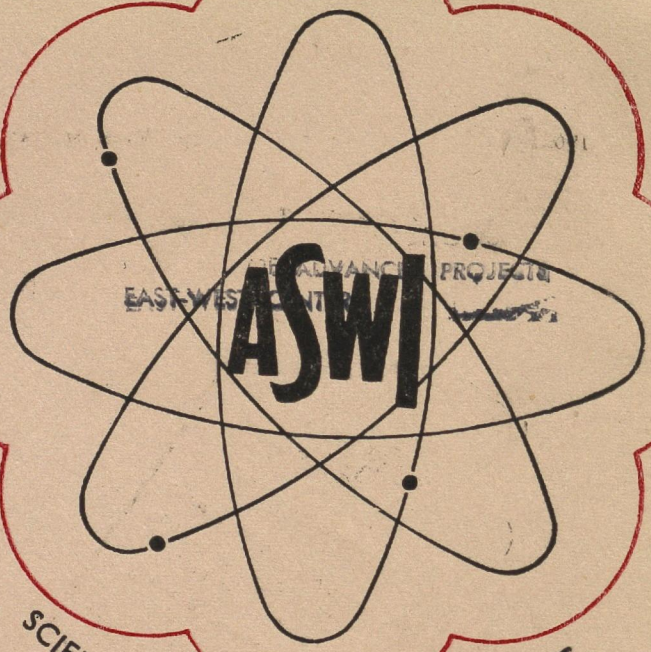

Vijnan karmee

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VIJNAN KARMEE

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(Founder-President : Shri Jawaharlal Nehru)

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Editorial

We regret to discontinue the previous series of articles on how to create workers with science embedded in their mind rather merely in their material attitude. When a country is forced to face a life and death struggle, the scientific workers cannot merely give long range solutions to country's problems. Meeting the challenge to the integrity, sovereignity and prestige of the motherland becomes the primary duty of all including those engaged in scientific/technological professions. Rather, because of their better training and equipments they can use their energy in a better and more thorough way in the service of their country and its efforts to meet the crisis than many other categories of workers. We would, therefore, like to impress upon our friends engaged in scientific and technological profession that this is a period of challenge to their capacity and patriotic feelings and they have to meet it boldly.

Despite our noble aspirations for place and tranquility in the world and our stupendous efforts in the way to outlaw war as a means of settlement of conflicting issues, we have to be always prepared to meet aggression and challenge to our integrity and sovereignty from howsoever strong source it comes. Maybe we have been temporarily mistaken in our confidence that our neighbours will pay due respect to our peaceful intentions. Because of this confidence we had engaged our country completely with its full might to the task of removing poverty and misery from our land and developing India, socially, economically and spiritually; we had even switched over our Defence installations, to produce consumer goods like tractors, trucks and transport planes instead of only war materials. All these steps taken in our country were a clarion call to our neighbours that ours were peacefull intentions and we reposed full confidence in our ideology of solving even most difficult issues by means of negotiations. But it seems these intentions were considered as sign of weakness by ruthless and unscrupluous neighbour. Despite their declaration of their faith in Panchseel they have attacked Indian soil after full military preparations. The sudden, shocking and cowardly invasion resulted in heavy loss to India in initial stages of the struggle not only in terms of territories, men and equipment but also in terms of ideological psychology.

The Association of Scientific Workers of India always appreciated and shared Govt. of India's anxiety to thrash out issues amicably through negotiations even if the settlement took a pretty long time. Having been forced to abandon its non-military outlook by the harassing aggressive attitude of the neighbour across the Himalayas, the Indian scientists will have no choice but to extend their total energy and untiring efforts to solve any difficulties faced by the Govt. of India in their noble task of maintaining their sovereignity and integrity of Indian people.

We will also like to impress upon our fellow scientists abroad to appreciate the difficult situation in which India has been placed by the threatening action of an aggressive neighbour. Let them exert a pressure on the Chinese Govt. and people that aggression will not pay and if the humanity has to pay the price for outraging the peaceful intentions of a peace loving nation like India, the entire blame for the misery will be on their shoulders. The future generations of humanity will curse them for pushing a peaceful and democratic country to a warlike situation; despite all the good intentions and manifold supports they have received from India for fifteen years in national, regional and international fields, in their turn they have taken recourse to dishonest intentions and deceitful military preparations to grab Indian territory instead of being grateful to India.

We have already issued our appeal to all scientists in India upon whose shoulders lies much greater responsibility, to respond to the call of our beloved Prime-Minister and exert last bit of their talents and energy to keep the integrity and honour of our sacred motherland intact. A letter from our Acting President to Prime-Minister and the latter's reply is also being published in this issue. We are sure everybody will stand up in the right type of responsive attitude be these appeals and every scientist, at whatsoever position he is working, will unhesitatingly put the hardest possible work and every ounce of his energy to fulfil the task for which he has been called upon by his sacred Mother-land.

Editorial News

ANATOMY OF SCIENTIFIC 'APTITUDES'

Our age has been a period of paradoxes. Our preferences and motivations had the sanctions as well as censures of social norms and modes juxtaposed simultaneously. As citizens we have both benefited from and therefore praised science; on the other hand the very process of attaining such results have at times been subject of intensive attack both from scientists in related fields as well as the taxpayers in the vast superstructure of social organism who has duty of maintaining science and right of criticising some of its methods, if not all. The situation abtaining in a democracy like that of ours in India is, if one may use the phraseology, infantile. As an instance organised social opposition to transportation of monkeys for experiments connected with *in vivo* physiological studies and virus researches particularly in poliom-y elitis (infantile paralysis) is an indication of these under-currents. The so-called *vivisection* studies have like-wise inspired the wrath of the lay brother. On the other-hand scientists engaged in these very fields of 'inhuman' researches have much to say on the mode of work of some of our conservancy boards, societies for prevention of cruelty to any and sundry, and patrons of 'wild' life (outside municipal limits in most our big cities).

