quence. This work afforded unequivocal proof of codon assignments.

It also permitted the definition of some codons that had not previously been determined. Other of the triplets, which had seemed to code for no amino acid, were shown to serve as punctuation for the initiation and termination of one polypeptide chain. These latter assignments had already been suggested by genetic and biochemical experiments. The experiments from Khorana's laboratory also supplied proof of other attributes of the code. They demonstrated directly, in a way that the genetic experiments could not, that three nucleotides specify an amino acid. They proved the direction in which the information of the messenger RNA is read, that punctuation between codons is unnecessary, and that the codewords cannot overlap. Furthermore, because of the way the polyribonucleotides were prepared, these experiments showed that the sequence of nucleotides in DNA does indeed specify the sequence of amino acids in a protein, and it does so through the intermediary of an RNA.

These then are the extraordinary accomplishments of three men. Other investigators made findings essential to the total picture, and, together with these three, many have contributed to aspects of the story which are not recounted here.

The story of the genetic code unfolded in a reasonable and logical manner. At many points, the plausible experimental approach was apparent to many. The achievements of Holley, Khorana, and Nirenberg show common attributes that set these men apart from the many. Their separate triumphs are a combination of elegant scientific insight and style with the courageous daring and determination of the frontiersman.

MAXINE F. SINGER
National Institute of Health, Bethesda, Maryland.

George C. Wallace: He's Not Just Whistling Dixie

The presidential campaign of George C. Wallace, candidate of the American Independent Party, is an extraordinary operation which transfers many of the techniques and devices of Deep South provincial politics to the national scene. Wallace is making his forays into the north and west accompanied by a string band and a retinue of aides and advisers who are as southern as cornbread. And, by his verbal blasts against meddling by federal judges and "brief-case-totin' guideline-writers" in local school affairs, open housing, and union seniority lists, Wallace plays on racial fears—just as he did in 1963 when, in futile but symbolic protest against the admission of Negroes to the University of Alabama, he "stood in the schoolhouse door."

Blatant anti-intellectualism has been a feature of the Deep South politics of the Gene Talmadges and the Bilbos, and this, too, Wallace is using in his bid for the Presidency. Hardly a day goes by that Wallace fails to speak of "pointy-headed professors who can't park their bicycles straight." And, he tells his large and generally enthusiastic crowds, "the pseudo intellectuals look down their nose at the average man on the street, the steel worker, the auto worker, the textile worker, the fireman, the policeman, the barber, and the beautician."

Nor does he hesitate to suggest that university campuses are harboring disloyal and dangerous influences. When Wallace appeared in Cleveland recently, the hecklers, many of them of college age, were present in force, at times creating a formidable din. "You're paying taxes to support colleges and universities here in Ohio, but they seem to be teaching anarchy," Wallace said. Wallace invariably draws the line between what he considers legitimate and treasonable dissent, and he did so again in Cleveland. "When I become President," he said, "we are going to have our attorney general seek out these college professors who are making these speeches calling for communist victory [in Vietnam] and put them under a good jail."

Wallace is, however, making an attempt to adapt his campaign to some of the norms of national political life. In selecting his vice-presidential running mate, he did not choose an Orval Faubus of Arkansas or a Marvin Griffin of Georgia. He chose, instead, a national figure in General Curtis LeMay, retired Air Force chief of staff. Furthermore, Wallace has made public a party platform which, except for a few notable oversights (as in its failure to mention civil rights and arms control), touches on the full array of national questions, from environmental pollution to U.S. objectives in space. And even some of Wallace's sharpest critics concede that his formal statements on Vietnam and foreign policy have shown evidence of some restraint.

One may assume that none of the indigenous institutions of Wallace's home state of Alabama are closer to national attitudes and values than are its educational institutions, especially its colleges and universities. Accordingly, it may be particularly useful to examine Wallace's relations with higher education as one significant test of his credentials in his new role as a national politician. But, first, let's look at his personal and political origins.

