen and alligator was one very frozen alligator. Thinking the gator was dead, Corps personnel removed him from the pond. But the warm Florida sun soon thawed him out, whereupon a very disgruntled saurian walked away into the marshes and had no more to do with the United States' space program.

Bramlitt recalls another time when the mosquitoes were so thick, but then that's another story and if you want to hear it, you should visit Ed at the Cape and hear it as it should be told.
AT THIS SEASON when the hard maple and the sumac burn scarlet and the ginkgoes gleam golden in the October sun, we become sentimental about trees.

Propelled by this Thoreauish spirit, we jogged over to Millbrook boulevard the other day to chat with the fellow who is responsible for the well-being of everything that grows on campus, William F. Rebbe, Sr., superintendent of grounds. We noted with approval that here was a man who obviously relied on more than a green thumb to keep the flora flourishing. On his door hung an impressive weed chart, nearby was a plaque awarded to him for "meritorious service to the floral industry," and over in the corner we saw, not the usual bedraggled office philodendron, but a covey of exotic plants identified by the knowledgeable Rebbe as members of the family Bromeliaceae.

Rebbe has been keeper of all the flora at Washington University for more than four years (before that he looked after the late Edgar Queeny's estate for sixteen years and put in a stint at Shaw's Garden). "Here," he explained, "I'm in charge of all the planting—everything outside the buildings except the sanitary sewers and the parking area."

Rebbe's a great man for making the most of the new technology in the plant world, and he speaks enthusiastically about herbicides and pesticides. He's particularly strong on the "systemics," which he spreads around trees and plants like fertilizer. The plants absorb these chemicals which kill the insects that feed on their leaves.

Just now Rebbe is employing "systemics" against the mimosa webworm, which has developed a voracious appetite for locust trees, and he's using the same stuff to attack another pet peeve of his, the holly leaf miner.

All of this keeps Rebbe mighty busy, for as everyone who has ever walked over the campus knows, there are enough trees around to make a good-sized forest. But apparently it wasn't always so. For Rebbe's records show that there was a great tree planting day back on April 22, 1905, and for years afterward all sorts of individuals and groups donated trees to the University. There's one avenue of trees named after former board members and benefactors, and another stately column stretching from Umrah Hall to Ridgley which is known as Professor's Row.

A line of trees planted by the classes of 1906 through 1929 runs north of Crow. Hundreds of trees bear the names of alumni who were arbor-minded—on Rebbe's charts there are, for example, Greenfelder, Rice, and Wiederholdt pin oaks. The white birches near Wilson and Rebstock were put there by the American War Mothers, one of the many patriotic organizations which have added to the University's tree population over the years.

But what with the Dutch elm disease (which Rebbe is fighting with "Bidren," a form of nerve gas) and expansion down on the South Forty which has left quite a few bare spots, there is a need for many more trees. To make this point, Rebbe was preparing to take the members of the Women's Society of Washington University on a campus tour. They have already added to plantings around Olin Library and several residence halls and he hopes to persuade them to do even more. Right now there are twenty-nine different kinds of deciduous trees on campus, including several rare Royal Paulownia (Empress trees) and some handsome Kentucky coffee trees. But Rebbe is not content.

A modern-day Johnny Appleseed, we reflected as we trudged through the leafy trails leading back to the foyer of Alumni House—newly decorated, we discovered, with two camellia bushes donated by the Women's Society.

IT WAS THE DREAM GAME. Gibson against McLain. McLain had said he wanted not only to defeat us, but to humiliate us. We knew that Gibson and our Cardinals would make him eat those words and we wanted to see it happen, close to the heat of battle inside Busch Stadium—not in the cool atmosphere around a television set. Like most Cardinal fans, though, we had no ticket.

Then the impossible happened. At 11 a.m. our phone rang. A friend in the chemistry department had one extra standing-room ticket. Did we want it? We were off for the stadium immediately, but when we finally got inside the good standing-room places had all been taken. The first Tiger batter already was approaching the plate. We looked around desperately, then a bugle blared from above our head. The noise was coming from a boy seated on a ramp which led to the upper deck.

We hurried up the ramp and took a place near the young bugler. From this vantage point, we had a fine view of Gibson (from over the shortstop's head) and of the Cardinal infield. The outfield could not be seen, but it didn't make any difference. Gibson kept mowing the Tigers down and very few balls were hit beyond the infield. And we had a perfect angle from which to see shortstop Maxvill (BSEE '62) make two beautiful one-hand grabs of line drives.

By the time the last half of the ninth had arrived, we grew daring and gained a standing-room spot in back of some box seats on the field level. Everyone was standing when Gibson struck out the first Tiger and came within one strike-out of Koufax's World Series record. When Gibson struck out the next batter, no Cardinal fan cared whether we had a seat. When Gibson broke the strike-out record, seats were knocked over in the bleachers. It was a sight to behold; and the perfect end to a perfect day was that the modest Gibson wasn't even aware that he had made history. He was simply concentrating on winning.

This was the game we'll remember all winter. We'd just as soon forget the seventh and final game.
The construction of University Hall (see story on page 15) was a big architectural event in the early days of this century. Adolph Gehrwald, the Herb Weitman of his day, meticulously recorded the activities of hundreds of skilled stone craftsmen as they rushed to complete the Washington University buildings before the opening of the 1904 World's Fair. Mr. Gehrwald's lens captured the flavor of the times, from the somewhat doubtful scaffolding supporting the daring vaulted ceiling of the main arch (above) to the classy livery parked in the rear of the Pickel Stone Company's cutting shed. Thanks to slow lenses and slower emulsions, photographer Gehrwald could only hint at the furious pace of the project by showing the blurred figures of workmen (above).