The problem is not peculiar to India alone. We will go even one step further and unhesitatingly state that relatively there is much more independence of work for a well intentioned physiologist in this country. The reasons in part may be linked with lack of 'organised conscience'. It is only a matter of little tax on memory to recall the world wide protests in the choice of a canine member as a 'pioneer' in *in vivo* space studies. A *homo* in like circumstances would perhaps have drawn less attention. That much for the 'modes' and 'norms' of our social 'moral', which regrettably has kept a very slow pace with the scientific and technological advancement. Quite apart from the defensive which we have so far discussed, there is a positive side of the problem. In a recent interchange of letters in the American Journal 'Science', several readers took up this issue of 'morality' of vivisection experiments. One of the pertinent points raised by a reader (and we assume that 'Science' reflects opinion of people engaged in science) was about the psychology of job preferences by scientists.

As the question touches some of the delicate points of scientific profession we propose to elaborate these, the general plea being that a scientist can understand the problem in much rational manner that an emotional lay man In the field of 'nutrition' studies and drug responses, medium sized mammals like mice and 'guinea pigs' of pure bredstrains are preferred to micro-organisms. In these too, there are two lines of approach. Some workers prefer assessment of responses evoked after administration of the drug/nutritional element under defined conditions, by methods which are least injurious to the ani-

mal and therefore 'less painfull'. For instance, cardiovasular responses are electronically recorded, CNS effects like-wise observed, defence mechanisms analysed by way of very minor operations on brain stem and drawing a small quantity of cerebrospinal fluid. Other workers believe that 'threshold' responses are best evoked on 'starved' animals. A period of 3-7 days starving procedes drug administration. Assessment is like wise based on large scale injuries to the animal, which look positively 'painful'. A close scrutiny reveals that reliability and accuracy of both methods is practically of same order. Why, therefore, someworkers choose methods which inflict uncalculated injuries on animals?

No straight answer can be given to this question. But perhaps when reliability index of two sets of procedures is same it is a safer course to adopt one which involves least pain to test animals and incidentally also serves the scientists from social wrath. We do need better understanding with our maintenance—the tax payer, if civilization is to draw benefits from services of science.

Science News

"Flying" Operating Theatre

A firm in Hanover has produced a "clinicopter", an operating theatre which can be flown from one place to another.

Made of light metal and weighing only 1½ tons, it has facilities deemed sufficient for small to medium-sized cases of surgery. It can be towed by a helicopter to any spot where it is needed. The "flying" operating theatre may be used, for example, to rush help to places where accidents or catastrophes have occurred and which are not accessible by the usual traffic routes. Stabilizing fins are fitted to the "clinicopter" to ensure a uniformly steady flight and to permit the doctors inside to make all the necessary preparations for the operation.

The same firm has produced several other novel aids to rescue work. One of them is the "Clinomobil", the clinic on wheels now to be found in many countries, including India.

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Indian technician wins a prize In Germany

Mr. Chandrashi Vithani, a young Indian from Kenya, was among the prize-winners in a competition for handicraft workers and technicians held by the Central Association of German Handicraft in Mainz.

The competition had evoked keen enthusiasm among handicraftsmen and technicians, 150,000 of whom participated in it. Mr. Wild President of the Central Association of German Handicrafts, addressing the prize-winners, expressed his appreciation of the performances of the winners. He added that there was a great future for handicrafts for, he said, they would receive public support as long as man appreciated craftsmanship and the value of individual effort.

The competition is an annual feature of the activities of the Central Association of German Handicratts. The Association has made 3,900 awards, of a total value of DM 4 million, during the last eight years.

Mr. C. Vithani, the first Indian to obtain a prize from the Association, had worked as a Radio technician apprentice in Cologne.

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Supersonic flying aids

Equipment which will take the "if" out of the complex requirements of super-high speed flying, and electronic devices which serve air and ground communications, are among the stand exhibits at Britain's Farnborough Air Show, September 2—9.

A comprehensive electrical control system for supersonic engines, which can be controlled by a single pilot's lever, will be shown by Ultra Electronics Ltd., of London. It is fully automatic and does not require special action by the pilot when calling-up engine power changes.

The control unit of the electric system can be divorced from the engine—an important factor in supersonic aircraft where there are exceptionally high temperatures in the vicinity of the engine. There is automatic control

of compressor speed, thrust, acceleration and turbine temperature.

The all electric throttle control system was designed, developed and manufactured by the firm for the Proteus engine on the Bristol Britannia and it has proved its reliability over some 3,000,000 hours of flying time.

Air traffic control organisations will be interested in two equipments to be shown for the first time by another British firm. They are Marconi's transistorised plan-position indicator display types 3001 and the transistorised tabular display system types 3101.

The plan-position indicator gives on one tube information which previously required 4 or 5 units, and the tabular display system provides a complete display of flight data to air controllers.

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Oil extension of natural rubber

By extending natural rubber with a cheap commercially available rubber processing oil, the price of natural rubber compounds can be made fully competitive with synthetic S.B.R., and considerably less expensive than the various polybutadiene rubbers.

This view is expressed in an article in "Rubber Developments", the quarterly magazine issued by the Natural Rubber Bureau in London. The article says that the use of extenders in rubber compunding is as old as the rubber industry itself. The main object is to lower the cost by adding as much as possible of a cheap material while retaining adequate properties for the particular use to which the rubber is to be put. Low-cost oils, resins, tars and pitches are examples of the usual extenders.

It is claimed that, when due regard is made to compounding, the wear resistance of oil-extended natural rubber, particularly in tyres, may equal and even surpass that of non-extended rubber. Natural rubber, which costs 25d a pound, can be made near competitive with oil extended S.B.R. (grade 1710) by replacing 33 parts by weight of the natural rubber by oil selling at 3½d. a pound. This degree of oil-extension of natural rubber can be carried out on conventional mixing machinery without difficulty and offers many technical possibilities to cheapen products and improve the competitive position of natural rubber.

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Automatisation in lift system

A new control system for gearless passenger lifts, developed by a British firm, automatically and precisely matches lift service to demand and provides an instant response to any one of an infinite veriety of traffic conditions.

The system takes into account the fact that traffic varies, not only with the type of building, but also with the time of day, and that traffic "surges" can be of short or long duration, in either direction or both.

