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ONR ltr dtd 8 Jun 1971

OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

No. 20-11

30 November 1966

Distributed by the
Office of Naval Research Branch Office,
London

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OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

Edited by J.E. Rasmussen and Victoria S. Hewitson

30 November 1966 Vol. 20 No. 11

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European Scientific Notes is Group II Newsletter type Class B periodical prepared & distributed by the Office of Naval Research London in accordance with NAVEXOS-P-35.

C.T. FROSCHER
Captain, U.S. Navy
Commanding Officer

MARINE BIOLOGY

A Question of Morals or a Moral?

A recent issue of the Sunday Times carried an article, "Oysters: a sombre sexual tragedy," which concludes with a moral that cuts across all geographical boundaries and applies equally well in the US.

Ostrea edulis, the British native oyster, has recently attained the distinction of being sold for 37s. 6d. ($5.25 US) for a dozen on the half-shell. In 1864 they were quoted at four a penny, which hardly needs translation into US currency. Although a number of political scapegoats were selected as the possible cause, the industry reported that the high prices were almost certainly due to a sombre sexual tragedy which has been taking place, unreported, in the muddy estuaries and inlets of the British Isles throughout the last summer.

Early in 1966, 300 tons of Portuguese "stud" oysters (Ostrea angulata) were tenderly transplanted into British waters. Since then the vast majority of these succumbed without breeding, in spite of the persistent efforts of the oystermen and fisheries experts. It is reported that the failure of these "immigrants" to breed, or even to survive, has placed the entire home demand on the dwindling reserves of native oysters and the stiff prices are the inevitable result.

The article then provides an interesting reflection on Aristotle's view that oysters "have no sensations or sex, but arise spontaneously from the foam around stationary ships." It points out that in this particular case Aristotle was misinformed and that the British oyster is bisexual, reproducing by a "complex and time-consuming process of being male, and then female, and then male again." Portuguese oysters are either male or female and breed by a "more Latin process not too different from mammalian reproduction." The spat which result are tougher with a deeper and thicker shell.

Throughout this century pollution of the rivers and estuaries in Great Britain has been placing greater stresses on the British oyster, and in 1959, when 50,000 lusty Portuguese oysters were first imported into the River Alde in Suffolk, they did so well that by 1965 half of the oysters consumed in Britain were Portuguese imports which had been bred or fattened up in British waters.

As a result of this summer's catastrophe, however, the number of Portuguese oysters in British waters has been considerably reduced and there will be far fewer around next year. After eliminating the possibility of an oyster disease as the cause, the Ministry suggested that additional imports be avoided during February, March and April since the young breeding oysters would be weakened by lower Spring salinities even before they left for Britain. In addition to these natural cause, however, most of the Portuguese oysters come from the River Tagus on which the expanding industrial city of Lisbon is located and it seems that pollution is beginning to take its toll there.

The industry intends to attempt the importing of more Portuguese oysters next year, hoping for better results from the La Sado River. But, concludes the Times, "a sad truth appears to apply to both British and Portuguese alike: oysters and industrialisation don't mix." (J.D. Costlow)

MATERIALS SCIENCES

Ministry of Technology Materials Research & Development Program

The Ministry of Technology (MOT), headed by A. Wedgwood Benn, M.P., is charged with the responsibility for government-sponsored industrial research. When the assimilation of the Ministry of Aviation (MOA) laboratories is complete, the MOT will manage virtually all government establishments in England which have materials research and development capability. The Electrical and Chemical Plant Division of the Ministry is headed by Dr. A.C. Copisarow and the Advisory Unit on Materials is headed by Dr. M.G. Church.

The major laboratories of the MOA with advanced metal and semiconductor research include the Royal Radar Establishment (RRE), Great Malvern, the Royal Aircraft Establishment (RAE), Farnborough, and the National Gas Turbine Laboratory, Pyestock. Although MOT plans are not formalized at this point and Treasury approval has not been obtained, some of the programs have begun to function. A national center of excellence in crystal growing has been proposed for the RRE laboratories. It is hoped that quality crystals (not Ge or Si) could be produced for both industry and government laboratory use. When a new material became of economic import, the

technology for growing the crystals would be transferred to industry. There is also a plan to make the RAE laboratory into a multi-discipline center for solving critical industrial problems. The recent scaling-down of the British atomic energy programs (cuts ranging from 20-50%) provides the MOT with an opportunity to redirect efforts toward helping industry. An example of this is the National Ceramic Research Center at Harwell described by J.B. Cohen in Technical Report ONRL-43-66. Under consideration is a National Nondestructive Testing program to be directed by R.S. Sharpe at Harwell. A national center for corrosion studies at Harwell is also being organized. In addition to the AEC and MOA laboratories, those previously under the Department of Scientific and Industrial Research (DSIR), namely, the National Physical Laboratory and the National Engineering Laboratory, also report to the MOT.

Drastic measures such as co-location of scientists with common interests and capabilities are being considered. It is estimated that at least five years will be required before these vast pools of R&D capability can be reshaped to enhance British industry and ultimately shift the balance of trade in a more favorable direction. Even if the program is not completely successful, major changes in materials R&D emphasis toward industrially pertinent problems will be obtained. (P.D.Maycock)

Fuel Cell Research & Development at Compagnie Générale d'Electricité de France

Introduction - Compagnie Générale d'Electricité (CGE) with headquarters in Paris is a large, multi-plant, high-technological-base company with production and sales organizations throughout the world. Primary products involve advanced materials and electronic capabilities. This year's sales will exceed $1 billion, and total personnel exceed 55,000.

The central research facility for this vast complex is the Centre de Recherches, 91 Marcousis, Route de Nozay, about 20 miles south of Paris, in beautiful, wooded country near Marcoussis. The laboratory is about seven years old and has 400,000 ft^2 of floor space and all the usual advanced experimental equipment. It has 850 employees, 250 of whom have Master's or higher degrees. The laboratory is organized as shown in Figure 1.

The fuel cell program has recently been reoriented toward production. Dr. J.M. Auclair was the head of CGE fuel cell research for five years, but recently has been given a broader assignment which includes fuel cell electrode research, superconducting materials research, plastics, semiconductors, and development of advanced measurement techniques. Mr. Pierre Dubois, educated at Ecole Polytechnique and California Institute of Technology,

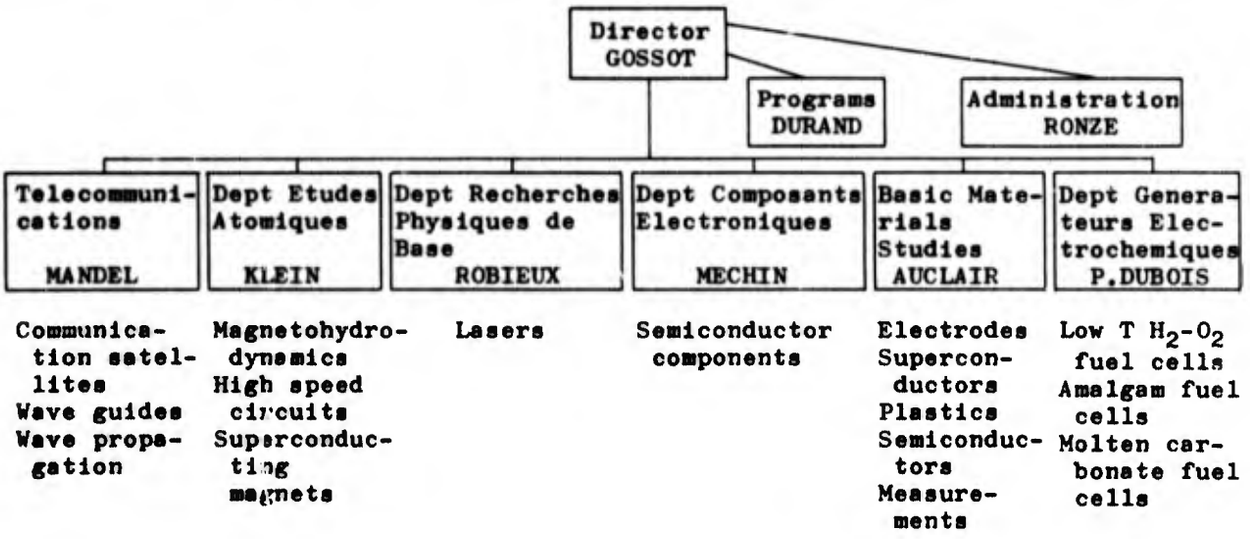


Fig. 1 - Organization of CGE Research Center, Marcoussis

heads virtually all fuel cell work and is aiming at some production within 18 months. Dubois has a total of 46 persons on the fuel cell project; thirteen are engineers while fifteen have the diploma. Auclair still has approximately 30 people working on Ag-Ni electrodes, molten carbonate electrolytes, high temperature electrodes, and amalgam systems. Six of these men are degree-holding electrochemists. Dubois has a plan for next year for 55 people. This would make the 1967 fuel cell effort of CGE nearly 90 people -- formidable, to say the least.

At the time of my visit all of Dubois' fuel cell test stations (approximately 30) were being converted from single cell testers to module test stations. Automatic readout of all test data was provided for. Construction was about 50% complete for a new fuel cell pilot production area (estimated at 40,000 ft^2).