Much has been made of Wallace's modest beginnings, but, although Wallace knew financial hardship as a youth, his family could not really have been placed among Alabama's poor white farmers and other have-nots. The Wallaces lived in Clio, a small community in southern Alabama, where George's grandfather was a respected country doctor who once ran successfully for a term as probate judge. Wallace's father (who had a history of chronic illness and died at the age of 40) was a failure at farming and most of his other ventures, but had flair enough for politics to win election as chairman of the county governing board. Wallace's mother was a high school music teacher.

This is the last of three articles on the presidential candidates.

Wallace worked his way through the University of Alabama, waiting on table, driving a taxi, and holding other odd jobs, and earned a bachelor's degree and law degree. In 1946, after service in the Air Force as a B-29 flight engineer, Wallace was elected to the state legislature. As a young legislator, he identified himself with Big Kissin' Jim Folsom, who served one 4-year term as governor of Alabama in the late 1940's and another from 1955 to 1959. Folsom, who tried without much success to befriend Negroes and poor whites alike by such measures as his proposal to repeal the poll tax, was the foe of Alabama's "Big Mules," the plantation owners and other wealthy men who had long manipulated state politics to their own advantage. During Folsom's second term, however, Wallace, who was still active politically though he had left the legislature after winning election as a state circuit judge, broke his ties with Big Jim. Folsom had by this time gained notoriety for heavy drinking and for once having invited Harlem congressman Adam Clayton Powell to the Governor's Mansion for a glass of Scotch.

Success in Governor's Race

Wallace ran an unsuccessful race for governor in 1958, when school desegregation had become the dominant issue in Alabama politics. Though Wallace has denied it, following his defeat he is reported to have said, "John Patterson [his opponent] out-nigguhed me. And boys, I'm not goin' to be out-nigguhed again." In 1962, Wallace again ran for governor, this time successfully, promising that, if necessary to prevent integration, he would stand in the schoolhouse door.

Outside Alabama Wallace is perhaps best known for his jousting with the courts over integration orders, but inside the state many people credit him with some positive achievements on behalf of education. Wallace himself boasts of his record, claiming that no previous governor ever did so much for the state's public schools and institutions of higher learning as he and his late wife, Lurleen, did (Mrs. Wallace, elected in 1966 as a stand-in for her husband, who, under the Alabama constitution, could not succeed himself, died of cancer this past May).

During the 5½ years of the two Wallace administrations the state's miserably low appropriations for education were doubled; teachers' pay was increased by 47 percent; the free textbook program was expanded; the University of South Alabama was established at Mobile; and, further, 15 junior colleges and numerous trade schools were established and made available to students throughout the state by a system of free bus transportation. On the other hand, his critics in the state educational establishment say that Wallace failed to press for adequate revenue measures and has left the state's entire educational system seriously underfinanced.

The public schools suffer from gross disparities and underevaluation in the assessments on which local property taxes are based. Alabama school people have long called for leadership by the governor's office and the legislature to correct the situation, but Wallace never chose really to come to grips with this property tax issue or with other controversial tax problems.

Early in his administration he prepared a package of tax measures to be borne principally by special interests such as insurance companies and building contractors. These interests mounted a fierce lobbying campaign, however, and soon it became apparent not only that the governor's tax proposals were in desperate trouble but that Wallace was making no fight to save them. Predictably, in order to raise the revenues needed for Wallace's education program, the legislature turned to the sales tax, raising it from 3 percent to 4 percent (and later imposing a new 2-cent tax on beer). The state's very low corporate income tax also was increased modestly, but this was accomplished by means of a constitutional amendment, thus making it difficult to raise this tax further in the future.

Last winter, Alabama teachers, white and black, were considering resorting to

AAAS Board Reviews Defoliation Data

The AAAS board at its meeting last weekend made no public comment on the progress of its dialogue with the Department of Defense (DOD) on the use of herbicides in Vietnam. In a statement issued in July (*Science*, 19 July) the board had expressed concern about the use of arsenicals in defoliation operations in Vietnam and urged that "steps be promptly undertaken to initiate detailed, long-term, on-the-spot studies of the regions of Vietnam affected by the use of herbicides."