It is designed to meet all these peak requirements, as will as the occasional call. The group of lift cars under its control operate only as they are required to match the traffic demand.

The "brains" of the system is a computing device, called a differential integrator, which electronically calculates and evaluates the traffic demand, automatically divides the demand, and assigns the cars to handle the traffic in the most efficient way. It continually computes and analyses the passenger

waiting time and allocates cars to particular sectors on a time preference basis.

On completing their assignments, cars are immediately allocated to the nearest demand sector as computed by the integrator. Each car, when assigned, travels directly to the sector, ignoring any secondary calls. In delivering the passengers to their selected destinations, it again ignores secondary calls, unless they happen to be from floors that the passengers are going to.

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Joining the un-joinable

Materials which could not be bonded together by any other means have been successfully joined by a radiation welding technique developed by Professor Vitaly Goldansky of the Institute of Chemical Physics.

Professor Goldansky's method involves irradiating a layer of boron or lithium between the materials to be bonded with slow neutrons.

Temperatures of several thousand degrees can be obtained very quickly in this way.

In a trial experiment teffon—one of the most chemically inert of substances—was successfully bonded to plates of quartz, aluminium and various ceramics.

Conveyor belts, motor vehicle and aircraft tyres are often rendered worthless by separation of the cord from the rubber.

When joined by "nuclear welding," however, the strength of the cord-rubber joint increased to more than four times that shown by the best previous techniques used.

In separation tests, the rubber didn't separate from the fabric but simply ruptured.

The method, Professor Goldansky says, seems to be most promising for materials which do not become radioactive themselves after irradiation in a nuclear reactor.

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Oxygen on Venus, water on Mars Is this Evidence of Life ?

Is there life on Venus ? Or on Mars ? The discovery that the atmosphere of Venus contains a significant amount of molecular oxygen has sparked off considerable argument on this subject. So has the confirmation that there is water, in the form of ice and snow, on Mars.

The discovery of oxygen on Venus was made by Professor Vladimir Prokofiev at the Crimean Astrophysical Observatory after close analysis of two spectra—one taken at the planet's closest approach to Earth and the other when it was at its most remote position.

Careful treatment and analysis of this material confirmed the presence of oxgen. "It was even possible to detect a weak absorption of sunlight by atmospheric oxygen", says Prokofiev.

'Quite a Lot'

The quantity of molecular oxygen, vital to life, found in the upper layers of the Venusion atmosphere was one two-hundredth of the amount on Earth.

"But this is quite a lot, when the fact that only the upper atmosphere was under study is taken into account", Prokofiev points out.

"If the Earth were covered by a dense blanket of clouds like Venus, then at a cloud altitude of six miles we could detect only a quarter of the Earth's oxygen.

"If the clouds reached 12 miles up, there would only be five per cent of the total oxygen above them.

"So far we don't know how high over Venus is its cloud cover. Therefore it is difficult to assess the total amount of oxygen in the planet's atmosphere".

It can be assumed that there is less oxygen than on Earth—"but the very fact of finding oxygen, after the discovery of nitrogen and carbon dioxide gives more ground to hypotheses about the existence of living organisms on Venus."

Academician Vasily Fesenkov, a well-known Soviet astrophysicist interprets the discovery very differently.

It in no way suggests the presence of life there, he says. It is established that three-quarters of the planet's atmosphere is carbon dioxide—"a convincing proof of the absence of living organisms there."

This view is confirmed by the radio astronomers, he claims, who have measured the temperature on the planet's surface as about 300°C.

How, then, explain the oxygen ? There is water vapour in Venus's upper atmosphere, Fesenkov points out. Ultra-violet rays would decompose it into hydrogen and oxygen.

Plant Activity ?

Dr. Nikolai Kozyrev, prominent astrophysicist of the Pulkovo Observatory, supports the "life on Venus" theory, however.

"It is very probable", he writes, "that the oxygen is formed in the same way as on the Earth, as a result of the vital activity of plants.

"The high content of carbon dioxide in the upper atmosphere of Venus is most probably maintained by intense volcanic processes."

Dr. Kozyrev also claims that he has proved the presence of ice and snow on Mars.

Analysis of scores of Martian spectrograms obtained by a 50-inch reflector telescope in 1954, 1956 and 1961 at the Crimean Astrophysical Observatory shows that dispersion of light there is caused by particles which sharply increase in quantity in conditions of low temperatures.

"It is natural to suppose that these particles are snow—that is to say, tiny crystals of ice in the atmosphere", says Kozyrev.

"They disperse light most effectively in a comparatively narrow green section of the spectrum. Ice crystals on the Earth have the same property."

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Thermal radiation from sun

The global distribution of the thermal radiation from the sun and its effects upon building materials are dealt with in a new publication by the Building Research Station of Britain's Department of Scientific and Industrial Research.

The first part of the study contains data on the intensity of solar radiation and temperature levels at the earth's surface, which are summarised in map form covering large areas.

Emphasis is placed on the effects of high temperatures. They cause premature evaporation of solvents from paints, and from cement mixes, producing early weakness, poor adhesion, and cracking. Another aspect is the occurrence in materials of surface temperatures greatly in excess of the air temperature.

Important also is the rapidity of daily and short period temperature variations. These

give rise to temperature gradients within materials and surface stresses which if frequently reversed may produce fatigue failure.

Bridging gap between plastics and metals

The development of a new material to bridge the gap between plastics and metals has been announced in London by the plastics division of Imperial Chemical Industries.

A glass-filled nylon, known as "Maranyl" A 190, the material is said not to have the disadvantages of the comparatively high thermal expansion and low rigidity of other plastic materials.

The manufactures claim that "Maranyl" A190 is particularly suitable for the replacement of metal parts, and can also be used in conjunction with metals where the difference in expansion between metal and glass-filled nylon does not present a problem. Some possible applications are as housing for electrical equipment, and as handles, hinges, rollers, and replacements for metal die-castings.

Glass-filled nylon is based on Type 66 nylon, the strongest and most rigid of the nylon types available. The glass strands are fully dispersed in the nylon, thus ensuring mouldings of uniform appearance and reproducible properties.