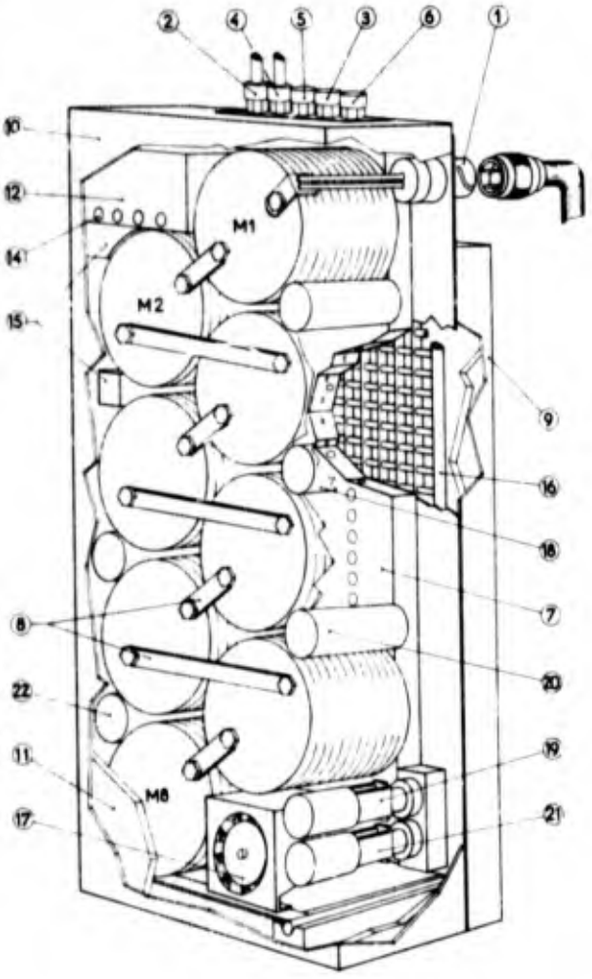
Although basic research continues on molten-carbonate high-temperature fuel cell systems, the project has gone from applied research back to basic studies. CGE collaborated with Verret and Souriau at Gaz de France on molten carbonate systems and has production rights for them. Dubois is well acquainted with the Electricite de France molten carbonate program, because he worked for Buvet and Millet. He said the molten carbonate work at Electricite de France has been terminated. CGE stopped molten carbonate module fabrication 18 months ago because of excessive corrosion. Only a defensive research effort remains.

Discussion of CGE Low Temperature Fuel Cell Systems - Present effort at CGE is aimed at finishing two systems utilizing silver-nickel (no expensive catalyst) electrodes with KOH electrolyte. Pure hydrogen derived from CaH_2 and bottle oxygen are used as fuel. The largest system will be 1-kW output with a CaH_2 hydrogen generator. The main goal is silence and lifetime. Minimal effort is being placed on weight or volume reduction. This effort is being supported by the French Army. The second system was a 100-150 W output assembly which Dubois hopes to market commercially. Both systems can best be described by considering Figure 2. The system is enclosed in an insulated case. Removable covers (9 and 10) equipped with insulation (11) allow access to the modules. The modules, M1 to M8, are connected electrically in series by metal junction bars (8). Each metal-plastic module is an assembly of elementary cells mounted electrically in parallel. A distribution plate (7) supplies the modules with hydrogen, oxygen, and electrolyte. The top of the plate carries the plug (1), the gas inlets and outlets (2 - 5) and the electrolyte filler cap (6).

The system is brought to its operating temperature ($\approx 30^{o}C$) when starting by an electric heater (14) consisting of electrical resistors situated at the bottom of the tank (12). The regulation device (15) of the heater draws, at any time, the maximum power the cell can supply without damage. An electric pump (19), equipped with voltage regulator (20), assures the circulation of the electrolyte. When the measured temperature of the electrolyte (13) exceeds a previously elected value, a regulator (22) starts the electric pump (21), which increases the electrolyte flow through the air cooler (16). If the temperature rises further, a fan (17) with a variable speed regulator (18) increases the heat exchange in the air cooler. The volume of the system shown is less than 40 liters and the electrical power at 6 V is 140 W at $20^{o}C$, and 320 W at $55^{o}C$. Normal current densities obtained are 50-70 ma/cm^2 at $20^{o}C$ and 100-200 ma/cm^2 at $55^{o}C$. The 1-kW output system uses thirty-two 11-cell modules. Life tests on the modules indicate less than 10% degradation after 4000 hours operation. After clean-up procedures, the cells returned to original operating levels. The 1-kW system was ready for checkout and the 160-W system was complete. An aspect of the CaH_2 hydrogen generator not fully appreciated when the system was proposed is that the amount of H_2O required for the CaH_2 hydrogen production is very close to the H_2O generated in the fuel cell reaction, so that electrolyte dilution is not nearly so bad as was anticipated. In fact, Dubois does not consider it a problem for the 200-hour mission time required by his 1-kW system.

The CGE effort represents a high-quality, well-staffed, multitechnology approach to entering the fuel cell business. Product division interest is evident, and it is believed that CGE is less than two years from production.

Details of CGE Process for Making Silver-Nickel Electrodes - A mixture of 30% Ag_2O and 70% Ni (reagent grade) powders with a uniform ≈ 5-μ diameter X-ray showed $5\ \mu \pm 1\ \mu$. This mixture

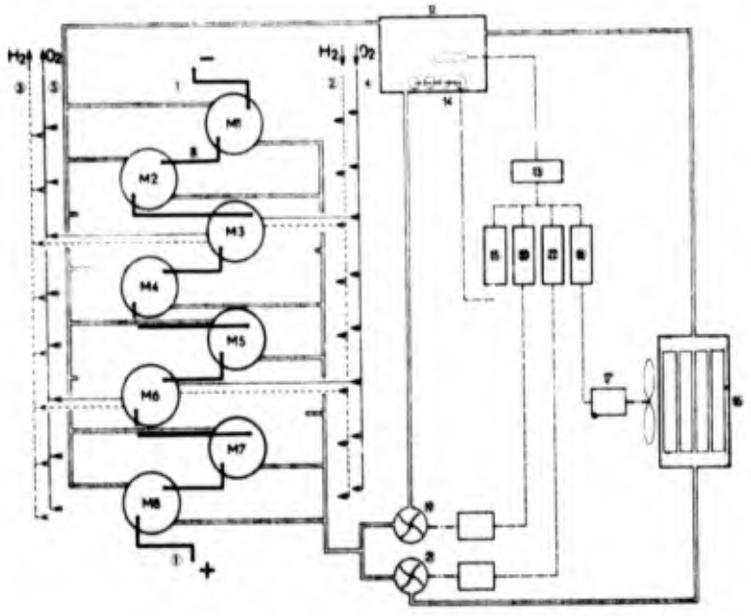


M1 -- M8: Metal-plastic modules connected in parallel

(1) Electrical outlet
(2) Hydrogen entrance
(3) Hydrogen exit
(4) Oxygen entrance
(5) Oxygen exit
(6) Electrolyte supply
(7) Electrolyte manifold
(8) Electrical connector
(9) Front cover
(10) Rear cover
(11) Insulation

Electrolyte system

(12) Tank
(13) Temperature measurer
(14) Electric heater
(15) Regulation device
(16) Air cooler
(17) Fan
(18) Variable speed regulator
(19) Electric pump
(20) Voltage regulator
(21) Cooler pump
(22) Regulator



is slurried with H_2O and air-dried on quartz dishes. This powder is then stored in bottles. A charge of powder is placed in a 1.5-ton press. It is pressed for four minutes at 1.5 tons on about 4-in-diameter discs. The result is a disc about 1/8-in thick, which is self-supporting. It is then sintered. The first sinter is in argon for three hours at 350°C. This causes the Ni to be partially oxidized by the O_2 from the Ag. The second sinter is again at 350°C for three hours in an H_2 atmosphere. Six sintering furnaces were operating with 16 plates being sintered at a time. This would provide enough for 50 complete cells per day. The 1-kW plant requires about 350 cells. These electrodes are continually improved and a goal of 10% silver content will likely be obtained. (P.D.Maycock)

Materials Science at the University of Sussex

Many conflicting views face the academician in the US engineering schools today. There is an increase in pressure from the students for greater exposure to the liberal arts (although arts students appear much less liberal in their interests in science and engineering). Yet, there is increasing interest in a unified engineering course, at least to the BS degree. While my own view has been that a deeper exposure to one field outside engineering would be very good, I wonder how much of this pressure for a "liberal" education stems from feelings of inferiority on the part of the BS candidates. After all, one has his whole life to attend evening courses and to read, although the average reading habits of our college graduates do not indicate that we have gone very far in convincing them that education is a continuing process.

More specifically -- there is also much interest in stimulating "cross-fertilization," the necessity for breaking down old lines and allowing early inter-disciplinary activity in the engineering and science curricula. Yet, traditional departmental walls usually prevent a student from hearing about any of the new fields that represent an interdisciplinary approach until it is too late. Often these areas are presented in the form of one survey course, which, after a student has committed himself mentally elsewhere, is thought of as a drudge - even before he hears the first lecture.