It has been reported that John S. Foster, Jr., Director of Defense Research and Engineering, replied to the AAAS board, in terms which essentially repeated an earlier DOD statement, that DOD judged, on the basis of information gathered in Vietnam, that no serious long-term ecological effects will occur as the result of the defoliation program, and that the military benefits of the program are substantial. Defense Department officials have told questioners that a full-scale ground survey of ecological damage of areas affected by spraying operations in Vietnam is impossible because of the tactical situation.

Board Withholds Comment

At its meeting last weekend the board held further discussions with Defense Department representatives, including government scientists who had participated in surveys of defoliated areas in Vietnam. The board decided not to release the DOD letter or to make any statement, but indicated it would seek more information from the Pentagon and report to the AAAS Council at the annual meeting in Dallas in December.

The fullest recent official comment on the defoliation program came in a report of a survey of allied herbicide operations which was released in September by the U.S. Mission in Saigon. An interagency committee which studied military, economic, and ecological aspects of the defoliation program reported that herbicide spraying had apparently not caused significant ecological damage and that, while the program had caused substantial economic losses due principally to timber damage, the interagency group had concluded that military benefits outweigh the "unknowns" of the military program.—J.W.

a strike to force the state to raise their salaries, which not only are far below the national average but compare unfavorably with those paid in some neighboring states. A strike next year is considered a real possibility if a major pay increase is not forthcoming. Meanwhile, Alabama is losing many teachers to other states. According to a recent survey, half of the teacher-trainees graduated by Alabama institutions this year are leaving the state.

Whatever may be said for the Wallace record in the field of higher education, Alabama now ranks last among the 50 states with respect to the percentage increase in its support of its colleges and universities. The state increased its appropriations for higher education by only 7 percent for the 1967–69 biennium, as compared with an average increase of 43 percent for all states. Moreover, while Alabama has increased its support for higher education by 161 percent since 1960, other states have, on the average, increased theirs by 233 percent.

Alabama's public school and higher education officials are not given to criticizing Wallace publicly, but some believe that, with his massive popularity among voters, he could have obtained far greater revenue for education had he really tried. "Instead of giving detailed attention to the state's problems, Wallace has devoted himself to his activities as a regional and national politician," observes a Wallace-watcher formerly connected with one of the state's major institutions.

Junior-College Pork Barrel

The new system of junior colleges, which Wallace regards as one of his proudest achievements, clearly has expanded educational opportunity in Alabama, but it is viewed by many Alabama educators as grossly overbuilt. In keeping with previous studies and legislative recommendations, Wallace proposed to the legislature a system of five new junior colleges. But he then cheerfully allowed the legislators to add 11 other colleges to the package. Now, even with buses scurrying far and wide to pick up students, several of these new 2-year institutions still have enrollments of only about 500.

Moreover, it seems that in order to head one of these colleges, one had to have school administrative experience, an advanced degree, and—credentials as a political friend of George Wallace. The presidents of these colleges have not forgotten who their patron was, and a number of them met earlier this year to talk about making contributions, of from $500 to $1000 apiece, to the Wallace presidential campaign. Byron Causey, president of the Alexander City State Junior College, who took part in this fund-raising session, says that for years there had been talk in Alabama of establishing a state junior college program but that nothing was done until George Wallace came along. "The only way we could get such a program was to put the colleges out there so nearly every senator and representative had one in his area," Causey says.

Wallace's most intimate friend in Alabama's higher education circles is Ralph W. Adams, president of Troy State University, at Troy, Alabama, which is still primarily an undergraduate institution. Wallace and Adams were law students together at the University of Alabama, and Wallace for a time hustled customers for Adams' boarding-house. Adams achieved some success as an Air Force lawyer and in other endeavors, but did not attain his present eminence until Wallace became governor. Adams is by no means the first politician's crony to be named president of a university, but his appointment (by the State Board of Education, which Wallace chaired) to head Troy State was regarded by some people as a particularly bad joke on the academic community.

Marshall Frady, author of the critical biography *Wallace*, tells how Wallace once, in conversation with a reporter, motioned toward Adams and said, "Hell, this fella here just did finish the sixth grade, and I appointed him president of one of our colleges down there in Alabama. That just goes to show you, in Alabama we don't discriminate for any reason—race, creed, color, religion, *or* ignorance." As Frady relates it, later, when Adams protested, Wallace grunted, "Aw, hell, Adams, you turnin' into one of them sensitive college presidents."