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Volcanoes at the bottom of the Indian ocean

The ship "Vityaz", which is on a scientific research mission, has left for the shores of Australia, having already covered about 2,200 miles on this voyage.

The scientists aboard the vessel have made a number of interesting observations in the ocean. Two underwater volcanoes up to 3,000 metres high were discovered 210 miles to the south of Christmas Island. One of the peaks is at a depth of 2,500 metres below the surface of the water and has the clearly outlined hollow of a crater at its top. Several new mountains were discovered in the waters off-shore North-West Australia.

During their six-month work in the Indian Ocean the Oceanologists collected samples of bottom sediment and information on its distribution in different layers of water as well as on the temperature and salinity of water.

The group of ichtiologists, headed by N. V. Parin, collected a large variety of fishes, among which are some belonging to extremely rare species. The 30-centimetre-long chiasmodon which they caught is particularly interesting, because so far we had only a description of a fish of this species. The chiasmodon was captured alive. When it was placed into the laboratory aquarium it began to devour other fish and great difficulty in "rescuing" their catch from destruction.

Near the North-Western cape of Australia our scientists measured the currents to the depth of two thousand metres by means of an anchored buoy. About 420 miles to the North-West of Freemantle they trawled the sea at a depth of 5,200 metres. When the trawl was raised a multitude of black balls rolled on to the deck. The diameter of these strange balls was about 12 centimetres; they weighed up to one kilogram each. They turned out to be concretions, masses of ferro-manganese ore. The trawl brought in about 220 of these balls, weighing over 150 kilograms. Professor Bezrukov, head of the expedition, remarked that he had never come

across concretions so perfectly round in shape during his former expeditions, and that this was a very rare phenomenon.

The echolocaters registered a dark wide layer near the surface of the water. It is called the reflecting layer and the scientists explored it by means of a special trawl drawn at a depth of 75 metres. The trawl brought a large number of crustaceans, including shrimps, medusas, and small deep-sea luminescent fish. At night they rise to the surface of the ocean from depths of several hundred metres. Reflecting sound impulses sent by echolocaters, they form a barrier hindering measurements of depth.

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Mobaltorn for cancer treatment

Visitors from many parts of the world saw a working model of one of latest British units for the treatment of cancer at the Eighth International Cancer Congress held in Moscow (July 22—August 4).

The Machine, known as the Mobaltron, is a rotating Cobalt unit. At Moscow an electrically-operated model, one-fifth scale, was exhibited with a lay-out showing how once the basic unit is installed, many features can be added, giving great flexibility in use.

The international regulation covering dose rate from a unit is 2 milliroentgens per hour at one metre; the British standard is 6.25 milliroentgens per hour on the surface. The Mobaltorn treatment head is so well shielded that when loaded with 10,000 Curies of Cobalt 60 the dose rate on the surface does not exceed 2 milliroentgens. The design of the Collimator is such that "shine through" does not exceed 1 per cent.

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Stainlees steel for stitch gun

The increasing use of stainless steel in hospitals is spotlighted in manufacture of the semi-automatic "Stitch Gun" — the device for stitching up arteries after operations. It is "a surgical sewing-machine" which can be employed by the surgeon for applying regular and consistent minute stitches at the completion of an arterial incision. It is designed to hold the needle and transfer from one "hand" to the other, so that at no time does the surgeon require both hands to do the job. At the same time, there is good clearance between the sewing point and the hand, making it easier to see where the stitches are being made.

In the manufacture of the instrument, use is made of a number of stainless steel investment castings, produced at a precision foundry at Sheffield, in the English midlands.

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Birmingham university develops new range of chemical compounds

A new field of studies which, in the opinion of the Council for Scientific and Industrial Research could have a "profound influence on polymer, dyestuffs and biological chemistry', is a research project by Professor M. Stacey, F.R.S., at Birmingham University, on the synthesis and properties of organic fluorine compounds.

A whole new range of compounds-organic fluorine compounds which may possibly possess hitherto unobtainable properties-is being developed by Professor M. Stacey, F.R.S., Professor J. C. Tatlow and their colleagues at Birmingham University. This important research-which is being supported by a grant of £42,000 from the Department of Scientific and Industrial Research—could have an

influence on many fields, such as plastics and polymer chemistry, biological chemistry in its many aspects, and dyestuffs chemistry.

The new range of compounds are the aromatic fluorocarbons and the multitude of derivatives containing reactive groupings which can be made from them. The basic raw material for fluorine chemistry is at present FLUORSPAR (CaF_2), and there are ample reserves of fluorides available in the earth's crust.

Aliphatic Fluoro-compounds

It is now well recognised that there exists a new type of organic chemistry, based upon the carbon-fluorine system and paralleling the carbon-hydrogen system of ordinary organic chemistry. A large range of organic fluorides of the aliphatic type are now known. They are non-inflammable and resistant to attack by acids, alkalis, oxidising agents and reducing agents.

These include fluoro-chloro-methanes and ethanes which are of considerable commercial importance, being used widely as working fluids in refrigeration and as aerosol propellents. The range of uses of aliphatic fluorides is already wide and is increasing stadily. Various compounds find application as monomers for making heat-resisting plastics and rubbers which have many uses; pharmaceuticals and anaesthetics (I.C.I.'s Fluothane is outstanding here); insecticides; water and grease proofing agents; surface active agents; fire extinguishers; and for many other specialist uses.

In addition to the aliphatic fluoro-compounds, a range of new compounds is now available, derived from the second important family of carbon compounds-the aromatic series. Fluorocarbon compounds of this type have not been accessible until very recently.

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Toyes give joy to dad and son in all the world

Every now and then cartoons in German newspapers and magazines will show Dad operating the toy trains of junior, who stands by weeping bitterly, asking Mom to make father let him play for a minute. For fifty years miniature toy trains have been one of the favourite hobbies of boys from the youngest to the oldest age. Models of moon rockets, sputniks and jet aircraft and other toys have never been able to oust locomotives and trains from the rooms where young and old boys love to play. Most of the toy trains giving joy all over the earth are traded under the name of the world-famous manufacturing company in the South-German city of Geoppingen. This company has acquired world fame in the production of toy trains. Its production is exclusively directed to the fulfilment of the dreams of innumerable boys in no less than 67 countries of the world, to which its products are at present exported. Toy trains made in the Federal Republic of Germany, modelled authentically after full-scale trains are as much in demand in New Zealand, as they are in Chile, South Africa, in Sweden or in India.

