no greater than 10 percent of the value obtained when the laser was tuned to the strongest line. If this residual reactivity were due to true continuous absorption, the resulting direct dissociation would be 100 times as efficient photochemically as excitation at a line. The observed reactivity, therefore, implies that the continuous absorption at 14,400 cm^{-1} is at least 10^3 times weaker than the strong individual lines in the same spectral region, at pressures of about 200 torr.

Conclusions

The results have shown that selective excitation obtained with a tunable monochromatic laser is a useful technique for studying photochemical and energy transfer processes. A new phenomenon in the photochemistry of bromine was observed, in which bound excited molecules, and not atoms, were formed in the primary process. The mechanism of the subsequent reaction consists of collisional dissociation of the excited molecules into atoms, which then initiated free-radical chains. A quantitative estimate of the collisional electronic relaxation rate for excited bromine molecules was obtained, and a new upper limit to the continuous absorption strength at 14,400 cm^{-1} was determined.

References and Notes

1. See, for example, G. S. Hammond and N. J. Turro, *Science* **142**, 1541 (1963).
2. A. L. Schawlow, *ibid.* **149**, 13 (1965).
3. A. L. Schawlow, *Bell Lab. Rec.* **38**, 403 (1960).
4. A partial list includes D. A. Buddenhagen, A. V. Haeff, G. F. Smith, G. Oster, G. K. Oster, *Proc. Nat. Acad. Sci. U.S.* **48**, 303 (1962); R. M. Wiley, *Ann. N.Y. Acad. Sci.* **122**, 685 (1965); Yon-han Pao and P. M. Rentzepis, *Appl. Phys. Letters* **6**, 93 (1965); C. Borde, A. Henry, L. Henry, *Compt. Rend.* **263B**, 619 (1966); L. M. Epstein and K. H. Sun, *Nature* **211**, 1173 (1966).
5. O. Darbyshire, *Proc. Roy. Soc. London Ser. A* **159**, 93 (1937).
6. R. S. Mulliken, *J. Chem. Phys.* **8**, 234 (1940); *Phys. Rev.* **57**, 500 (1940); A. L. G. Rees, *Proc. Roy. Soc. London Ser. A* **59**, 1008 (1947).
7. G. Herzberg, *Molecular Spectra and Molecular Structure I. Spectra of Diatomic Molecules* (Van Nostrand, New York, ed. 2, 1950), pp. 141–145.
8. See, for example, H. E. Gunning and O. P. Strausz, *Advances Photochem.* **1**, 209 (1963).
9. The pure isotopic samples of Br_2 were obtained on loan from the Oak Ridge National Laboratory.
10. G. B. Kistiakowsky and J. C. Sternberg, *J. Chem. Phys.* **21**, 2218 (1953).
11. W. B. Tiffany, in preparation.
12. I. D. Abella and H. Z. Cummings, *J. Appl. Phys.* **32**, 1177 (1961).
13. D. Roess, *Proc. Inst. Electric Electronic Eng.* **52**, 196 (1964).
14. W. G. Givens, Jr., and J. E. Willard, *J. Amer. Chem. Soc.* **81**, 4773 (1959).
15. D. Britton and N. Davidson, *J. Chem. Phys.* **25**, 810 (1956).
16. W. B. Tiffany, thesis, Stanford University, Stanford, California, May 1967.
17. H. Steinmetz and R. M. Noyes, *J. Amer. Chem. Soc.* **74**, 4141 (1952).
18. R. M. Noyes, *ibid.* **88**, 4311, 4318 (1966).
19. A. B. Callear, in "Chemical lasers," *Appl. Optics Suppl.* **2**, 145 (1965).
20. H. P. Broida and T. Carrington, *J. Chem. Phys.* **38**, 136 (1963); A. B. Callear and I. W. M. Smith, *Trans. Faraday Soc.* **59**, 1720 (1963).

21. We thank Drs. H. W. Schultz, J. I. Brauman, H. W. Brewer, and M. J. Weber for stimulating and helpful discussions. One of us (W.B.T.) acknowledges partial financial support from Sylvania Electronic Systems. Supported by NASA grant NsG 331.