I have no immediate answers to offer, and indeed, many feel that the traditional lines are better and that in the long run we are going to badly damage such established areas as mineral engineering and process metallurgy. Fortunately, with the great diversity characteristic of the US educational system, it is doubtful whether any one or several plans will dominate.

The new University of Sussex offers a unique opportunity to follow the results of an interdisciplinary scheme and a unified engineering program. For this reason, I will spend as much time on the educational aspects as on the research. The school itself is an exciting one in many ways. A similar spirit of cooperation and excitement prevails on this new campus as it grows, as it did at Brandeis University in its early days, but the reader should keep in mind that this experiment is just starting.

The University and Materials Science - The original idea of a University at Sussex was suggested as early as 1911, but because of the intervening wars nothing was really done until the middle '50's, when the pressure of increasing numbers in the British university system began to be felt. Building started in the fall of 1960. Fifty students were admitted in Arts in October 1961, although the first buildings were not ready until a year later. In the engineering and sciences, building is still very much in progress with many having been occupied just this past fall and with some of the staff in "terrapins" (shells or huts).

The school itself has traditional departments only in the sense of several professors, readers and lecturers appointed in traditional fields. But these are organized into schools, such as the School of African and Asian Studies. Materials science can be entered through two schools - Molecular Science and Applied Science (and this dual entry is true of other fields as well). All candidates for the BSc degree take a common first two quarters, followed by an exam. This includes a course in "Structure and Properties of Matter," which while covering some electrostatics, mechanical behavior and atomic theory, allows the student to be exposed to various disciplines, taught both in lectures and tutorials by the experts in their field. The result has been more transfers into

the School of Applied Science than away from it. The third quarter is devoted entirely to economics as the Arts requirement. (The arts students are being introduced to science and technology in relation to their courses -- and have to write a paper. This approach is apparently not quite settled yet so the staff have the same problem of liberalizing the arts as we do!)

If the student enters materials science from the school of Molecular Science, he begins to specialize in his second year. If he is in the School of Applied Science, this second year is devoted to general engineering, with courses on electricity, electronics, analogue and digital computers (including numerical analysis), servo mechanisms, mechanics, thermodynamics, fluid flow, properties of materials, and physical metallurgy. During the third year he will specialize in materials courses in defects, deformation, more on physical metallurgy, magnetic and electrical properties and preparation and characterization of crystalline materials. In addition, he chooses two electives from a list of five, including courses on polymers and glasses.

The staff at present consists of one professor (Prof. R.W. Cahn , who has been at Sussex for 18 months, a senior lecturer (Dr. A.W. Simpson), and three lecturers (Drs.S.M. Ertl, B. Harris, and R. Doherty).

The University will reach a total of 3000 students by the fall of 1967, about 20-25% of whom will be graduate students. The first class of 13 in materials science (out of about 80 in applied science) is just starting. There are eight graduate students and three post-doctorals.

The Physics Department is quite strong in solid state with Profs. D.F. Brewer (low-temperature electrical behavior) and M.W. Thompson (formerly of Harwell and whose work in atomic collision processes is well known). Dr. J.A. Venables is a lecturer.

There are a number of interesting all-university features. Several keyboard links to large computers elsewhere are available, and others will be distributed in various buildings. A Centre for Academic Affairs is developing filming, TV, and computer teaching. Centers are also actively involved in studying science policy and planning in the UK and the developing nations.

Several interesting laboratory sessions have been planned for materials science: (1) Zone refining a dye in an organic and using optical methods to obtain the concentration-distance profile, (2) With thin-layer organic solutions sandwiched between glass slides and a thermocouple which serves both as heat and as a temperature-sensing device during a fraction of the ac cycles, cooling curves and optical observations of an entire phase diagram can be made in a few hours, (3) The Fermi energy is obtained by bombarding a substance with positrons from a source and studying the γ-ray intensity resulting from positron-electron recombination as a function of angle about the specimen.

Research Activities in Materials Science - Cahn is starting research in three main areas: (1) The effect of pores of various shapes and amounts on recrystallization, (2) Effect of stress on domain boundary orientation in CuAu, and the resultant effedt on mechanical behavior, (3) When a magnetic material is stressed in the absence of a field, re-orientation of the domains occurs, which contributes to the material's anelastic behavior up to a certain stress. The importance of metallurgical variables in determining this stress is not known, and Cahn's group is studying this.

Dr. Brian Harris, who has just returned from three and a half years with Pratt and Whitney Company in the US, will start work on composites and refractory materials.

Dr. Michael Ertl is primarily interested in thermoelectricity at the moment. He has found large variations in the thermoelectric coefficient in specimens of Bi-Sb alloys, and is trying to find out if this is due to impurities or segregation. He is also preparing Bi-insulator sandwiches, by vapor deposition, to see if the coefficient can be improved by increasing the relative importance of phonon scattering.

Dr. J. Venables in Physics is doing his work under a USAF contract. He has built a stage for the electron microscope in which samples can be cooled to 4.2°K, and bombarded in situ. This is an improved model of the device he built with Prof. Baluffi during his stay at the Univ. of Illinois a few years ago. Drift has been greatly reduced by translating the (two-tilt) stage with two quartz rods and balls. The low expansion of quartz compared to nylon (which has been used in other

devices) enables him to work at magnifications of 100,000. Helium consumption is only one liter in about three hours. Venables is continuing his previous studies of the mobility of interstitials, but in Al, whereas his former work was with Au. The technique involves measuring the temperatures at which vacancy clusters are annihilated by interstitials resulting from ion bombardment in the bulk of a wedge-shaped specimen, rather than just at the surface.

He has also successfully deposited crystals of fcc argon, which contain a density of stacking faults, quite similar to those in electro-deposited silver. Through a measurement of the fault energy, he hopes to evaluate the difference in energy of the hexagonal and fcc forms. Theoretical calculations predict the hexagonal form, and this measurement may help to guide future theoretical studies. (J.B.Cohen)

Materials Science at Imperial College

One of the most difficult areas in the ever-increasing interdisciplinary programs in universities, as mentioned above, is to arrange a good course program - graduate, or undergraduate - which meets with sufficient enthusiasm in the various departments to become a truly working program. While effort on this started later in England than in the US, there are some interesting examples in the field of materials which I have been reporting in these columns. Another is the one at the Imperial College of Science and Technology.

Imperial College is the largest technical school in the London University complex. Since 1953, the government has been pouring in large sums of money (about 100 million dollars so far), and hardly anyone can now recall a period when the continual sound of construction crews was not part of the myriad of noises in South Kensington. Many large new buildings are in full operation and others are rising steadily. With an enrollment of 3500 students, it is Britain's stronghold of technological education.

In 1963 the Departments of Chemical, Mechanical, and Electrical Engineering, Chemistry, Physics and Metallurgy, worked up an interdepartmental MSc program. This is designed primarily for those who wish to retrain themselves, for those switching fields, or for those whose backgrounds make it uncertain as to whether they will be able to go on for PhD's. (Normal PhD candidates in the various departments may attend lectures, or whole courses, and are encouraged to do so, especially if they have obvious weaknesses in certain areas. But they are still not required to do so.)

About a dozen students are enrolled this year in the first of three terms which make up a school year. Students are required to attend courses in solid state physics, statistical thermodynamics, crystallography, imperfections, and materials preparation. The Electrical Engineering Department gives 35 lectures, Metallurgy 30, Chemical Engineering 20, Physics 10,and Mechanical Engineering 5. In addition, a student may attend a course in mathematics, including, if he wishes, a quick refresher course in the first few weeks. Labs are held on techniques. A material is prepared and studied by diffraction. A thin film is deposited and studied by electron microscopy. A ferroelectric crystal is grown and domain properties are examined with a polarizing microscope. Dislocation etched pits in an alkali halide are examined, etc. Seminars with industry are also held.

In the second term, a course on mechanical, physical and chemical properties is required. And in this term, as well as the last, the student may follow courses of his own interest. Examples of such courses are rate processes, diffraction, polymers (in chemistry and mechanical engineering), lasers, electron spin, etc.

In addition, during these last two terms, the student chooses a special research topic from a large list.

Some 350 researchers work on material at Imperial (and we will report in detail on their efforts in ESN during the year). As the result of a $300,000 grant from the Science Research Council, matched by about twice as much by the University, "facilities" have been set up for polymer characterization, analytical services, mechanical testing, and crystal growth. These are directed by faculty but have a separate staff as well. Services are available free to anyone at Imperial working on materials, and a certain amount of work is done for outside groups, depending entirely on the discretion of the staff member in charge.

While there is the usual faculty group in charge of the over-all program, it was developed in detail by the

younger members, who all seem to be getting along quite well and "interacting." (J.B. Cohen)

CHEMISTRY

Inorganic Chemistry at Strasbourg

The School of Chemistry at the University of Strasbourg has just moved into a new building, or rather, two connected buildings. The undergraduate laboratory and lecture building is about 200 ft x 50 ft and five stories high. The building in which the staff offices and research laboratories are located contains approximately the same square footage of useful space, but it rises 15 stories and is oriented so as to make a T with the other building. Essentially, each professor has a floor to himself in which he places his junior faculty assistants, research workers, and research students. One predictable result has been experienced already, that is, a very few, very sensitive instruments have had to be removed from the upper floors of the taller building.