But, to many of the faculty members at Troy State, Adams is no joke at all. An American Association of University Professors investigating committee has reported, in the September AAUP *Bulletin*, a "flagrant violation" of academic freedom at this institution. The particular case in point has to do with a nontenured English instructor whose contract was not renewed in 1967 because of his public protests at Adams' censorship of the student newspaper. More generally, however, the AAUP report describes a condition which any visitor to Troy State can readily see for himself: In Adams' view, one of the principal tests of institutional loyalty, is for the faculty and students to abstain from all criticism of either himself, George Wallace, or the Alabama legislature.

"We Lost Some Agitators"

Several faculty members have either departed in protest or been fired, and some others are looking around. All this Adams regards with equanimity. "I wouldn't say we lost them," he told a *Science* reporter. "We got rid of some folks. We lost some agitators."

The current troubles at Troy State began in the spring of 1967 when the student editor tried to break through Adams' censorship and defend Frank Rose, president of the University of Alabama, in a speaker-ban controversy for which Wallace bore no little responsibility. A bill banning Communists and other revolutionaries from state campuses had been introduced in the legislature following publication, by the University of Alabama Student Government Association, of a booklet containing articles by Stokely Carmichael and Betina Aptheker, as well as articles by such pillars of the establishment as Secretary of State Dean Rusk and General Earle G. Wheeler, chairman of the Joint Chiefs of Staff. Moreover, Rose was being denounced by some legislators and told he should resign.

The speaker-ban bill was not introduced by a Wallace man, but it was similar to a measure Wallace had backed 2 years earlier. Rose, who had recently refused to sign a resolution condemning a federal court order requiring desegregation in all Alabama public schools, seemed to feel that Wallace had a hand in his difficulties. In an emotional speech before a group of Birmingham lawyers he indicated that, on the issue of academic freedom, he would yield neither to threats nor to blandishments. "I'm not for sale," he said, "and the University of Alabama, as long as I am president, is not for sale." And, later, as an after-thought, he added: "I have no ambition to be president [of the United States]."

Although the speaker-ban legislation was killed in committee, the controversy attending it has added to what some Alabamans see as the state's generally repressive political atmosphere.

Of all the state institutions, the University of Alabama is perhaps the least vulnerable to pressure from Wallace or other politicians. It has a virtually self-perpetuating board, and, as the alma mater of many of the state's business and political leaders, it is far from helpless politically. On the other hand, Rose is walking a political tightrope, and the penalty for falling off might be reduced university appropriations. Accordingly, he has been imposing restrictions of his own on whom the students may invite to speak on campus. The Democratic Student Organization, a mildly radical campus group, has just been turned down on its plans to bring to the campus such provocative speakers as Mark Rudd, leader of the Columbia revolt, and Eldridge Cleaver, information minister of the Black Panther Party.

Except for his losing battle against the admission of Negroes, Wallace seems not to have tried very hard to interfere in the internal affairs of either the University of Alabama or the state's other major institution, Auburn University, even though as governor he was ex-officio chairman of their boards of trustees. Last year the university, along with other state institutions, was asked—by formal resolution of the legislature and by an executive order of Governor Lurleen Wallace—to play "Dixie" and to display the Confederate flag at football games. However, this trifling chauvinistic gesture represented no serious effort at thought control, and the university went along with it.

A Degree for Adams

Wallace did arrange, it seems, to have the University of Alabama confer an honorary degree on Ralph Adams. And, when the Auburn board met, Wallace sometimes came brandishing a copy of *The Plainsman*, the campus newspaper, and complaining, in effect, that the student editors were being brainwashed by the anti-Wallace publisher of the Auburn *Bulletin*, the commercial newspaper in the town of Auburn, which printed the student paper. But his suggestion that the university itself arrange to print *The Plainsman* was never followed.