NEWS AND COMMENT

The Administration of Federal Aid: A Monstrosity Has Been Created

The administrative system for providing federal support for academic research and higher education has become a monstrosity.

That is the conclusion that emerges from a *Science* survey that drew detailed responses from 81 colleges and universities throughout the nation. These schools receive at least 65 percent of all federal expenditures in institutions of higher learning. The respondents, in most instances the chief campus officer for government relations or research administration, generally observed that administrative problems have always accompanied federal assistance. With few exceptions, however—and it must be emphasized that there were exceptions—they agreed that the difficulties have never been worse and have become, in fact, enormously burdensome, expensive, and disruptive. Specifically, the respondents were asked to describe "any significant changes" that have recently taken place in regulations governing the use of federal funds and in the paperwork requirements that accompany these funds. Representative excerpts from their replies follow.

G. W. Hazard, associate provost at Washington University, St. Louis, stated that, because of federal record-keeping requirements, "We estimate that a given transaction involving federal money costs twice as much to carry out as one involving endowment income."

Sidney G. Roth, director of the office of research services at New York University, stated, "The paperwork requirements have grown unconscionably," but he optimistically added, "self-correcting factors do appear with time."

More than half of the respondents singled out for strong criticism the "cost sharing" regulations on federally supported research. Hugh Clark, associate dean at the University of Connecticut, wrote, "The cost-sharing legislation is an absurdity and an abomination." Anson Burlingame, director of the office of projects and grants at Columbia University, stated that the cost-sharing "standards that are being applied vary not only from one government agency to another, but among different parts of the same agency."

Eugene H. Man, dean of research coordination, at the University of Miami, Coral Gables, wrote: "Paperwork, paperwork, paperwork—and with it all, the growing tendency for the feds to give more administrative responsibility (i.e., paperwork) to the University. One of the nightmares of all time is the protocol and procedure required by the PHS for research involving human subjects. Down the pike we see the same for animals, conflict of interest and who knows what. . . . I find it impossible to believe that the universities will not eventually find their administrative machine clogged by the administrative requirements of federal support on campus—unless by some miracle the Highest Authority decrees that all agencies follow the same format in disbursing and control of funds. It

NEWS IN BRIEF

• **MIDDLE EASTERN TRAVEL**: The State Department recommends that U.S. citizens wishing to enter any of the nine Middle Eastern countries on its restricted list, apply to the department for a specially validated passport. The countries on the list are: Algeria, Iraq, Jordan, Lebanon, Libya, Sudan, Syrian Arab Republic, United Arab Republic, and Yemen. Applications for the validated passport may be made by writing to the Department of State, Passport Office, Washington, D.C. The application should include: the traveler's destination, his reason for going there, possibly a letter from a superior indicating the need for the visit, date of birth, place of birth, and passport number. The application may take 2 weeks to process. The State Department will not issue validated passports to tourists, and in many cases, to dependents of persons whose travel to the Middle East has been approved. Generally, applications are considered from scientists, physicians, businessmen, and newsmen. U.S. commercial airlines are not running regular flights into the countries, but travelers may get there on American chartered flights or by transferring abroad to foreign carriers.

• **ANIMAL CARE**: Research facility registration forms, required under the Laboratory Animal Welfare Act passed last August by Congress, are now available from the veterinarians at the state field offices of the U.S. Department of Agriculture Research Service. The offices are generally located in state capitals; a list can be obtained from the USDA research office in Washington, D.C. The forms must be filed by 24 August. The law (PL89-544) requires registration of all research facilities that purchase or transport dogs and cats in interstate commerce or receive federal money for research. By signing the registration form, the research facility acknowledges receipt of the regulations, and agrees to comply with them.

• **SONIC BOOM OPPONENTS**: Two Harvard scientists have formed a League Against the Sonic Boom to oppose production of commercial supersonic transport planes. William Shurcliff, a senior research associate at the Cambridge Electron Accelerator, is director of the League, and John T. Edsall, professor of biological chemistry, is deputy director. The League is concentrating on writing letters to Congressmen and government officials and is also conducting an advertising and educational campaign. Formed 3 months ago with eight people, it now has more than 200 members. Of these, Shurcliff said, about half are from the academic community and one-quarter are scientists.