Profs. R. Rohmer (Inorganic) and J. Byé (Physical) occupy the 9th and 10th floors, respectively. Byé has been interested for 20 years in the aqueous chemistry of Mo, and has several assistants studying the nature of Mo(VI) in $NaClO_4$.aq. over a wide range of acidities, from no acid to 4-6 M $HClO_4$. His principal technique is spectrophotometry, but all of the normal physical chemical techniques are available. Rohmer is also interested in Mo chemistry but only as a part of an interest in Mo, W, Nb & Ta chemistry and their aqueous complex chemistry. As liganda he considers $C_2O_4^{2-}$, O_2^{2-}, Cl^-, Br^-, SO_4^{2-}. Recently he has done quite a bit of work in formic acid solvent in lieu of H_2O. All of the physical chemical techniques are used, spectrophotometry, conductometric studies, X-ray powder patterns of crystalline substances, differential thermal analysis, thermogravimetry, and magnetochemistry. Most recently a detailed study has been made of the visible and ultraviolet spectra of Mo(V) in Cl^- and Br^- media, using both HOH and HCOOH solvents. Also mixed peroxohalo complexes of Nb, Ta, Mo, and W have been studied. The assignment of the spectral bands appears to be very difficult in terms of the Gray-Hare model for $X_5V{=}O$. Doubt is also cast on the existance, in solution, of $MoOBr_5^{2-}$. (S.Y. Tyree)

Conference on Radiation Chemistry and Photochemistry

From 21 to 24 September 1966, an international meeting on radiation chemistry and photochemistry, organized by Prof. G. Scholes (Univ. of Newcastle upon Tyne), was held on the occasion of the 60th birthday of Prof. J.J. Weiss of that University. The Conference was held under the auspices of the British Empire Cancer Campaign, which for historical reasons was instrumental in the sponsorship of Weiss' earlier work in radiation chemistry and was instrumental in the establishment of a distinguished school of radiation chemistry at the University of Newcastle upon Tyne. The Conference was very well attended by international experts in both radiation chemistry and photochemistry and admirably served the objective of bringing together people who are experts in the two respective fields for exchange of ideas on problems of mutual interest.

Among the topics discussed that were of specific interest to the writer was a paper by Drs. A.R. Anderson and J.A. Winter (UK Atomic Energy Establishment, Harwell) on temperature effects on gas-phase radiolysis of selected polar molecules. This paper discussed in particular the effect of temperature on the yield of hydrogen from the vapor-phase gamma radiolysis of alcohol, ammonia, and water. The results showed that the G-value of hydrogen depended on temperature in such a way that there were several plateau values of the hydrogen yield. The results were interpreted in terms of the thermodynamic equilibrium involving solvation of the proton in these systems. On the assumption that the mechanism of neutralization gives rise to a hydrogen atom, the plateaus were interpreted as solvation spheres involving a specific number of solvent molecules clustered around a proton in each of these systems. The results were compared with data from thermodynamic equilibria for methanol, and general agreement was observed. For more than qualitative agreement, however, it was necessary to invoke a change in mechanism which was represented as the collisional deactivation of excited molecules.

Dr. Peter Ausloos (National Bureau of Standards) presented a paper on a

topic clearly intermediate between photochemistry and radiation chemistry -- namely, the study of photoionization of cycloalkane molecules. In this study neutral products formed in mixtures were analyzed and information derived on ion molecule reactions, fragmentation of the parent ion, and decomposition of super excited molecules (i.e., molecules excited above the ionization potential which do not ionize) from these systems. Cyclopropane, cyclobutane, cyclopentane, and the corresponding alkenes of the same empirical formula were studied under the influence of 1236 Å (10 eV) and 1050 Å (11.5 eV) radiation and were compared with data previously obtained at the Bureau of Standards on the radiation chemistry of these compounds. It is of parenthetical interest to note that in recent unpublished work from our laboratory we have obtained data from a mass spectrometric study of reactions of parent molecule ions in these systems which support, in most cases, the conclusions deduced from the analysis of Ausloos and his collaborators.

Dr. J. Bednar (Institute of Nuclear Research, Rez, Czechoslovakia) presented a paper entitled "The Optical Approximation in Radiation Chemistry." This paper was a theoretical discussion of implications of the optical approximation for primary radiation chemical yields in the radiolysis of water by gamma rays or fast electrons. This approximation is used to calculate numbers of excited molecules and ions formed by the primary processes of radiation chemistry. A mechanism is then postulated for the reaction of these species, and the ultimate chemical yields are calculated. A similar approach was a applied to a discussion of the radiolysis of liquid benzene-pyridine mixtures. Although reasonable agreement with experiment was observed in both cases, it is the impression of the writer that the level of sophistication presented in this paper is at the approximate level of discussions held in radiation chemical circles in the US four or five years ago and that it does not represent any advance in our understanding of such processes.

Prof. George Hammond (California Institute of Technology) presented a paper on the quenching of excited singlet states of aromatic hydrocarbons. Here he discussed the observation that the characteristic fluorescence of a series of aromatic hydrocarbons is reduced by the addition of conjugated dienes to the system. Quenching of fluorescence is further correlated with changes in the photochemical decomposition of these systems as anticipated by the generally accepted mechanism for these processes. At higher concentration levels of the dienes they themselves exhibit a reduced quantum yield for decomposition. These results may be drawn together by the assumption that the sensitized reactions involve triplet states of the dienes and the assumption that excited singlet states of the aromatic absorber are quenched before they can undergo intersystem crossing. A general mechanism for the quenching sensitization, and intersystem crossing reactions was proposed. It was shown how quenching data may be used to estimate the lifetime of the singlet states of the aromatic molecules -- from a study of competitive quenching by the dienes and by added oxygen.

Dr. L. Kevan (Dept. of Chemistry, Univ. of Kansas) presented a paper on the rare-gas sensitized radiolysis of liquid hydrocarbons. This was a study rather similar to previous work by the writer on the rare-gas sensitized radiolysis of gaseous hydrocarbons. In order to correlate Kevan's results, it is necessary to postulate that the energy available via charge exchange or energy transfer from each of the species R^+, R^*, R_2^+ and R_2^* (where R is any one of the rare gases) is reduced by approximately 1.5 eV as a result of solvation interaction in liquids. With this assumption in mind, a mechanism quite analogous to that previously accepted for the gas phase study correlates the results of the liquid-phase investigation very nicely. Selective channeling of radiation energy into the formation of specific products is observed, and evidence was further presented for ion-molecule reactions in the liquid phase.

An interesting paper presented by Prof. F.W. Lampe (Pennsylvania State Univ.) described a quantitative study of reaction of hydrogen atoms with NO molecules from a mass spectrometric study of the mercury photosensitized hydrogen-nitric oxide reaction system. This study showed quite clearly that the nitroxyl molecule (HNO) which is formed by the third order of reaction $H + NO + M = HNO + M$ reacts very rapidly at sufficiently high pressures

(i.e., in the presence of a third body) with two additional H atoms to form the product NOH_3, probably the hydroxyl amine molecule. Various species and intermediates interact via a rather complex mechanism, but resolution of the kinetics is possible, and rate constants can be deduced for many of the elementary reactions. An incidental by-product of the study has been the measurement of the ionization potential of the HNO radical, which is, of course, an unstable species under ordinary conditions. Dr. R.N. Schindler (Max-Planck Institüt, Mulheim) described the decomposition of electronically excited alkyl halides. This study made use of monochromatic light sources of wavelengths 2537, 2062, 1849, 1470, 1235, and 1165 Å incident on ethyl iodide, fluoride, and bromide. These molecules decompose via two principal steps in the primary act, i.e., elimination of molecular halogen hydride and rupture of the carbon halogen bond. The relative probability of the two processes depends on the wavelength of exciting light. These results are, of course, of considerable interest to the interpretation of radiolysis of these compounds. (J.H. Futrell)

MECHANICS

Ferrybridge Obituary

It was particularly significant that the seminar given by Prof. B.G. Neal, Dean of the City and Guilds College, London, on "Cooling Towers" should have occurred on the day that the report by the investigating committee on the recent Ferrybridge collapses was made public. Further, the committee, composed of Prof. P.R. Owen (Prof. of Aviation, Imperial Coll.), Prof. A.L.L. Baker (Prof. of Concrete Structures & Technology, Imperial Coll.), and Prof. A.H.Chilver (Prof. of Civil Engineering, Univ. Coll.), was in attendance and contributed much to the discussion period which followed.

Neal, in the capacity of a cooling tower designer, at first described the structures (which are used in UK to cool the water used at electrical power stations and are typically 270 ft wide at the base, 375 ft high, and roughly of hyperboloidal shape) in general and then proceeded with an analysis of the design procedure. It should be mentioned that the Ferrybridge towers were not of Neal's design.

Briefly, the results of the stress analysis showed that there could develop large tensile stresses on the windward side in the meridional direction when one combined the dead weight stress with the wind-induced stress. Where the dead weight could be prescribed quite readily, the wind velocity can be prescribed in only a statistical, time-wise sense. Since the stresses due to wind loading will vary as the square of the wind velocity, it becomes apparent that the design wind condition must be carefully examined.