When the grandfather of the present owner of the company began to make toys in a small workshop 100 years ago, which his wife sold on the local markets, he did little think that his name would once be identical for most children in the world with a dream coming true. At first business must have been very difficult for the grandfather, as the IOUs indicate that have been preserved in the fam-

ily museum. The decisive turn of fate happened, when his son had the idea of copying the newly introduced railways in Germany and marking them as toys on the various markets. In 1890 the first forty models of the first toy locomotive were made at Goeppingen. They we propelled by a clockwork system ; soon they were to be found in all parts of the world, enthusiastically demanded by children. Wonderful foreign train models were also manufactured, and soon industrial production began ; and the number of different models sold rose, as did the volume of business and the number of workers. By 1910 the Goeppingen works employed already a labour force of 600, and for the first time electric toy trains were designed then, in those days a rather expensive and by no means harmless toy.

Today a modern electric toy locomotive with three good wagons and a transformer set can be bought in packages at prices from eight dollar upward. The Goeppingen factory has further expanded : today no less than 2,500 workers are employed by it to produce the two hundred different models, small locomotives and wagons and coaches. The models are smaller, faster and more perfect than in grandfather's time. Every hour no less than 72 toy locomotives leave the assembly lines of the factory. For a full year this will be 150,000 of any one model ; no locomotive factory in the world will achieve such production figures. The Goeppingen designers in planning their models at a scale of 1 : 87 endeavour to make an authentic product, for boys are very severe critics, and their criticism, if the model of their favourite locomotive has one rivet less than the real one, is heeded seriously by the plant. Before the toys leave the company's works, they are tested seven times before they get the final O.K.. Every individual model is a small marvel of precision and engineering, be it the elegant Santa-Fe' Express, or the old steam locomotive 01 that produces genuine smoke in the sitting room, or the numerous types of different goods trucks and the modern station equipment with complete and automatic signals and switches. It is understandable that fathers can rarely ever escape the great attraction and magic of the toy trains made in Goeppingen in the Federal Republic of Germany, and, indeed, it may very well be that there are more grown-up model-railway enthusiasts than little boys playing with trains.

Articles

SCIENCE AND TECHNOLOGY IN THE WORLD OF THE FUTURE

By Prof. John Bernal

We cannot fully predict the future of science and technology but we can and must try to analyse some separate elements and trends. After all it is better to go by guesswork than to carry on blindly.

Such natural sources of heat as coal, oil, and gas are increasingly developing into chemical raw material. Still man will not experience any insufficiency of sources of energy. We have tremendous supplies of fissile materials and if mankind stops using them so irrationally and stupidly for the stockpiling of nuclear weapons these will become the fuel of the future.

We know what thermo-nuclear reactions and finally solar energy promise. Still science must strive to achieve the better utilization of power, as at present, we are being fantastically wastefull about it. As a rule we have a thermo-dynamic efficiency running from 30 to 40 percent, but while productivity per manhour has gone up that per horse-power has gone down. We should save on manpower and use energy better, instead of the other way round as now. If we use energy more rationally and economically its productivity will multiply.

We are living through a scientific and technological revolution. I think the most revolutionary discovery of today is electronics, electronic computers.

Another five years in the use of computers in industry may completely overhaul technology and production technique. Computers have analogies with higher nervous activity, and help us to under-stand how the human brain acts. Computers are more and more imperiously invading every field of science and technology. We are facing an age of automation based primarily on automatic electronic computers. The machine is being used in building, government, medicine, planning, biology and space travel, in all processes of production. Our task, however, is to rule out every possibility of using computers for military development in our dream-world of the future.

I am sure that we shall soon see revolutionary transformations, according to the Marxist principles of the development of quantity into quality. The increasingly wider use and improvement of computers will lead to machines working a million times faster than the present fast devices. We shall have a new quality which will fundamentally alter the whole of our life and our mentality. So far we have reached only the first stage of computer development. They enable us not only to do immeasurably faster what we could do before, but also to do things we could only dream about before. And they can even realise what we dare not dream about today.

In researches in chemistry, biology, crystallography and other sciences computers are essential as they generalise the results of a host of experiments. Science, after all, is the digestion of information from its various branches. But I would like to emphasize that computers are only an auxiliary in research, that they do not create. It may be that in several years from now the machine will immediately memorise science's accumulated stock of knowledge to thus extend the scope of research, especially in such fields as biology which so far resisted the introduction of mathematics. Electronics is already closely linked with physics, is being decisively introduced in biology and it may develop into a major factor in the humanities.

Computers not only help us solve problems; they also pose new problems.

Sometimes these devices are called the electronic brain. They are indeed able to programme many human activities and comprehend the logics of brain processes and even introduce corrections. The human brain, however, is the result of intricate lenghty evolution. But the electronic device regenerates so quickly that this contains the danger of an obsolescence that is as rapid. In other words, the rates of scientific and technological advancement are so great that a computer may grow obsolete even before designed. This can be overcome by continual redesigning and constant computer improvement.

The computer, of course, will never supplant the brain. It can only be its ancillary, helping to extend the scope of the brain's possibilities in quantity and quality. With no clever operator the computer is stupid, and does not even know when it is stupid. A stupid programme will extract nonsence from the machine. An amusing instance : the US constructed a super-computer to predict when a war would break out. All the necessary information was programmed. The answer the General got from the machine was : "Yes". "What do you mean by 'yes' ?" the General inquired. The machine went through the entire set up again. Its second answer was : "Aye, aye, Sir".

I wish to re-emphasise my point that I think the discovery of computers the greatest in man's history,

It was language that distinguished man from animal. Only letter and sound were able to give shape to human thought. Today computers and their ciphers can give entirely new shape to human thought and even go further in development than language.

