

sition of the model polypeptide, polymethylglutamate (43), and in the collagen-to-gelatin transition (43). If one could manage to induce or modify specific configurations of proteins at the site of interest, adhesion could be either hindered or assisted.

The knowledge gained from studies of simple systems may well provide a useful starting point for better understanding of biological adhesion, which is the necessary prerequisite to beneficial interference with living systems.

Note added in proof. Since this article was written, Lyman, Brash, and their colleagues (44) have demonstrated a direct correlation between the number of platelets adherent to plastic surfaces and the critical surface tensions of the surfaces involved.

References

1. R. Holm, *Die Technische Physik der Elektrischen Kontakte* (Springer, Berlin, 1941).
2. F. P. Bowden and D. Tabor, *Friction and Lubrication of Solids*, pt. 1 (Oxford Univ. Press, London, 1950); *ibid.*, pt. 2 (Oxford Univ. Press, London, 1964).
3. J. S. McFarlane and D. Tabor, *Proc. Roy. Soc. London Ser. A* **202**, 224 (1950).
4. D. Tabor, in *Adhesion*, D. D. Eley, Ed. (Oxford Univ. Press, London, 1961), chap. 5.
5. F. P. Bowden and J. E. Young, *Proc. Roy. Soc. London Ser. A* **208**, 311 (1951); O. Levine and W. A. Zisman, *J. Phys. Chem.* **61**, 1068 (1957); ———, *ibid.*, p. 1188; R. L. Cottington, E. G. Shafrin, W. A. Zisman, *ibid.* **62**, 513 (1958).
6. R. C. Bowers, W. C. Clinton, W. A. Zisman, *Mod. Plastics* **31**, 131 (1954).
7. N. K. Adam, *The Physics and Chemistry of Surfaces* (Oxford Univ. Press, London, ed. 3, 1941), p. 9.
8. H. M. Budgett, *Proc. Roy. Soc. London Ser. A* **86**, 25 (1911).
9. J. W. McBain and D. G. Hopkins, *J. Phys. Chem.* **29**, 88 (1925); J. W. McBain and W. B. Lee, *Ind. Eng. Chem.* **19**, 1005 (1927).
10. N. A. deBruyne, *Nature* **180**, 262 (1957).
11. W. A. Zisman, *A Decade of Basic and Applied Science in the Navy* (Government Printing Office, Washington, D.C., 1957), p. 30.
12. ———, in *Adhesion and Cohesion*, P. Weiss, Ed. (Elsevier, New York, 1962), p. 176.
13. ———, *Advan. Chem. Ser.* **43**, 1 (1963).
14. A. A. Griffith, *Phil. Trans. Roy. Soc. London Ser. A* **221**, 163 (1920).
15. W. A. Zisman, *Ind. Eng. Chem.* **55**, 19 (1963).
16. C. Mylonas, in *Proc. Int. Congr. Appl. Mech.*, 7th, London (1948).
17. H. W. Fox and W. A. Zisman, *J. Colloid Sci.* **5**, 514 (1950).
18. T. Young, *Phil. Trans. Roy. Soc. London* **95**, 65 (1805).
19. R. N. Wenzel, *Ind. Eng. Chem.* **28**, 988 (1936).
20. A. B. D. Cassie and S. Baxter, *Trans. Faraday Soc.* **40**, 546 (1944); R. Shuttleworth and G. L. Bailey, *Discussions Faraday Soc.* **3**, 16 (1948); F. E. Bartell and J. W. Shepard, *J. Phys. Chem.* **57**, 211 (1953); R. E. Johnson, Jr., and R. H. Dettre, *Advan. Chem. Ser.* **43**, 112 (1963).
21. E. G. Shafrin and W. A. Zisman, *J. Phys. Chem.* **61**, 1046 (1957).
22. V. R. Gray, *Forest Prod. J.* **12**, 452 (1962).
23. E. G. Shafrin and W. A. Zisman, *J. Phys. Chem.* **66**, 740 (1962).
24. H. R. Baker, P. B. Leach, C. R. Singleterry, W. A. Zisman, *Ind. Eng. Chem.* **59**, No. 6, 29 (1967); M. K. Burnett and W. A. Zisman, *J. Phys. Chem.* **70**, 1064 (1966).