As an added complication in picking the design wind condition, it was pointed out that there were conflicting estimates of the variation of wind pressure with height along the tower. A typical profile of the wind velocity near the ground shows that the velocity varies as the height of the ground, raised to the power 0.1 or so. One might conclude from this that the wind pressure should increase with height, raised to the power of the square of 0.1. However, it was later shown that in wind tunnel tests of isolated towers the pressure was approximately constant with altitude.

From the point of view of stability, some experiments were undertaken to determine the deflected shape during buckling of an isolated tower in a wind tunnel. As the towers were observed to deflect near the top in a heart-shaped cross-sectional pattern (with the two lobes oriented to windward), which did not correspond to the observed mode of failure (a collapse of the lower section of the windward side), it was concluded that stability was not critical.

As a final study, one of Neal's students undertook the experimental determination of the frequencies and mode shapes of free vibration of a cooling tower separated at a number of discrete points by simulated columns. It was of interest to see if the lowest natural frequencies would lie in the region of frequency with which vortices are shed from a right circular cylinder.

A model was constructed by electroplating copper on a perspex core. It was found that the lowest natural frequency of the fully-supported model corresponded to a wind velocity of 200 mph. This velocity was computed using the analysis of A. Roshko. However, if some of the supports were removed from the windward side, symmetrically about the wind direction.

the following equivalent wind velocities were observed:

On supported arc length (degrees)

0	18	36	54	72	90
Velocity (mph)					
200	180	140	100	70	50

Such an unsupported arc could presumably represent a horizontal crack near the bottom edge of the tower.

Thus, it was concluded that the failure of the Ferrybridge tower was due to picking too low a wind velocity as the design condition and augmenting this with too low a safety factor.

In the discussion period, Chilver asked if the properties of concrete were acounted for in the design process, i.e., shrinkage effects. It seems that cracks are being observed in practically all existing cooling towers. In some there are pronounced vertical cracks extending from the point of support at the bottom.

Baker added that the cracks might be due to the uneven drying process. He suggested that some steel reenforcement be used to limit the width of the cracks as well as making a double layer of reenforcement so as to prevent the cracks from extending through the thickness.

In a final comment, Owen suggested that the vortex shedding produces an oscillating circulation pattern which would move the point of maximum wind-induced stress over a rather wide circumferential direction. No doubt Owen will have something further to say about this in his seminar, "Flow about a Group of Cooling Towers," to be given in early November.
(H.E. Williams)

MISCELLANEOUS

Walk or Ride?

Mrs. Barbara Castle, the Minister of Transport, is concerned about the congested state of traffic in London, and the local newspapers have given a lot of space lately to discussing various proposals to alleviate the jam. Anyone who rides a bus through the middle of town, as I occasionally do, must often wonder whether it isn't quicker to walk. I am convinced that it is. Last week, while my big red chariot sat motionless at a clogged intersection, I resolved to make a scientific inquiry into this question. A scientist ought to participate in examining the central public issues of the day.

What is the average speed of a London bus?

The naive investigator, approaching this problem, might be tempted to time a number of buses over a measured course. Needless to say, this procedure can be rejected out of hand. It lacks style; it is not sporting, for you are certain to get the right answer; it calls upon no arcane store of knowledge worthy of a true savant. Indeed, there is little to recommend it except directness, simplicity, and accuracy. Therefore, I adopted for my work a more elegant procedure which is free from these objections.

My office overlooks Oxford Street, a typical crowded thoroughfare. From the window, I can see the entire block which is bounded by Orchard Steet on the west and Duke Street on the east. This stretch is about 440 feet long. Armed with chronometer and teacup, I recently made a record of the number of eastbound buses in the block at 15-second intervals. This operation is called "taking the data." (Never mind what I'm going to do with these numbers; I'll get to that in a minute.) Ideally, since my method is a statistical one, the sequence of observations should be prolonged indefinitely -- that is to say, it should extend over the whole duration of the tea-break. However, this phase of the research was terminated after 40 minutes by the passage of a spectacular pedestrian in a miniskirt who distracted my attention from these scholarly labors. Hence, a finite sample will have to suffice.

From the analysis of the statistical fluctuations in the sequence of counts, it is possible to compute a parameter P which defines the probability that a bus observed on any occasion will have passed out of the block before the next observation is made, t seconds later. The theory for this was worked out by Smoluchowski in 1914 without any help from me; the essential formula for our present purpose is $P = \Delta^2/2N$, where N is the average value of the variate and Δ^2 is the mean square difference between successive values (separated by a uniform interval t). The following table gives experimental values of P for different time intervals as obtained from the bus-counting data:

t, sec	P	P/t, sec^{-1}
15	0.32	0.021
30	0.61	0.020
45	0.82	0.018
60	0.86	0.014

To complete the analysis, it is necessary to relate P to the speed of a bus. The asymptotic solution in the limit $t = 0$ can be shown to be $P = vt/a$, in which v is the average bus speed and a is the length of the block. The rather tedious proof of this result is left as an exercise for the reader, who should be willing to take my word for it anyway. By extrapolation of the tabulated values of P/t to $t = 0$, it is now a straightforward matter to establish that $v/a = 0.022$ sec^{-1}. The average speed of a London bus passing my office therefore comes out to be 6.6 mph. I'll bet Mrs. Castle didn't know that!

Certain of my colleagues maintain that this finding refutes my own contention that I can always get from A to B faster on foot than on a bus. They base this conclusion on the fact that my best walking speed, clocked en route to the pub on a clear track, is barely 4 mph. So it's quicker by bus, they say. Are they right? Can I be mistaken? Of course not. The explanation, although absurdly simple, is an instructive object lesson in the proper interpretation of experimental results. Where my friends went wrong was in failing to recognize that my experiment gives the speed of an average London bus. The clear conclusion is that when I take a bus, I always happen to catch one that is destined to travel at less than average speed during the time I am on it. This may seem an unlikely conspiracy of events -- as indeed it is. But these long runs of improbable happenings are bound to occur. For example, everyone knows that a chimpanzee, banging away randomly at a typewriter, is dead certain to reproduce eventually all of the books in the British Museum, correct to the last comma. Oddly enough, this interesting fact has never yet been demonstrated experimentally, so far as I am aware.

Tomorrow I have an appointment with the Director of the Regent's Park Zoo. (J.A. Bierlein)

New Campus of the University of Surrey

The student dormitory buildings at the new campus of the Univ. of Surrey (formerly Battersea College of Technology) in Guildford, Surrey, will have a number of unique features. First, it was suggested by the present Dean of Students, Dr. M.M. Clark (a member of the Mathematics Dept. who is active in relaxation methods as applied to elasticity) that there be no wardens quartered in the buildings. In his opinion, students should be encouraged to develop their own dormitory regulations and also do their own enforcing -- up to a point.

Second, the bedrooms on each floor enclose a central kitchen area. This led to the description in the press that the dormitories feature "farmhouse" kitchens where students can make their own breakfasts. It should be noted that dining facilities are available in adjacent buildings, but this new kitchen feature should accommodate students' individual tastes and preclude the necessity of going out into the weather.

The first 1200 students will move to the Stag Hill site, below the new Guildford Cathedral, in October 1968. The first group will include the Engineering Dept., which will occupy the ground and first floors of the academic block. The Mathematics Dept. will also be in this group, but will spend part of their time commuting to Battersea to provide mathematics courses for those departments scheduled to move later.

The Administrative Building will be situated immediately above the academic block on the hill with refectories on each side. The dormitories lie between the Administrative Building and the Cathedral. There will be nine four-storey blocks of dormitories built in the first phase. A typical floor plan shows four suites of bedrooms for four students each, adjoining toilet, bath and laundry rooms, and the central kitchen. The pattern differs in some buildings in which flats have been provided for married students and junior staff members. (H.E. Williams)

PHYSICAL SCIENCES

Humidity Measurements at NDRE

Dr. Dag T. Gjessing of the Norwegian Defense Research Establishment, Kjeller, is well known for his investigations of radio-wave propagation in the troposphere. For these studies a new fast response technique has been developed for measuring water vapor content in the atmosphere.

The technique is based on the measurement of the difference frequency between two stable and closely separated (in frequency) crystal oscillators. The crystal used for sensing humidity is coated with gold and then with a very thin layer of BaF_2. Air

enters the crystal cartridge through a small hole and, since water vapor controls weight, therefore influences the crystal resonance frequency. Preliminary experiments indicate that water vapor can be measured with response times as short as a few milliseconds.

The measurement device employs an 8-Mc oscillator and an oscillator at a frequency approximately 1 kc removed from 8 Mc. Difference frequency, sensed with a frequency discriminator and a diode, is used to provide high speed measurements on atmospheric humidity. (M.W. Long)

Annual Meeting of the German Physical Society, Munich, 1966

To observe the different styles of running a scientific meeting in a rather heterogeneous continent like Europe and to compare it with the American way is a rather illuminating experience. From these variations one is almost tempted to derive conclusions about the general approach to science and the standing of scientists and scientific work within the different European societies.