Nevertheless, scientific and technological development cannot be viewed in detachment from the external factors of man's life. How can we gauge human needs, that is needs and hunger on a world scale ? We must understand both mankind's essential difficulties and possibilities. Because to evolve a correct solution the problem must be properly formulated.

The basic problems with which man is concerned are the elimination of the nuclear war danger and the abolition of want, disease and ignorance.

The first can be solved through disarmament, the second by employing modern technology to increase the food output, erect housing, etc. If even a small fraction of the present military expenditures was spent on health and medical research we could count on great health improvements, even the full solution the problem of cancer prevention and cure and of sttopping the processes of general againg.

We are confronted with the major problem of remedying the backwardness of the underdeveloped countries. This disparity must be superseded and the underdeveloped countries must be brought up to the level of the developed ones. However, the reverse is taking place; far from decreasing, the economic gap is increasing, and there is an imperative ripe need to plan the development both of science and technology and of economy and education in these countries. They must advance in order to contribute to human progress, and for that, they need an intellectual potential. It is not only new deposits of uranium or coal that are important today. Education for people who must know how to properly use the natural wealth is also important. Real wealth is comprised of knowledge, not of material values. The human brain is the prime natural wealth. And if the populations of the underdeveloped countries are educated and enabled to develop their talents this wealth of mankind will be immeasurably multiplied thereby.

Higher education should not be an elite education. We must strive for a mass education. The Soviet Union shows how viable this system is.

A special aspect of the edcation of the future—evidently the near future—is that it must incorporate and reflect the changing environment. Today a schooling is no longer enough; a person must study all his life if he desires to keep abreast of the rapid scientific and technological development of our time.

As technology, especially automation, develops, less and less people will be occupied in production. Consequently, more and more people will devote themselves to scientific research as work preparing for the future and requiring mental effort. In other words, more and more people will devote their time to creative work. Man will be master of the machine, no longer part of it.

The man of the future will have more time for leisure, for education. I think education should incorporate both the training of a person to do the tasks life sets before him and also to use his leisure properly and develop his intellect.

Society will change more and more quickly. Scientific advancement will give people a richer and fuller life.

But we cannot and have no right to forget the war threat, that all these achievements may be distroyed and that the people of the future may inherit nothing but ruins, hunger and degeneration. We must, therefore, dedicate every effort to prevent war. Only peace gives man the change to reveal his abilities and attain prosperity and happiness for all.

THE HISTORY AND PRESENT STATUS OF TISSUE CULTURE*

By P. Maheshwari

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In 1665 Robert Hooke, a resident of London made the first observations on the cellular organization of plants. He was a man of eccentric habits and appearance and indulged in many kinds of scientific experiments. On examining charcoal, cork, and other plant tissues with his microscope he found in them small honey-comb-like cavities which he called cells. In this he no doubt made a remarkable discovery but, as we now know, he had seen only the lifeless boundaries and the importance of the protoplasm inside the walls was appreciated only much later by other people. Another Englishman Robert Brown, announced in 1831 that cells contain nuclei, and that normally there is a single nucleus in each cell. This was soon confirmed by many other botanists. In 1838 M. J. Schleiden and Th. Schwann, the former a botanist and the latter a zoologist, discussed their observations and concepts on the constitution of living organisms at a dinner table, and came to the conclusion that all plants and animals are constructed of cells, i.e., the cell is the primary agent of organization and each cell leads a double life, one pertaining to its own self, and another a social one in respect to other cells of the organism. Schwann said: "That not every cell, when separated from the organism, does, in fact, grow is no more an argument against the theory (of physiological independence) than the fact that a bee dies when separated from its swarm is a valid argument against the individual life of the bee.

This was an important statement, but it was severely critized in subsequent years by Sachs, De Bary and others who emphasized that owing to the high degree of physiological differentiation among the various tissues and organs the cell could not be regarded as an independent unit but only as an integral part of a higher individual organization. Thus many biologists began to maintain the organism itself as the primary agent of organization rather than the cell. This would imply that a multicellular organism does not originate as an aggregation of many cells, but by the growth, differentiation and septation of a single entity.

The only way to test the issue would be to take the organs, tissues and cells of a plant or animal and see how they would behave as isolated units. There are perhaps facets of the cell which are integral and peculiar to it and therefore cannot be modified. On the contrary, there may be others which are imposed on it by its surroundings and therefore liable to modifications. Haberlandt (1902) developed this idea in his mind, and tried to grow single cells of the mesophyll tissue of leaves, but his attempts failed partly due to his poor choice of material and partly due to the inadequate knowledge of those days about the nutritive requirements of plants. He left off with the remark: "At any rate, the method of cultivating isolated plant cells in nutrient solution should make

* Lecture given on December 22, 1961, on the day of inauguration of the Symposium of "Plant Tissue and Organ Culture", held at the Department of Botany under the joint auspices of the UNESCO and the University of Delhi.

possible the experimental study of many important problems from a new point of view."

Root Cultures

Although Haberlandt did not have any success himself, he encouraged his pupil Kotte (1922) who succeeded in culturing isolated roots in an artificial medium. Simultaneously Robbins (1922) achieved something similar in the U.S.A. They germinated seeds under aseptic conditions and transferred the excised root tips to a nutrient medium. In this the roots showed abundant growth. After a time the tips were excised from these roots and transferred to fresh flasks where they again continued their growth although at a diminished rate. However, with each successive transfer there was a progressively diminishing rate of growth indicating that the culture media used at that time did not contain all the factors essential to continued root growth. White (1934) was able to remedy this by adding to the medium certain other substance besides sucrose and mineral salts. While the exact requirement differs from species to species, in general three substances are involved; thiamine, pyridoxine and niacin. It was already known that roots obtain their mineral salts from the soil and sugar is translocated from the leaves. Henceforth it became clear that thiamine, pyridoxine and niacin are also needed by roots, although supplied to them by the shoot an excellent example of the interedependence of roots and shoots. In a complete culture medium containing salts, sugar and vitamins the roots can grow indefinitly without the shoot. Sometimes, as in *Convolvulus*, the roots may produce buds from which shoots may arise in due course. More thorough studies have been carried out recently on root cultures.