25. E. G. Shafrin and W. A. Zisman, *J. Amer. Ceram. Soc.* **50**, 478 (1967); M. K. Burnett and W. A. Zisman, "Effect of Adsorbed Water on Wetting Properties of Borosilicate Glass, Quartz, and Sapphire," *Naval Res. Lab. Rep. No. 6705* (1968); M. K. Burnett and W. A. Zisman, "Effect of Adsorbed Water on Critical Surface Tension of Wetting on Metal Surfaces," *Naval Res. Lab. Rep. No. 6727* (1968).
26. E. P. Plueddeman, H. A. Clark, L. E. Nelson, K. R. Hoffman, *Mod. Plastics* **39**, 135 (1962); S. Sterman and J. G. Marsden, *Ind. Eng. Chem.* **58**, 33 (1966).
27. F. Hauserman, *Advan. Chem. Ser.* **23**, 338 (1959).
28. W. A. Zisman, *Ind. Eng. Chem.* **57**, 26 (1965).
29. J. G. O'Rear, P. J. Sniegoski, F. L. James, "Chlorophenyl-alkyl-substituted carboxylic acids and silanes designed as adhesion promoters," paper presented at the 154th national meeting of the American Chemical Society, Chicago, 1967 (*Advan. Chem. Ser.*, in press).
30. E. G. Shafrin and W. A. Zisman, "Preparation and wettability of terminally chlorophenyl-substituted carboxylic acid films," paper presented at the 154th national meeting of the American Chemical Society, Chicago, 1967 (*Advan. Chem. Ser.*, in press).
31. W. D. Bascom, "The wettability of ethyl- and vinyltriethoxy-silane films formed at organic liquid/silica interfaces," paper presented at the 154th national meeting of the American Chemical Society, Chicago, 1967 (*Advan. Chem. Ser.*, in press).
32. A. H. Ellison and W. A. Zisman, *J. Phys. Chem.* **58**, 260 (1954).
33. D. J. Lyman, W. M. Muir, I. J. Lee, *Trans. Amer. Soc. Artificial Internal Organs* **11**, 301 (1965).
34. A. C. Taylor, *Exp. Cell Res. Suppl.* **8**, 154 (1961); ———, in *Biological Interactions in Normal and Neoplastic Growth*, M. J. Brennan and W. L. Simpson, Eds. (Little, Brown, Boston, 1962).
35. L. Weiss and L. E. Blumenson, *J. Cell. Physiol.* **70**, 23 (1967).
36. L. Weiss, *J. Theoret. Biol.* **6**, 275 (1964).
37. D. J. Crisp and J. S. Ryland, *Nature* **185**, 119 (1960).
38. D. J. Crisp and P. S. Meadows, *Proc. Roy. Soc. London Ser. B* **158**, 364 (1963).
39. I. M. Perel'man, *Colloid J. (USSR) English Transl.* **27**, 422 (1965).
40. S. E. Moolten, L. Vroman, G. M. S. Vroman, B. Goodman, *Arch. Internal Med.* **84**, 667 (1949).
41. D. M. Zubairov, A. V. Repeikov, Timberbaev, *Fiziol. Zh. SSSR* **49**, 85 (1963).
42. A. L. Copley, in *Flow Properties of Blood and Other Biological Systems*, A. L. Copley and G. Stainsby, Eds. (Pergamon, New York, 1960).
43. R. E. Baier and W. A. Zisman, "Critical surface tension of wetting for protein analogues," paper presented at the 153rd national meeting of the American Chemical Society, Miami Beach, 1967.
44. D. J. Lyman, J. L. Brash, S. W. Chaikin, K. G. Klein, M. Carini, *Trans. Amer. Soc. Artificial Internal Organs* **14**, 250 (1968).

NEWS AND COMMENT

Strategic Studies: British Center Said To Attract Nixon's Interest

London. Apparently in line with President-elect Nixon's pledge to engage a wide range of advisers for his administration, a Nixon emissary, former congressman Robert Ellsworth, recently spent an afternoon here visiting a research organization known as the Institute for Strategic Studies (ISS).