• **NSF AWARD**: John T. Wilson, deputy director of the National Science Foundation since July 1963, has been named the first recipient of the NSF Distinguished Service Award, the highest honor conferred by NSF on its employees. The award, which includes a gold medal, is made for "singularly outstanding service."

• **TECHNOLOGY AND HEALTH**: Charles D. Flagle, professor of public health administration, Johns Hopkins University, has been named to a new Public Health Service position, Special Assistant to the Surgeon General for Health Applications of Modern Technology. He will be responsible for the coordination and assessment of PHS activities related to the application of modern systems analysis, computer and communication technologies to the delivery of health services. PHS currently supports approximately $20 million worth of research in the field. Flagle holds a Ph.D. in engineering and has been involved in the application of operation research techniques to medical and hospital care since 1956.

• **UNITED STATES–INDIA EXCHANGE PROGRAM**: An exchange program of scientists and engineers between the United States and India is being established under an agreement signed in February by the two governments. The NSF is administering the program for the United States and the Council for Scientific and Industrial Research for India. Under the program, financial support will be provided for exchanges ranging from 2 weeks to several months. Additional information may be obtained from the NSF Office of International Science Activities, Washington, D.C. 20550.

does not seem too much to ask; after all, we all use the same forms for income tax reporting."

M. E. Forsman, director of the engineering and industrial experiment station at the University of Florida, Gainesville, reported, "We have had a plentiful supply of government auditors and others from various agencies visiting our campus on official business. One recently was trying to close out a building grant and asked if a particular air-conditioning duct was paid for from state funds or from their grant funds. Obviously we do not request that the contractor maintain cost records in this detailed manner." Forsman added that, in support of a construction program on campus, "there are funds from the university, NSF, Title I of the Higher Education Act of 1963, and Title II. . . . We have had to supply colored floor plans showing which areas are obtaining support from each of the agencies. NSF and Title II support graduate education and research whereas Title I supports undergraduate. We will probably be expected to use the space as outlined in our accepted proposal for funds. However, a growing university is a dynamic institution, and I know that changes in the use of space will probably be made even before we move into the buildings."

James M. Miller, associate director for administration at the Kitt Peak National Observatory, in Arizona, listed the following reports that are required of the observatory, which is operated by a university consortium under contract to the federal government: nondiscrimination report, Davis-Bacon labor report, computer utilization report, federal contract report, excess property report, federal property report, federal drivers' licenses report, gold flow report, and patent report. "We are subject to three audits," Miller stated, "that of our sponsor, our corporation and the General Accounting Office. In 11 months of calendar 1966, we experienced 22 man-months of audit, with no disclosures of significant transgression." He pointed out, however, that, whatever the headaches of administration may be, he believed that the government's sponsored research program had been "outstandingly successful."

Byron Backlar, manager of life sciences contracts and grants at the University of California, Los Angeles, wrote: "A major trend, which is not

yet recognized by universities, and principal investigators in particular, is the constantly increasing administration required for each project. The impact of regulations imposed within the last few years has been overwhelming. The time and effort required to implement new federal demands in such areas as cost sharing (with its multiplicity of agency interpretation and requirements for time and money commitments, monitoring to and accounting for such commitments), human subjects research (including the need for establishing and coordinating the work of a number of new campus committees), Fair Employment Standards (newly applicable to universities), and animal care legislation, frequently seems entirely out of proportion to the benefits to be gained. Certainly, all the correspondence made necessary by such new regulations has increased significantly the workload in our office at a time when the number of proposals and awards is remaining essentially static. We do not believe that we are unique in this experience. Neither universities nor government agencies seem to have been prepared for the new regulations. . . . There is no attempt made by government agencies to coordinate with each other with the aim of imposing uniform regulations."

Doris H. Merritt, assistant dean for research at the Indiana Medical Center, stated, "I get the impression that the collection of *statistics* is becoming more important to the federal granting agencies than the pursuit of *results*. Carried out *ad absurdum* there will soon be only statistics and no results if our investigators are to keep chasing their tails writing reports. . . . It seems frighteningly clear that coupled with an emphasis on service as opposed to on research ingenuity we are going to achieve magnificantly documented mediocrity."