Stem Cultures

Like root tips, shoot tips can also be grown in culture. They require only sugar and the usual minerals, and can manufacture the vitamins for themselves. In light they generally become photosynthetic, and then do not even require the sugar. After some time they form root primordia, and can eventually be transplanted to soil to form new plants. Sometimes even a very small piece (0.25-0.5 mm) will grow and form a whole plant. In ferns whole plants have been obtained from apical pieces no longer than 0.25 mm and only one cell broad. The shoot apices of Cuscuta do not form any roots but this is also true of them under natural conditions. Nevertheless, they grow so well in test-tubes that they can even be made to flower by proper photoperiodic treatments. Gautheret, in France, has made cultures of the cambial tissue of many plants and the same can be done with phloem and even pith cells.

Leaf Culture

The first experiments in leaf culture were made with the immature leaves of pea seedlings. When placed in a nutrient solution containing sucrose and inorganic salts, they enlarged only slightly but on the addition of adenine they attained a size nearly matching that of the nature leaves. The new chemical kinetin, plays a similar role by favouring the accumulation of nitrogenous substance and retarding the loss of proteins. Kinetin is now known to have a distinct effect on the metabolism of nucleic acids, ultimately facilitating the synthesis of proteins from amino acids.

Reproductive Organs

In this laboratory we have paid more attention to anthers, ovaries, ovules, and

embryos, and it is clear that if excised at certain stages of development they can be successfully cultured and reared to maturity.

The chief point that emerges from all this is that many organs of plants can be excised and grown to maturity under purely artificial conditions. This enables a better understanding of their nutritive requirements. For example, if the time taken in the maturation of seeds could be hastened, this would be a distinct advantage. If ovules could be cultured before fertilization, this would be a big feather in the cap of the person who does it.

Requirements

In reviewing these developments we have done a rather quick job. In practice, however, it is extremely slow and requires infinite patience and skill—specially in the tropics where the danger of infection is ever present. The nutrient media good for tissue cultures are also excellent for the fungi and bacteria which are omnipresent, and even the most skilful and cautious worker cannot always avoid these tiny foes. Antibiotics like penincillin and streptomycin can no doubt be added but these may easily have secondary effects and are therefor avoided by critical students. The best course is to have strictly aseptic conditions. There have to be special rooms for the washing of glassware and preparation of media. Transfer rooms have to be fitted with ultraviolet lamps to kill germs, and air-conditioned rooms are needed to prevent changes of temperature and humidity. For critical work there have to be light controls and other things. With the power shortage, constant fluctuations of voltage, lack of repair facilities, breakdown of electricity, and want of foreign exchange to buy essential apparatus, the task becomes fairly formidable.

Techniques have now advanced to the extent that not only organ and tissue cultures, but cell cultures can also be made. Even human cells can be cultured, and a great deal of work has been done in Professor Steward's laboratory* in making plant cell cultures. In fact he has been able to obtain whole plants from cell aggregates of the phloem of the roots of carrots. It is interesting to note that coconut milk, long known to be good for the health of human beings is equally satisfactory for stimulating the growth of plant tissue cultures.

Applications of tissue culture

There are many ways in which tissue culture methods have found application in biology. One of these is in the culture of viruses. While many kinds of microbes have now been conquered through the use of antibiotics, the viruses still remain a challenge to human ingenuity. These are "organisms" which can be preserved as crystals in a vial, and yet have a remarkable capacity for rapid multiplication in the presence of a living host. A tissue grown aseptically in an artificial medium can also serve as host for the multiplication of viruses. Of late several viruses are being cultured in this way. The tobacco mosaic virus has been grown on root cultures of tobacco. The polio virus has been successfully grown on animal skin in a test-tube and even a vaccine prepared from it during recent years.

Tissue culture can also be used for a study of the biosynthesis of many metabolites. Carboys of even five gallon capacity are being used for this purpose.

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Human cells are best grown in a broth containing a "feeder" layer prepared by exposing normal cells to small doses of X-rays which destroy their ability to multiply but do not kill them. This has opened a way to the study of several problems. For example, we are all greatly concerned with the effect of radiation on man, animals and plants. With cells and tissues grown in culture it is easy to study the effect of various environmental factors inculding radiations upon them. This is likely to yield valuable clues to their effects upon the whole organism.

What happens when the body ages is another problem that can be tackled by making cultures of the cells and studying their behaviour as compared with that of cells from an organism which is still in its prime. It is now known that of nature cells which have seemingly lost their capacity for division can be rejuvenated and made to divide again by the use of certain chemicals, the so-called kinins.

Ordinarily the condition known as disease implies a weakness, degeneration or breakdown of some part of the body. In cancer it is the opposite. Here an occasional cell in the body becomes an anarchist. After having functioned for months or years in harmony with its neighbouring cells it suddenly behaves in a lusty, erratic and undisciplined manner to give rise to a mass of tissue, a so-called tumour. The proliferation may be slow and limited, like the warts on the skin or the galls on leaves caused by insect attack. But sometimes the tumefacient elements invade other organs of the body and cause terrible consequences. The usual method of screening chemicals with a view to destroying cancerous outgrowth is to test them in tumorous rats and mice. With our present techniques the misbehaving cells can be grown in culture and their responses studied to various changes of their physical and chemical environment. This may lead to the discovery of some safe agents which may kill these cells without harming the healthy cells of the body. Cancerous growths, it may be noted, occur in plants too and the American Cancer Society is making large grants to both botanists and zoologists for a study of this problem.

Many years ago H.V. Wilson of the University of North Carolina observed that when a marine sponge is cut up into minute fragments, each fragment grows and develops into a complete individual. This induced him to press live sponges through a fine cloth into sea water. This gave a dense suspension of cells, but surprisingly enough the cells soon condensed into clusters and then into tissues which finally developed into complete sponges. No one has been able to do so with vertebrates, but this capacity of dissociated cells to synthesize into a tissue offers many possibilities to the medical practitioner.