Alabama's Negro institutions, public and private, are perhaps those entitled to complain the loudest about Wallace. Last year Wallace attempted, with partial success, to cut off state financial assistance to Tuskegee Institute, in Macon County, where the Negro has made

NEWS IN BRIEF

● **SOVIET DISSENTERS:** Two Soviet scientists are among five Russians sentenced to 3 to 5 years of exile and hard labor for taking part in the August Red Square demonstration against the Soviet invasion of Czechoslovakia; they are Pavel Litvinov, a 30-year-old physicist and grandson of Stalin's foreign minister, and Konstantin Babitsky, a mathematical linguist. Litvinov was a former teacher in the Moscow Institute of Precision Chemical Technology and Babitsky was at the Russian Language Institute of the Soviet Academy of Sciences. In the trial both denounced the Soviet bar on free speech and free assembly. Vadim Delone, a Russian student who was also sentenced, said, "For three minutes on Red Square I felt free. I am glad to take your three years for that." Other dissidents included the wife of an imprisoned writer and an unemployed worker.

● **ECOLOGISTS ENDORSE HUMPHREY:** A group of ecologists who have canvassed major presidential candidates on environmental issues, including population problems and air and water pollution, have endorsed the candidacy of Vice President Humphrey and Senator Edmund Muskie (D–Maine). In his reply to the ecologists, Humphrey said that he would establish a special advisory board on ecology and a National Institute of Ecology to support research and analysis of environmental problems. The 12 ecologists supporting the Humphrey-Muskie candidacy include three former presidents of the Ecological Society of America, Arthur D. Hasler of the University of Wisconsin, Murray F. Buell of Rutgers University, and W. Frank Blair of the University of Texas.

● **ASTRONOMY SITES:** Construction sites are available for optical telescopes on sites adjacent to the Kitt Peak National Observatory on the Papago Indian reservation in Arizona and the Cerro Totoral Inter-American Observatory in Chile, South America. The Association of Universities for Research in Astronomy (AURA), subject to approval of the National Science Foundation, will lease sites on Kitt Peak, at 6800 feet, and near Cerro Totoral, at 7200 feet, to groups and universities who wish to operate their own instruments, rather than compete for observing time on AURA telescopes. Applications should be addressed to the Observatory Director, Kitt Peak National Observatory, P.O. Box 4103, Tucson, Ariz. 85717.

● **NYC—UNIVERSITIES LINK:** An Office of University Relations has been established in New York City to improve relations and to coordinate programs between local colleges and the city government. The purpose of the new city agency, which will be established in the office of the deputy mayor, will be to keep city officials informed of university research projects and the colleges informed of city problems and programs. City cabinet meetings will be planned on campuses to give students and faculty the opportunity to meet city officials, and exchanges will be arranged to provide both the faculty members and the students with the opportunity to work in city agencies on urban problems.

● **STUDENT OMBUDSMAN:** The first student ombudsman has been named by the University of Chicago to receive and review student grievances in conflicts over university policies. Provost Edward H. Levi says that the ombudsman will be an independent agent, not a student representative, and that his influence "will depend upon his ability to suggest and persuade." Levi has named John W. Moscow, a senior in political science and last year's news editor on the *Maroon* to the post. Moscow will be provided with an office, a staff, and a salary; he may make investigations of student grievances and will issue a public report quarterly.

● **NEW MICROBIOLOGICAL CENTER:** A new national microbiological testing center has been established in Minneapolis, Minn., by the Food and Drug Administration (FDA) to test products for bacterial contamination. One function of the new center will be to develop new methods to help FDA identify inspection problems. An FDA 4-month pilot program will test a new broad range of food, drug, and cosmetic products, including dried foods, frozen pies, cooked shrimp, and drugs, such as insulin and thyroid preparations. Eighteen microbiologists from FDA's headquarters and 17 field laboratories are participating.

major political breakthroughs, as in electing a black sheriff. Furthermore, when Governor Lurleen Wallace last year set up an education study commission for a major survey of future needs, none of the regular members chosen was a Negro.