William J. Argensinger, Jr., associate dean of faculties, University of Kansas, stated: "Often despite avowed intentions to the contrary, the paperwork requirements accompanying Federal support are . . . growing in volume and complexity. In my father's words, it would 'take two men and a boy' just to handle the paperwork on one small $5000 NIH grant which involved foreign field travel by a non-citizen research assistant using government-financed equipment in a program of LSD research with cats, dogs, and human beings."

It might be expected that institutions with relatively little experience in dealing with the federal government would be particularly struck by the administrative complexities of federal programs. But even at institutions long experienced in using federal support, there were reports of a burdensome escalation in regulations and paperwork. It is interesting to note, however, that officials from institutions that are major recipients of federal aid were more inclined to offer their comments on an anonymous basis than were those from schools outside the mainstream of government aid. Thus, the director of research at a major eastern university noted that "regulations governing the use of funds are becoming increasingly complex. This is true for those agencies that have a long history in the area, and is further complicated by new agencies, each with their own and different regulations."

A Midwestern administrator, who asked not to be identified, wrote, as several others, in effect, did, "Although regulations governing the use of federal funds for research and teaching are more restrictive than we should like to have them, in general, with difficulty, we can live with them." But he went on to observe, "In some cases, particularly where allocations for educational and research facilities are involved, the restrictions are so absurdly inflexible that unique worthy building projects are automatically excluded. . . . A continually larger proportion of staff time in a university is utilized in paperwork rather than in creative thinking, research and teaching. The waste of scientific manpower as a result of this additional paperwork is regrettable if not tragic."

Robert E. Burroughs, director of research administration, University of Michigan, told of the receipt of a questionnaire titled, "DOD and NASA Economic Reports—Economic Information System," accompanied by 19 closely typed pages of instructions. The questionnaire, which was intended to assess "the economic impact of the defense and space program procurement," was designed for industry, Burroughs concluded; nevertheless, "This university received the questionnaire with a request that it execute one of these every six months. It asks such questions as: Employment: 'all business,' 'plant-wide'; 'off-site firm business'; 'plant-wide straight time direct hours'; and 'overtime'; 'off-site procurement materials and purchased parts.'" Burroughs added, "University data supplied under these headings will be meaningless and will bring into question the validity of the results when combined with industrial data. . . ." And he pointed out, "We are continually impressed with the competition between agencies that appears to determine how differently each can implement the identically same instructions."

Commenting on the costs of adhering to the regulations and handling the paperwork that accompany federal funds, an administrator in a midwest medical school stated: "In a period of six years, my office has grown from myself and one secretary to an assistant director, a grants management officer, two secretaries and a key punch operator. In addition we now have associates in all departmental areas administering more than $250,000 worth of sponsored programs funds." (This staff does not handle accounting and audits; a central research accounts office provides these services for the entire university.) During the six-year period referred to by the administrator, federal funds received by the medical school rose from $2.8 million to $4.3 million for research, and from $760,000 to nearly $1.1 million for training; total annual revenues remained fairly constant, rising from $10.1 million to slightly over $11 million.

At the University of Rochester, federal support for research and training rose from $11.5 million in 1962–63 to $15.5 million in 1965–66. In approximately the same period, according to David A. McBride, director of research administration at the university, changing or newly imposed federal regulations and procedures "have resulted in an estimated doubling of the amount of paperwork concerned with each contract and grant." To which he added, "The government is apparently contesting the integrity of the institutions at every turn and will not 'take our word' but rather requires us to prove everything that is done." McBride also noted, "Most of the changes . . . have been subtle, incipient ones which we believe have detracted from the primary objective of accumulating new scientific knowledge."

Typical of the few who took a brighter view of matters was W. B. Durant, Jr., executive officer for the faculty at Dartmouth College. "As to regulations governing the use of funds," he observed, "if any trend is discernible

at all, it would be toward liberalization by the various agencies rather than in the other direction." But, he continued, "Paperwork requirements related to federal support of course represent the most troublesome aspect of recent years. . . . The requirements for time and effort reporting on behalf of the faculty are so removed from the reality of academic organization and operation as to make this requirement more than just a burden. In fact, it becomes, at least for many of our faculty members, a question of conflict with normal traditions of academic freedom and commitment to educational and research objectives."