The structure of the German Physical Society is very similar to the organization of the American Physical Society. In addition to the regional sections within the Society, there exists also a typical structure which resembles the Divisions of the APS. Called "Ausschuss" or "Fachgruppe" in German, they unite within the Society the physicists working in the fields of high polymers, acoustics, high frequencies, mass spectroscopy, nuclear physics semi-conductors, metal physics and magnetism, respectively. This similar organizational structure, however, has not hindered the German physicists from establishing their own and rather different mode of communicating with each other in the conferences of their Society.

There are sectional meetings within the German Physical Society and there are divisional meetings in the spring. It is at these sectional and divisional meetings that the new results of physical research in Germany are reported. The big annual meeting in the first half of October, uniting once per year all the members of the Society, is kept entirely free from the communication of new results. There is nothing that compares to the "contributed papers" at a meeting of the APS, and only a small part of the time is devoted to something that can be compared to our "invited papers." The tendency of the annual meeting of the German Physical Society, in addition to the usual social and professional benefits of talking to friends and colleagues, is exclusively educational. The meeting is supposed to provide a forum for a communication not so much of the same, but of different fields of specialization. It gives the opportunity and an incentive for the physicist to continue his education and to bring himself up-to-date in fields other than his own.

This educational function is mainly accomplished by "plenary lectures" which take up the whole morning and therefore approximately half of the total available time. Lasting one hour each, they are usually brilliant from a pedagogical point of view and reflect the best of a long-standing tradition of university teaching. Content and level of these lectures are best compared to the articles in "Scientific American" - possibly making up for a shortage of publications of this type in a country in which the specialist still feels no real obligation to bring his science down to the popular level. This year, the subjects of these lectures selected to bring the audience up-to-date, covered the Gunn effect, holography, cybernetics an interfacultative science, molecular structure and information transfer in biological systems, physics of weak interactions, experimental tests of time reversal, new results of the physics of many body-systems, and new results on quasars, on moon and planet surfaces.

The afternoons are set aside for meetings of the Divisions. The nucleus of the four simultaneous sessions is the "Fachbericht" (topical report), which comes close to the "invited paper" of the APS meetings, but is slightly more general. Presented by specialists, of which some were invited from other countries, these Fachberichte usually start out with a review of his field and conclude with a summary of the contributions from the author's institute.

In keeping with the educational tendency of the meeting, each "Fachsitzung" (topical session) is opened by an introductory lecture, in which the basic facts and definitions of the field are explained to the outsider, so that everyone can understand what is then to follow in greater detail. The full program of these topical sessions provides a compendium of

subjects which are of interest to physicists in Germany these days and provides a guide to "Who-is-doing-what," therefore, the program is listed in a detailed conference report available through this office (ONRL-C-24-66).

Since this was a joint meeting together with the Austrian Physical Society, concessions had to be made to their needs. Thirty "Kurzvorträge" (short papers) were submitted exclusively by Austrian authors, mostly from the Atomic Institute of the Austrian Universities, Vienna, and the Reactor Center, Seibersdorf. These were similar to contributed papers, but apparently not much importance was attached to them, in that the solid-state physics papers, for instance, were scheduled as sessions parallel to the solid state "Fachsitzung."

There are three more things of a German Physical Society meeting worth mentioning. The first, Americans also have; the second, we perhaps don't need; and the third we don't have, but perhaps should consider copying.

1. Similar to our own program, one morning is set aside for physics teachers. This year one-hour lectures were presented on noise problems, extraterrestrial physics, the physical aspects of music, and solid noble gases, each being delivered by first-rate authorities in the respective field.

2. The "Evening of Contact," bringing together young students and physicists with a group of senior scientists from the universities, is possibly justified in view of the strong vertical structure of German scientific organization and hierarchy. It provides the opportunity to bridge the gap between the two groups of a community in which it is still somewhat unusual for the younger member simply to button-hole the older one informally outside of the conference rooms.

3. It seems worthwhile to consider copying the "Evening Lectures," which have somewhat the formal and grandiose air of a scientific show. Two were given in plenary and public session in the big conference room of the Deutsche Museum. The first one, historically oriented, was by W.Gerlach (Univ. of Munich), on the "Early history of the physics of light and colors," and the second one, with experiments, by H. Auer (Univ. of Munich) on radio astronomy.

The high standing of scientific, in particular academic, activity in German society was not only expressed in a widespread newspaper coverage of the meeting, but also in a very formal opening session of high ceremonial value. A symphony orchestra played Bach at the beginning of the usual sequence of "We-are-so-glad-you-are-here-and-we-hope-you-enjoy-yourselves" speeches, which included addresses by the Federal Minister for Scientific Research and the Bavarian Prime Minister.

The opening address of the President of the German Physical Society, Prof. W. Finkelnburg reflected some of the difficulties which the universities encounter in post-war Germany. In an attempt to have the old academic values survive unchanged, the German university finds itself in a dilemma between tradition and progress, between keeping up esoteric demands and giving in to the needs of society. The progressive element in this struggle is the "Wissenschaftsrat" (Council for Science) a body established by administrative agreement between Federal and State governments, consisting of representatives of both, as well as delegates from the institutions of higher learning. Although no executive power is vested in this Council, its periodic "recommendations" for improving the higher educational system are somewhat hard to ignore. Its latest report recommends not only a restriction in the length of courses and thesis work, but suggests even a mandatory expulsion of "external students" who misuse the traditional academic freedom of German universities. Orienting themselves predominantly on the image of a university as seen by the liberal arts-faculty, rectors and professors consider such a recommendation as lack of confidence in their own judgement and as an attack on the "concentrated leisure" which is the embodiment of intellectual activity.

Finkelnburg in his opening speech took side against any restrictions in the length of the thesis work, but recommended strongly a larger influence of the natural-science faculty in shaping educational policy, which is at the present still dominated by the liberal-arts faculty.

The formal address of the opening sessions was given by C.F. von Weizsäcker (Univ. of Hamburg), physicist and philosopher, famous for his contributions to the philosophical foundation of physics. He stated in the

beginning that the title of his lecture, "Unity of Physics," seemed somewhat inappropriate in view of the diversity of specialists sitting in front of him. Nevertheless, he claimed, the unity of physics seems to be just around the corner. Elaborating on this statement, he described how the history of physics proceeds in cycles, starting from unity, developing into complexity and returning to unity. Atomic physics, in particular, is a good example for this progress in cycles. The complexity of present day physics is therefore nothing but a transitionary phase, almost a crisis situation, which will be overcome like a sickness is overcome by the following recovery.

In its early phases, science establishes certain laws on a rather naive or strictly philosophical basis. As it progresses, certain modifications and additions are necessary, which form the bulk of the complexity and specialization. By probing progressively into depth, however, the limits of our recognition are realized and science can be seen as a whole, returning thereby to unity. Such an argumentation depends, of course, upon the possibility that the limits of physics, for instance, can actually be recognized. Is physics a finite problem, or are new views and avenues of progress opening up every time we reach a borderline? From every day's experience, the physicist is inclined to believe that there is no final borderline, but according to Weizsaecker, he is in the position of a man awakening five times during the night and concluding that, therefore, it will never be daytime again. It is a built-in feature of a physical theory that it can give no reliable information on its own limitations. Only the next step after modifications and expansions can outline these limitations by looking back to the previous stage. Descending from the philosophical level onto the level of actual physical theories, Weizsaecker returned to his original claim of a future unity of physics. By expanding the present quantum mechanics to the areas of very large and very small dimensions, he has hope for a unification of quantum theory, cosmology and elementary particles, in particular.

Weizsaecker's lecture was apparently designed as a challenge rather than an attempt to unite everyone in the audience in whole-hearted agreement. Accordingly, the discussion was vivid and quite up to the demanding level of the presentation. It can be expected that the lecture will be published in detail in scientific and philosophical journals, so that the interested reader will have an account more competent than this amateurish summary.

Weizsaecker's lecture provided the link between the political and the professional part of the opening session. After the award of the Max-Planck-Medal of the German Physical Society, the prize lecture of Prof. G. Lueders (Univ. of Göttingen) on "The method of the correlation functions in the theory of superconductivity" guided the audience all the way into physics. From then on the remainder of five days was devoted to the serious business of educating each other in what modern physics has to offer. (B.O. Seraphin)

PSYCHOLOGICAL SCIENCES

Third Anglo-American Symposium on Military Psychiatry

On 16 November the British Army was host for the third of what has become an annual UK-US meeting on military neuropsychiatry. The first Symposium in this series was sponsored by the Royal Air Force and the second by the U.S. Air Force. Brigadier J. McGhie, Director of Army Psychiatry, was responsible for organization of the program and served as chairman. In addition to representatives of the UK and US military psychiatry programs in Europe, this year's conference was opened to personnel from the Canadian and Australian Armed Forces. In all, approximately 50 psychiatrists, psychologists and social workers attended the one-day meeting.

The Symposium was held in the Royal Army Medical College, a late-Victorian structure situated on the banks of the Thames, in the heart of London. From the outside the College is not particularly imposing, and the interior is characterized by high ceilings and a maze of passageways, classrooms, and small offices which are the inevitable result of modifying old buildings to meet changing requirements that accompany the passage of time. There is an exception, however, to this sweeping generalization. The reception room, main dining room, and anterooms of the Headquarters Mess contain all of the heavy paneling, oil paintings, silver, and trappings

associated with the formality, dignity and grandeur of the Victorian era. Of particular interest is a small room devoted to commemorating Royal Army Medical Corps officers who have been awarded the Victoria Cross, Britain's highest military decoration.