Ellsworth's time abroad was brief, and seems to have been for no other official purpose than to look in on ISS. He said his object was merely to be-

come acquainted with ISS's operational methods, and ISS staff members say they discussed nothing but that. What, if anything, is going to come out of the visit has not been revealed to outsiders. But what makes the episode a bit curious is that the director of ISS, Alastair Buchan, who is on 3 months' leave to a Canadian university, saw Ellsworth in the United States prior to his visit here, and the ISS staff says that it knew nothing of Ellsworth's

visit until the morning of the day he showed up for a noon-to-5 p.m. discussion. Probably the whole matter can be explained in terms of crossed signals and the incoming administration's desire to learn something about one of the more esteemed and unusual institutions of strategic scholarship. Nevertheless, if the administration is going to seek advice abroad, it is worth looking at what is possibly the first foreign organization to engage its interest.

ISS, little known to the general public but extraordinarily well connected to western military and political circles, is a British incorporated, nongovernmental, London-based organization founded in 1958. Listed as the founders were seven Britons, including Denis W. Healey, who is now Minister of Defence; there was also a retired admiral who was a director of Vickers-Armstrong, and the then-editor of the

Economist. Buchan, who was director of ISS from the start, came to the post from the *Observer*, for which he had been a correspondent in Washington and, later, military and diplomatic correspondent in London. The stated purpose of the Institute was to study "the influence of modern and nuclear weapons and methods of warfare upon the problems of strategy, defence, disarmament and international relations."

However, though British in location and personnel, ISS was financially a creation of the Ford Foundation, which started it off with a grant of \$50,000 a year for 3 years. Ford's support was reduced to \$35,000 a year in 1961, but in 1963 it was decided to make ISS international by admitting foreigners to its previously all-British Council, and the following year Ford provided a \$600,000 grant to be expended over 6 years. Eventually this brought onto the Council persons from some dozen western nations, including several Americans, among them Albert J. Wohlstetter, University of Chicago political scientist; Louis J. Halle, a former State Department official who is at the Graduate Institute of International Studies, Geneva; Robert R. Bowie, of the Harvard Center for International Affairs; and Marshall D. Shulman, director of the Columbia University Russian Institute. Today, the Ford grant, plus \$25,000 each from the Rockefeller Foundation and the Carnegie Endowment for International Peace, account for some 55 percent of the ISS budget, with the rest coming from membership fees, corporate gifts, several European foundations, and the sale of publications. The total budget, however, is modest as such things go, somewhat less than \$200,000 a year. (The RAND Corporation, for example, has an annual budget somewhere in the neighborhood of \$15 million.) But, though the money is relatively insignificant, the connections are not, for ISS is, in many respects, a super-think-tank of cold war scholarship, a sort of international—though mainly Anglo-American—fraternity of what has come to be known as "defense intellectuals."

In terms of staff, ISS is tiny—27 in all. Buchan and two associates constitute the full-time professional staff; there are eight research associates appointed for limited periods, and the rest are clerks and secretaries. But the number of persons associated with ISS is actually well over a thousand, since, instead of being organized on the con-

NEWS IN BRIEF

● **CALTECH NAMES BROWN:** Harold Brown, Secretary of the Air Force since 1965, has been named as the new president of the California Institute of Technology. Brown is a former Director of Defense Research and Engineering (1961–65) and a former staff member and director of the Livermore Radiation Laboratory of the University of California (1952–60). Brown will succeed Lee A. Dubridge who resigned to become President-elect Nixon's science adviser.

● **ANSWER TO AGNEW:** The operation of a chapter of Students for a Democratic Society (SDS) on a Maryland state college campus, which was questioned in October by Governor Spiro T. Agnew, has been upheld by the college president. Agnew requested an investigation of the Towson State College SDS chapter after a campus campaign visit during which he was heckled by students he believed to be SDS members. Towson State College President Earle T. Hawkins told *Science* that, in response to Agnew's request, an investigation was made that "showed no need for university action against students or faculty members" who were involved in the militant student organization. Agnew said the issue was whether a state college should "support an organization that appears intent upon disruption."