Elburt F. Obsorn, vice president for research at Pennsylvania State University, noted that "Paperwork requirements accompanying federal support are tremendous and constantly on the increase. . . . Administrative manuals and directives are constantly expanding and being revised. It is a herculean job just to be aware of these constantly changing requirements not to mention the paperwork involved."

H. F. Robinson, administrative dean for research at North Carolina State University, Raleigh, told of NSF recently seeking an explanation of a $36 expenditure from a grant totaling some $30,000. "This inquiry took almost half a day to satisfy and involved several people on the campus."

The research administrator at a major Catholic university stated, "NSF is almost a model of efficient administration except for a 10-foot long quarterly fiscal report that no one in NSF can tell us why they need it. I suspect it is another case of computeritis."

The associate director of a large university-operated laboratory on the West Coast offered the view that "an inordinate amount of time is being spent by principal investigators and senior research personnel in negotiations, in detailed accounting, in complying with the myriad reporting requirements, etc. Each agency seems to come up with its own unique set of practices, ranging, for example, from the color of report covers and size and position of report numbers printed thereon, to increasingly disturbing attempts to control and limit the appropriate distribution and dissemination of research results. . . . The combined result of these influences," he added, "discounting inflation, fully supports the contention that it is costing more dollars today to do less research."

In the federal agencies that preside over the programs and policies that generate the comments and complaints cited above, there are ready-made, and often quite sound, explanations for the present state of affairs. It is said, for example, that if the universities did a better job of managing federal funds, government bookkeepers would not be so intrusive. It is also noted that when federal agencies try to cut down the administrative burden by giving block or institutional grants to universities, old-time beneficiaries of the project grant system angrily rebel. Furthermore, it is noted that in many instances Congress attaches restrictions to certain appropriations, and the agencies handling these funds have no choice but to carry them out, regardless of what other agencies are doing in the same area. The statistics-gathering boom that plagues the universities is a direct outgrowth of Congress's desire to know whether the wealth is being spread in accordance with its demands. Finally, though the system creaks and groans, and overwhelms the vice presidents for research, that's what they are there for—to handle the problems of getting and using federal money, while faculty members go about the business of researching and teaching.

There is truth in all of this, especially in the observation that the officials to whom *Science* directed its inquiries would have the darkest possible view of doing business with the federal government.

Nevertheless, after allowance is made for the fact that government has an instinct for tidiness and accountability while universities are untidy and often unaccountable, it appears that the administrative system between government and academe is en route to chaos. It is difficult to find broad agreement on remedies, but remedies are badly needed. They are not likely to take effect if they emanate from any of the lower-level committees that toy with these matters in the federal executive hierarchy. The incredible confusion and ill-will generated by the cost-sharing regulations are a monument to the efficacy of these committees. Perhaps it is time for the White House or Congress to decree that coherent, rational, and predictable government-wide regulations on the use of federal funds for academic research and higher education are necessary and attainable. And then let the quest for administrative sanity start from that point.—D. S. GREENBERG

Oxford: A Vote for Latin on the Way to Reform

Oxford. As the guide books say, Oxford breathes the last enchantment of the Middle Ages. This spring Oxford's critics said the university showed how enthralled it was with its own past by voting to keep what in effect is a requirement that candidates for admission pass an examination in Latin.

It was not as straightforward as that. Things at Oxford seldom are. What the governing academic assembly did was to defeat a move to reduce from two to one the number of foreign languages required for matriculation.

As things still stand at Oxford, candidates must pass O (for ordinary)-level secondary school examinations in two languages, one of which must be Latin or Greek. Candidates who qualify in mathematics or science in advanced-level examinations may offer a second modern language instead of a classical language. But, because of the actual language teaching situation in most British schools, private and state, Latin, for all practical purposes, is the sole second choice.

Cambridge, which in most things marches with Oxford, dropped the classics requirement 6 years ago and last winter went on to reduce the number of languages required to one. The breach in the Oxbridge united front is, therefore, wider now.

Oxford's language requirement has been attacked on the ground that it