The program differed from those of previous years in that fewer theoretical and/or research papers were presented. While the program as a whole tended to lack a number of scholarly characteristics which usually typify professional meetings of this nature, its focus was quite appropriate, as this was not a meeting of a learned society. The majority of participants were practitioners faced with problems of enhancing the contribution of psychiatry to their respective military services. There are many professional societies, international congresses, and journals which serve as vehicles for theoretical and research contributions; this Symposium filled a gap in providing a platform for the military psychiatrists to exchange views with colleagues from other countries on the problems of daily practice.

A brief and sincere welcoming address was given by Major General Morrison, Director of Medicine of the College. This was followed by equally brief introductory remarks by Brigadier McGhie. The program per se consisted of seven formal papers and a viewing of the controversial film "The War Game." The majority of the presentations were concerned with describing the development and functioning of clinical programs in a variety of service settings. One scheduled paper was canceled at the last minute because of difficulties in obtaining a security clearance. A discussion period was scheduled following each paper, but scheduling problems required that this be limited or omitted for several of the papers.

Wing Commander A.B. Goorney (RAF) presented the first, as well as one of the more intriguing papers of the day, entitled "The Treatment of Flying Phobias and Allied Conditions in Experienced Aircrew." Goorney, who is a qualified aviator as well as a fully-trained psychiatrist, described a current clinical study utilizing behavior therapy in the treatment of fliers suffering from anxiety. The study is not far enough along to warrant drawing conclusions, and it actually may have been somewhat premature to report on it at the Symposium. At the same time, it is also sufficiently novel to warrant more than passing comment.

Approximately one-third of the psychiatric workload in the RAF program centers around problems of flying which are directly or indirectly related to anxiety. Somewhat less than 20% of patients in this category must be grounded permanently, including officers with long and extensive flying experience. This situation is not new in the RAF (or any other air force) and has been approached for years with orthodox treatment procedures. The therapeutic goals usually involve reduction of environmental stress with ultimate assignment to a less stressful form of flying. While the more traditional approaches may be successful, it frequently is difficult to restore the patient to flying his original type of aircraft, and long-term follow-up has disclosed that problems of anxiety generalization are not uncommon.

Goorney is working with individuals who have not responded to traditional treatment and are scheduled to be grounded. Thus, his subject population is composed of patients who have clearly and unequivocally been identified as losses to the RAF flight program. The treatment is carried out in two distinct phases, the first of which is on the ground and the second in the air. At the beginning of the first phase, a hierarchy of stress situations related to flying is developed from interview and case history material. The patient then undergoes a sequence of therapeutic sessions aimed at progressive desensitization to this hierarchy of stress situations. After the patient has been able to imagine or verbalize his feelings about the most extreme of the situations without experiencing conscious anxiety he is introduced into the second phase of treatment.

The flying phase of the treatment is varied according to both the patient's background in aviation and the nature of his complaint. The underlying principle, however, involves moving through a carefully planned sequence of steps which culminates in the subject being able to carry out the type of operational flying for which he was trained. A hand-picked group of pilot instructors work as co-therapists in this phase of the treatment. The second phase essentially duplicates the ground desensitization in the air, using the

type aircraft in which the symptoms originally occurred. The ultimate step in the desensitization hierarchy may involve (and actually has in one case) the performance of combat maneuvers in a jet.

To date, Goorney has completed the treatment of five patients with this method, four of which were restored to full flight status (three pilots and one navigator). The fifth subject, a navigator, had his fear of flying reinforced when the pilot co-therapist attempted to short-cut the progressive desensitization and prematurely subjected the patient to a series of combat maneuvers. All of the successful cases have been highly experienced pilots with considerable experience and good pre-illness performance records.

It is unfortunate that more time has not elapsed since Goorney started his study, as little can be said about prognosis in this treatment program or about displacement of symptoms. The first subject, a flight instructor, has been back at duty for only three months, and the last successful subject less than one month. However, all four are reportedly totally asymptomatic and functioning without impairment. No claims are made that this approach is the panacea for disorders of this nature or that the recovery will be sustained over any significant period of time. Goorney has adopted an empiricist's outlook in his study. On the basis of his experience to date, three factors enter into successful application of the treatment program: selection of patients, the timing in transition from the ground to the flying phase of the treatment program, and the requirement that the therapist be a trained flyer. The method is proposed for use only in the case of experienced aviators who have failed to respond to more conventional forms of psychiatric treatment and whose potential value to the service justifies the rather considerable expenditure of time and money which is required. One might predict that it will be some time before high performance jet aircraft and aviation gasoline become stock items along with meprobamate in the medical supply catalogs; however, the old practice of requiring an aviator to fly again immediately after a traumatic experience certainly has become markedly more sophisticated with the passing of time.

The second paper in the morning session was presented by Lt.Col. T.B. Stephens, RAMC, a staff psychiatrist at the Royal Army Medical College. Stephens' paper, "The Psychiatrist With a Special Force In An Overseas Theatre," described a visit he made to Aden in connection with a survey of morale and effectiveness of British troops stationed in this rather desolate and primitive outpost. Much of the presentation was concerned with relating the approach used in collecting information from commanding officers, medical officers and troops, along with the pitfalls which the psychiatrist meets in the unstructured field situation. Stephens used colored slides to illustrate the nature of the stresses which troops encounter in Aden and the conditions under which they must live. Psychiatric referral and admission rates reported by Stephens did not appear out of line with service in this environment; and, as might be expected, they tend to rise during times of increased tension.

Major R.S. Britton, RAMC, described the development and present operation of a child guidance clinic in his paper, "Organization of a Child Psychological Service in an Overseas Theatre." Britton, who is currently serving in Germany, presented some interesting summary data on the differences in family background and reasons for referral of children between his clinic and in England. Generally speaking, delinquency and truancy are less common complaints among children referred in the overseas clinic, where approximately one-third of the referrals were related to educational problems and enuresis. Somewhat surprisingly, 74% of the mothers in Britton's sample had at some time or another received psychiatric treatment. Further, 26% of the fathers had been raised either partly or totally in foster homes.

Squadron Leader A.S. McVicar, RCAF, was the only Canadian speaker on the program. His paper, entitled "Community Care In A Service Environment," described the development of an admirable preventive psychiatry program in a Canadian Air Force community near the German-French border. Essentially McVicar's approach is to hold "community conferences" with chaplains, administrative officers, medical officers, and others who are concerned with human problems. The conferences are focused on increasing perceptiveness of problems faced in this environment and changing negative attitudes through group dis-

cussion. The major meetings are planned on a semi-annual basis, although smaller groups now have evolved which meet more frequently. Separate seminars also are held for general medical officers. McVicar's paper was particularly complete and objective, and he very candidly discussed resistances encountered, as well as his own mistakes and frustrations in the program. As in any approach of this nature, it is very difficult to arrive at an objective assessment of the definitive contribution which the program is making to a constantly changing military community. However, if acceptance by the group involved serves as any criteria, McVicar appears to have done an excellent job.

Lt.-Col. B.L. Livingston, the neuropsychiatric consultant for the U.S. Army Forces in Europe, outlined the Army's preventive psychiatry program in his presentation "Mental Hygiene in the American Army." Livingston's paper was well organized and well received. Although the content of the paper was familiar to the US participants, it was of obvious interest to their colleagues in the British forces.

Surg. LCdr A. Scott-Brown, RN, spoke on "Psychiatric Problems of Personnel Serving in Small Naval Ships." The primary thesis of Scott-Brown's paper was the need for medical officers on small ships to recognize early signs of psychiatric disturbance and take action before the illness has assumed more serious proportions. It is his contention, based partially on his own experience in small ships, that young medical officers fail to recognize many cases of psychiatric illness. To a certain degree it is considered that this problem arises because the medical officer tends to become an integral part of the small ship crew and lacks the emotional and professional detachment which is important in perceiving early signs of illness. However, far more important is the lack of sensitivity to and orientation toward detection of psychiatric disorders.

Interest in this problem has led Scott-Brown to collect data on the source of referrals seen at the Royal Navy Hospitals, Haslar, Portsmouth, and Plymouth. The incidence of patients who ultimately were referred to the psychiatric consultant at these hospitals is greater for small than for large ships. The highest incidence of claustrophobia was found in men who served in submarines. However, it is interesting to note that 100% of these patients were individuals who had <u>not</u> volunteered but were assigned to submarines. (The Royal Navy assigns men to submarines as a routine personnel action when an insufficient number of volunteers is obtained to fill quotas.)

The last formal paper of the day, "Psychophysiological Effects of Intercontinental Flight Through Multiple Time Zones," was presented by Major S.L. Freud, a USAF psychologist. Freud discussed a series of studies carried out while he was assigned to the FAA on disruption of circadian rhythm induced by jet flights. No attempt was made to present the detailed results obtained on the rather extensive psychological and physiological measures used in the study. Rather, the data were presented in summary form with an emphasis on the practical significance of the findings. As the conclusions derived from this research are fairly well known in the US they will not be repeated here; it is sufficient to say that all available evidence indicates there are certain types of activities, particularly in the area of high level abstraction and negotiation, which should be avoided by the international traveler passing through more than three time zones until his circadian rhythm becomes readjusted. Freud began his presentation by quoting from the Declaration of Independence - a somewhat novel approach in the home of British Army medicine. Even though this was the last paper of the afternoon, the attention of the audience certainly was captured by the opening remarks. Exactly the right balance between data and conclusions was maintained; which, combined with a lucid and humorous form of delivery, made this the most enthusiastically received and discussed paper of the meeting.