● **SCIENTISTS AGAINST CHEMICAL WARFARE:** An effort to establish a "Scientists' Committee To End Chemical Warfare in Vietnam" will be made at the AAAS meeting in Dallas. The organizing session will meet at 8 p.m. on 28 December in the Embassy East Room of the Statler-Hilton Hotel. J. B. Neilands of the University of California at Berkeley is acting chairman of the organizing group and E. W. Pfeiffer of the University of Montana is executive secretary. Other members of the 12-man organizing group include Edward U. Condon of the University of Colorado, John T. Edsall of Harvard, and Arthur W. Galston of Yale.

● **TROPICAL STUDIES:** The permanent North American headquarters of the 24-university consortium, the Organization for Tropical Studies (OTS), has been established at the University of Miami. OTS, which serves about 280 U.S. students and research scientists,

provides research facilities throughout Central America in tropical terrestrial biology, zoology, botany, geography, and marine and atmospheric sciences. OTS operations are funded by member institutions, the National Science Foundation, and the Ford Foundation.

● **ARMY ACCELERATOR:** A \$4-million tandem Van de Graaff electrostatic accelerator, the only one of its kind within the Department of Defense, has been completed at the Army Nuclear Defense Laboratory (NDL) at the Edgewood Arsenal, Maryland. The accelerator will be utilized to perform basic research, aimed at enhancing U.S. ability to predict nuclear weapons defects and to develop new nuclear defense weapons. NDL, which conducts basic and applied research on effects of nuclear weapons, including initial and residual radiation, fallout, shielding, and thermal radiation, operates on a \$2-million annual budget.

● **AID TO STATE SCIENCE:** The federal government has given the State of Tennessee an \$85,000 National Science Foundation (NSF) grant as part of its effort in assisting studies on science policy planning at the state and local levels. The purpose of the grant is to find out how science and technology might better contribute to the economic and social welfare of Tennessee. The 18-month study, which will center at the University of Tennessee, is also supported by a \$41,800 grant from the state, a \$15,000 grant from the Tennessee Valley Authority, and a \$10,000 NASA sustaining grant to the University of Tennessee. The federal grant was awarded under a long-standing NSF policy development research provision, but indicates NSF's increased willingness to boost applied research efforts under the new NSF reorganization policy.

● **MINORITIES IN MEDICINE:** Stanford University's School of Medicine will increase its enrollment of educationally deprived racial minority students. Ten places for minority students are being reserved, commencing in September 1969. Stanford's medical school now admits 64 students each year. The university will provide tutoring for the students, but all students accepted will be required to compete on the same basis as regularly admitted students.

ventional style of a mainly self-contained research institute, ISS is a vast international association of people who, for one reason or another, are concerned with strategic studies. These people include, under the title of members, some 800 academics, industrialists, diplomats, military officers, international civil servants, journalists, and others, each of whom pays a membership fee of eight pounds (\$19.20). These members range from obscurity to considerable public prominence, and include Henry A. Kissinger, whom Nixon has appointed to be his assistant for national security affairs (Kissinger and Buchan are old friends); Herman Kahn, president of the Hudson Institute; Adam Yarmolinsky, who was a longtime aide to Defense Secretary McNamara; Henry S. Rowen, president of the RAND Corporation; and Vikram A. Sarabhai, head of India's atomic energy and space programs. For the same price, ISS also offers associate memberships for those who do "not wish to be held in any way responsible for the Institute's activities." What motivates the choice of full-fledged or associate membership isn't clear, since there are instances of people in the same organization choosing differently on this score. But the associates, numbering a couple of hundred, include many high-level figures, among them Alain C. Enthoven, who is an assistant secretary of defense, and Admiral John S. McCain, Jr., commander of the U.S. Seventh Fleet. And, finally, at \$240 apiece, there are about 100 corporate members, including many major newspapers, Radio Free Europe, the Boeing International Corporation, the M.I.T. Center for International Studies, a number of military services, and several London embassies.