Though Wallace frequently is spoken of as a politician in the southern Populist tradition, to many academic people in Alabama his performance in the field of education has had a look of expediency, and, clearly, his relations with the academic community have been troubled and often marked by mutual suspicion. Other presidential candidates have their committees of scientists and engineers, but Wallace has no such group of academicians touting his candidacy. In fact, this Deep South politician has moved from the provincial ot the national scene without an academic brain trust even within his home state.—LUTHER J. CARTER

300 Gev: Europe Moves Closer to Getting Its Big Machine

Geneva. Europe's plans to build what would eventually be the world's most powerful particle accelerator appear to be successfully emerging from the same sort of cliff-hanging dramas that have become commonplace in American high-energy physics. As was the case with the 200-Gev machine now under construction near Weston, Illinois, and the 2-mile linear accelerator that went into operation at Stanford in 1966, the high cost and disputed value of high-energy physics dictate that no "frontier" machine can come into being without generating a good deal of scientific and political turmoil. Nevertheless, on both sides of the ocean, though politicians gag on the incomprehensibility and high costs of particle physics, the decisive elements are strikingly alike—namely, ominous, though vague, warnings of the afflictions that await nations that lag in this field; the military-based position of physics as the scientific discipline with the closest governmental ties; meticulous cost planning, which is, understandably, appreciated by national budget makers; and, finally, continental, even world-wide, cohesion among the practitioners of high-energy research.

What the Europeans are planning is a 300-Gev accelerator to be built by the 13-nation European Organization for Nuclear Research (CERN) as a successor to the 28-Gev CERN machine that has been in operation here since 1959. And, on the basis of what happened at a crucial meeting of the CERN Council here earlier this month, the odds now seem very good that they are going to get it. The latest Council meeting, held on 2–3 October, was the first since last June, when Britain announced that, for financial reasons, it would not participate in the $408-million project (*Science* 28 June, 23 August). Since Britain, which is CERN's second largest contributor, was to provide about 25 percent of the costs—a figure computed on the basis of national incomes of the CERN membership—the announcement stunned the organization. Atop this came rumors that the third largest contributor, France, with its economy disrupted by last spring's upheavals, would not be dismayed to find a gracious way out of fulfilling its previously stated intent to take part in the project.

With good reason, then, the June meeting ended in gloom and even gave rise to some talk that CERN, far and away the most successful example of European cooperation in big science, might ultimately wither away. The gloom, however, was short-lived, for not only did France show no sign of changing its decision but, in September, West Germany, CERN's largest single contributor, announced that, subject to a number of easily met conditions, it would come into the project. Along with the French commitment, and previous commitments from Austria, Belgium, and Italy, the German move brought CERN to within 60 percent of the original cost—not very close, but still not so bad in view of the fact that the CERN design group was revising its plans so that the project could proceed without the money that had been anticipated from the British.

Meanwhile, in mid-September, at the 14th International Conference on High Energy Physics, in Vienna, the particle physics fraternity put on a group press conference that was quite enough to chill any statesman concerned for the fate of his nation. Bernard Gregory, the Frenchman who serves as CERN's director general, warned, "if we do not have in Europe one of the best machines in the world, then I believe that activity in this field will slowly decay. I believe that some people will be invited to work on the U.S. [200-Gev] machine and will indeed participate in the work there, but in terms of the overall status of physics research in Europe, essentially this field will decay. . . . Moreover, we should lose our best people to other fields and to other countries and there will be little opportunity in the future of regaining the situation."

Robert R. Wilson, director of the 200-Gev project, was asked, "If the worst came to the worst, could in fact the American project accommodate a significant overseas participation?" Wilson grimly replied, "The answer is, with money 'yes,' without money 'no.' Without money we cannot even accommodate our own regional interest. . . . We should of course try and accommodate people from Europe if the worst came to the worst, but I think we should regard this as a pretty desperate circumstance." And so proceeded the mutual commiseration.

When the CERN Council convened for the 2–3 October meeting, the situation was as follows: the design group had reworked its plans so that the cost was reduced from the original $408 million down to $307 million. With five nations already committed to the project, 80 percent of this revised amount was assured.

None of the still uncommitted nations was prepared to declare itself at that meeting, but the general atmosphere was one of amiability, confidence, and solicitude for the problems that each delegation had to cope with in dealing with politicians at home. Thus, when the time came to approve