The last hour of the seminar was devoted to a viewing of the controversial movie "The War Game." This 50-minute film, made by the BBC, has been banned from British television. The plot of the film in concerned with a hypothetical atomic bomb attack on England. The story begins with the early warning phases before the attack, progresses through the blast, and portrays the destruction, physical injury, death, and breakdown in social order following the catastrophe. The death and destruction scenes are extremely realistic, and the acting out of psychological response to the

to the disaster and the mass social disorder which follows is superb. It was interesting to observe that the Symposium audience, composed primarily of experienced military medical officers, sat in absolute silence at the end of the film. There is no question as to its power and impact. Brig. McGhie led a brief discussion as to the appropriateness of this movie for viewing by unsophisticated audiences. The general consensus of the group was that it should be shown only to selective audiences because of its shocking realism.

The seminar was closed by McGhie, who, because of time limitations, did not make the formal address which had been scheduled in the program. After announcing that the USAF would be host to next year's Symposium, McGhie thanked those who had assisted in planning the program and indicated in passing that the goal had been to present a full day of interaction on "practical military psychiatry." On the basis of comments overheard at the delightful cocktail party given by the Royal Army Medical College at the close of the meeting, there is no question about the participants considering that the goal had been achieved. (J.E.Rasmussen)

NEWS AND NOTES

The Second European Symposium on Marine Biology will be held at the Biological Station, Espegrend, Blomsterdalen, Norway, 24-28 August 1967. The general topic of the Symposium will be the importance of water movements for biology and distribution of marine organisms. Within this general topic will be included a consideration of the measurement of water movements, the ecological and physiological effects of water movements, and water movements and distribution. The announcement invites papers within the general topic, stressing that new results should be presented. Presentation will be limited to 20 minutes with additional time alloted to the discussion. Papers and discussion remarks may be presented in English, German, or French, but simultaneous or other translation services will not be available. An abstract of the paper should be submitted before 1 August 1967 to permit time for duplication and distribution. Papers submitted at the Symposium will be published in Sarsia, and thus it is essential that "finished" manuscripts be delivered at the meeting.

Individuals interested in further details or application forms should write: Prof. H. Brattström, Director, Biological Station, Espegrend, Blomsterdalen, Norway. (J.D.Costlow)

The British Government White Paper on the decimalization of the £ has now been published, and arguments were being voiced on the day of publication, not as to whether decimalization should be adopted (this has already been accepted as a necessary evil) but whether a hundred pennies should be worth ten shillings or a pound. (The Chancellor of the Exchequer in a television interview dismissed the suggested substitute of the word cent for penny as "too American.") A Decimal Currency Board will deal with the practical problems associated with switching from £ s d to the new £, which is predicted to take place in February 1971. The Chairman of the Board has been named and his salary fixed -- £3500 (or 350,000 new pennies).

Dr. W.C.E. Higginson, Reader in the Faculty of Science at Manchester Univ., has been appointed to the Third Chair of Chemistry at Hull Univ.

Dr. B. Rose has been appointed Head of the Nuclear Physics Division of the UK Atomic Energy Authority in succession to Dr. E. Bretscher, who has retired.

Prof. I. C. Goddard, Professor of Mathematics at the Univ. of Tasmania, has been appointed Professor of Mathematics at Salford Royal College of Advanced Technology - the proposed new Univ. of Salford.

R.A. Cawson, Senior Lecturer, Guy's Hospital Medical School, London Univ., has been appointed to the Chair of Dental Medicine there.

R.P. Bell, Fellow and Vice-Master of Balliol College, Oxford, has been appointed Professor of Chemistry at the Univ. of Stirling.

F.G.T. Holliday, Lecturer in Zoology at the Univ. of Aberdeen, has been appointed to the Chair of Biology at the University of Stirling.

Dr. A. Korner, Lecturer in Biochemistry, Cambridge Univ., has been appointed Professor of Biochemistry at the Univ. of Sussex.

Dr. W.L. Wilkinson, of the Atomic Energy Authority, has been appointed to the second Chair in Chemical Engineering at the Univ. of Bradford.

Dr. F.M.J. Cornish, Senior Lecturer in Applied Mathematics at Leeds Univ., has been appointed Professor of Mathematics at the Univ. of York.

Prof. H.C.H. Gurney, Professor of Civil and Structural Engineering at the University College of South Wales and Monmouthshire, Cardiff, has left to take up an appointment as Prof. of Mechanical Engineering at the Univ. of Hong Kong.

Dr. H. Tajfel, Lecturer in Social Psychology at Bristol Univ., has been appointed to the Chair of Psychology at Bristol University.

Dr. N. Thompson, Reader in Physics and Assistant Director of the H.H.Wills Physics Laboratory, has been appointed to a Chair at Bristol Univ.

Dr. B.G. Dickins is to be Deputy Controller of Guided Weapons at the Ministry of Aviation. He was director, Guided Weapons Research and Development at the Ministry of Supply.

Dr. Roger Penrose has received the title of Professor of Applied Mathematics at Birkbeck College, London.

Dr. Brian Donovan has received the title of Professor of Physics at Westfield College, London.

Prof. G.P. Crowden, Emeritus Professor of Applied Physiology at the Univ. of London, died on Nov. 22. He was the author of many papers dealing with muscular work, fatigue, and recovery, the effects of heat and cold with nutrition, lighting, noise, and vibration. He was appointed Reader in Industrial Physiology at the London School of Hygiene and Tropical Medicine, and later became Professor of Applied Physiology at the same School. His department was responsible for much applied research which has had effects in fields of housing, high temperature physiology, and the physiology of work.

Prof. R.M. Sievert died recently in Stockholm. He had been Director of the Institute of Radiophysics since 1937 and was an authority on the biological effects of ionizing radiation, radiation dosimetry and protection, and on natural radiation and radioactive fallout.

Technical Reports of ONRL

The following reports have recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office, Box 39, Fleet Post Office, New York 09510.

ONRL-45-66 Radar Research in the Netherlands by M.W.Long
ONRL-46-66 Psychiatry in the Norwegian Defense Forces by J.E. Rasmussen
ONRL-47-66 Notes on Psychology in Northern Ireland by J.E. Rasmussen
ONRL-48-66 Military Psychology in Norway by J.E. Rasmussen
ONRL-49-66 Technische Hochschule Aachen, Germany by J.B. Cohen
ONRL-50-66 Some Solid State Physics in the Paris Area by B.O. Seraphin

The following conference reports are releasable to European scientists:

ONRL-C-18-66 International Symposium of the Joint Services Electrical Power Sources Committee 1966 by P.D. Maycock
ONRL-C-19-66 1966 Symposium on Gallium Arsenide by P.D. Maycock
ONRL-C-20-66 Electron Microscopy in Metallurgy: A Conference Sponsored by the British Institute of Metals, Sept. 1966 by J.B. Cohen
ONRL-C-21-66 The Tenth International Conference on Low Temperature Physics (LT10) Moscow, Aug-Sept. 1966 by R.S. Allgaier (NOL Silver Spring)
ONRL-C-22-66 Sixteenth Meeting of the International Committee on Thermodynamics & Electrochemical Kinetics, Budapest by A.L.Powell (ONR Boston)

ONRL-C-23-66 The Combined Royal Aeronautical Society's Centenary Congress & the 5th Congress of the International Council of the Aeronautical Sciences by H.E. Williams

ONRL-C-24-66 Annual Meeting of the German Physical Society, Munich, 1966 by B.O. Seraphin

ONRL-C-25-66 First European Symposium on Marine Biology, Helgoland, Sept.-Oct. 1966, by J.D. Costlow

ONRL-C-26-66 International Symposium on Fluid Dynamics of Heterogeneous Multi-Phase Continuous Media, Oct. 1966, Naples, by I.Glassmann

ONRL-C-27-66 Symposium on Bionic Models of the Animal Sonar System, Frascatti, Italy, Sept-Oct. 1966 by W.J. Trott

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DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) OFFICE OF NAVAL RESEARCH BRANCH OFFICE LONDON, ENGLAND	2a. REPORT SECURITY CLASSIFICATION 2b. GROUP

3. REPORT TITLE

EUROPEAN SCIENTIFIC NOTES 20-11

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
N.A.

5. AUTHOR(S) (Last name, first name, initial)

Rasmussen, J.E. and Hewitson, Victoria, ed.

6. REPORT DATE 30 November 1966	7a. TOTAL NO. OF PAGES 20	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO. N.A. b. PROJECT NO. c. N.A. d.	9a. ORIGINATOR'S REPORT NUMBER(S) ESN-20-11 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) N.A.	

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510

11. SUPPLEMENTARY NOTES N.A.	12. SPONSORING MILITARY ACTIVITY N.A.

13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

DD FORM 1 JAN 64 1473

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