A lot of this membership does no more than pay its dues and receive the many publications that come out under ISS sponsorship. But it is clear that ISS profits greatly from its well-connected membership, and nowhere is this more apparent than in the publication for which it is best known, the annually issued *Military Balance* which is the most comprehensive publicly available rundown on military forces around the world.* ISS insists that it is not in receipt of any "intelligence

information," that it works only with publicly available materials (also, that none of its own output is restricted in circulation). Nevertheless, the foreword to *Military Balance* states, "Not all countries have been equally cooperative in producing information, and some figures have been estimated. The Institute owes a considerable debt to a number of its own members and consultants who have assisted in compiling and checking this material." A staff member explained that "the members do not supply us with information, but they will check over what we have and tell us if we're wrong." However it is done, the *Military Balance* is annually greeted by the popular press as a highly authoritative statement of military forces, and it is the publication of this report that creates the most public notice for ISS.

ISS Publications

Generally given lesser public attention, but of greater influence, are the reports, periodicals, and book-length works issued by ISS or under its sponsorship. These are many in number and include a monthly magazine, *Survival*, and an annual publication, *Strategic Survey*, which is a complement to the *Military Balance*. Then there is a series called the Adelphi Papers, which ranges over a variety of subjects. Recent Adelphi papers have included "The Implications of Military Technology in the 1970s," a collection drawn from a conference held last year. Contributors are Wohlstetter; J. J. Coffey, of the University of Pittsburgh; Air Marshal Sir Christopher Hartley, of the British Ministry of Technology; John P. Craven, chief scientist of the U.S. Navy's Strategic Systems Project Office; E. C. Cornford, deputy chief adviser for research and studies in the British Ministry of Defence; and Leland L. Johnson, a RAND economist. Book-length works include *The Spread of Nuclear Weapons* by John Maddox and Leonard Beaton.

ISS also sponsors several annual conferences. The last, held recently at Oxford, was attended by some 200 persons, among them Yarmolinsky; Thomas C. Schelling of the Harvard Center for International Affairs; Herman Kahn; Rowen of the RAND Corporation; and Morton Halperin of the State Department.

ISS states in one of its brochures that "it is not the advocate of any particular school of thought," and

within certain bounds this is true. Thus, the Adelphi series includes papers pro and con on the value and implications of antimissile defense systems. Among these is "The Case Against Missile Defenses," by Jeremy J. Stone, a Stanford economist, who, incidentally, is the son of I. F. Stone, the radical journalist. In Washington recently, Buchan was quoted as saying about ISS, "This is not a cold war organization. We have quite a lot of dealing with Eastern Europe"—which is true, since ISS annually holds a quiet get-together with eastern Europeans interested in strategic studies. Nevertheless, there is a Western, often American-oriented center of gravity to most of the studies. For example, there is an ISS study on "Defeating Communist Insurgency," by Robert Thompson, who headed the British advisory mission in Vietnam from 1961 to 1965. There is no comparable ISS study on defeating counter-revolutionary interventionism. The paper by J. J. Coffey, "Technology and Strategic Mobility," deals with future transport requirements for U.S. military forces, and could easily have emanated from one of the more hawkish precincts of the Defense Department. To be sure, it simply states the problems and technical possibilities of moving troops rapidly from here to there, but only passing reference is made to the argument that the existence of capabilities has, in the past, been an encouragement to their use—with innumerable unhappy consequences.

Buchan, who is spoken of with vast respect by those who know him, was quoted in Washington as saying, "The United States has very little freedom of action. It's one of the two main pillars of power in the world. This difficult dual position requires it to be in dialogue with the Soviet Union for its own safety, and also with its allies.

"Once Vietnam is over," he continued, "the United States is going to be involved in dialogue with the developed powers—Europe and Japan. Its role as policeman will end. The role isn't feasible anyway."

Just how, if at all, his Institute will be involved with the new administration is not clear. But, in a very real sense, the absence of any formal link would have no significance. As Buchan said, "Henry Kissinger is a very old friend of mine—I've known him for at least 10 years. But I've had lines of communication into the White House ever since the Kennedy Administration."—D. S. GREENBERG

* Available from the Institute for Strategic Studies, 18 Adam Street, London W.C.2, England; 61 pages, \$2, postage included. Other currently available ISS publications are listed in a bibliography, which may be obtained without charge.