The tissue culture techniques has been used to settle the controversy about the number of chromosomes in human beings. Studies on cultured cells made in 1956 showed that normal human cells contain 46, and not 48 chromosomes. Not only this: it has also been possible to study each chromosome and delineate its structure.

There are many fungi which can be grown in artificial media, and detailed studies can consequently be made of them at all stages of development under controlled conditions. The mildews and rusts are, however obligate parasites which grow only on the living host and are therefore less amenable to such investigations. The culture of tissues and organs in artificial media has provided a new tool in the hands of mycologists and plant

pathologists. Norel (1948) cultured the downy mildew and oidium of vine, and Mozzolillo and Craigie (1960) have cultured pieces of cotyledon, hypocotyl and stem of sunflower seedlings infected with *Puccinia helianthi* on artificial media.

One of the central problems in biology is that of morphogenesis. Why do some cells behave in one way and others in a different way? If the fertilized egg itself, or the very young embryo, becomes segmented into two or more sections, each may develop into a separate organism, resulting in twins or super-twins. At a latter stage, however, this becomes difficult. Like the teachers in a large science department, they specialize in one direction or another, and resist any attempt to revert them to their original unspecialized but more versatile state. That this can happen sometimes is, however, well known. For example, the cut surface of a potato tuber soon shows the formation of a new skin, the periderm. In this, cells which had ceased to divide resume mitotic activity. Much work has been done during recent years on the stimuli which promote or inhibit cell division, but we still know very little about what causes a cell to differentiate in a particular fashion.

Finally, what are called "test-tube babies" are by no means really so. While it is possible to preserve sperm in a test-tube, no one has yet been able to effect the fertilization of the mammalian ovum in a petri dish, and obtain a live mature embryo from it. Ova and young embryos can be removed from a female guinea-pig or rabbit, and kept in a culture medium for some time, but they have eventually to be transferred to the womb of a foster mother for their full development. The eggs of the flowering plants, being attached to the wall of the embryo sac, are even more difficult to handle than those of a mammal. Nature has created many cunning safeguards in the form of the many coverings of the nucellus, integuments, and ovary wall, and human ingenuity has not yet succeeded in removing them in an undamaged condition.

And now I am at the end of my brief talk. To understand a living organism we must employ the dual process of analysis and synthesis. The subject of cell, tissue and organ culture is therefore a fascinating one. The reason why it has not made much headway in India, excepting at two or there laboratories, is partly the lack of facilities and even more the dearth of trained personnel. This has to be corrected in the not too distant future.

There is one point which I wish to mention before I close. Often the statement is made that research in biological sciences has not made the same progress as that in physical sciences. This is not quite correct. With only meagre facilities in both man and equipment, biologists have done much that stands to their credit, such as the discovery of microorganisms leading to safe surgery, knowledge of vitamins, hormones, viruses, artificial insemination, vaccines, antibiotics, genetical methods of plant and animal improvement, and the destruction of many pests and parasites. Further, even a single cell of a living organism is infinitely more complicated than an automobile or aeroplane. Biology needs encouragement, not merely in terms of money but also with a view to attracting superior brains. Most of the world's talent at present is being drifted into the making of ever larger bombs, while the life giving sciences are accorded a secondary place.

If the human race is to survive, more attention must be paid to biology!

IS EFFICIENCY OF A CLASS RELATED TO ITS SIZE

By Peter Ebstorfer

Occasional complaints about the declining level of education and knowledge of young people joining their vocational lives after having left school, were the reason, why in recent years in all parts of Germany reform plans of the educational system have been discussed : apart from the demand for a lengthening of schooling from eight to nine and even ten years of elementary school education, there has again been the clamour for more modern and individual teaching methods particularly in the upper classes of primary schools, or in other words the desire to reduce the number of children in each class as far as possible, in order to raise the standard of learning.

Ever since the Currency Reform of 1949, that major event which triggered off the rehabilitation of the economy in the Federal Republic of Germany, approximately 1,500 million dollars have been expended in Western Germany for the erection of new schools. In spite of this tremendous sum, another 30,000 additional school-rooms will be needed, and as many as 15,000 teachers for the reduction of the number of pupils to the desired small classes. Yet the educational system, as in all countries, suffers from the lack of funds, and realisation of this wish-dream of the educational authorities in all countries to have as few pupils in a class as possible, is one that has not been fully accomplished.

However, psychological and educational experts have recently been studying the question whether the efficiency of individual pupils does, indeed, depend on the size of classes. The head of the statistical department of the International Pedagogical Research Institute in Frankfurt, Dr. Fritz Suellwold, for example, holds that a small class is no guarantee for greater efficiency in learning and better results. Recently tests were carried out as regards efficiency in arithmetics, amongst 4,000 young boys and girls in the upper classes of elementary schools in all of Germany.

The test method developed by Dr. Suellwold provided for a number of simple and more difficult problems to be solved by fourteen and fifteen-year-old boys and girls. Small and large groups, divided by boys and girls, were asked to solve 50 problems in 60 minutes. The result was that the smallest classes with less than 20 pupils and the largest with more than 40 children solved the same number of problems correctly, namely around 34.9 per cent. Amongst the girls the result was most striking : here it appeared that there was no difference at all in efficiency and knowledge, between large and small classes. For these reasons, the number of children appears to have no bearing on the efficiency and the success of class work.

This, however, does not mean that in future the endeavours to reduce the number of pupils in classes will slacken. For a small number of pupils gives a much better opportunity to the teacher to promote the development of the individual pupils. This however, was something not considered in the test ; Dr. Suellwold's enquiry was only to show that many of the demands which the public sometimes raises are not based on facts and figures. In spite of the results, parents, authorities, teachers and everyone concerned with education will countinue to do their utmost to improve the educational system of the Federal Republic of Germany.

INTERNATIONAL CO-OPERATION IN SCIENCE NECESSARY

Cockcroft's Speech At British Association Meeting

Only by international co-operation could the smaller countries take part in expensive scientific programmes, Sir John Cockcroft, the eminent British nuclear physicist, said in his presidential address to the annual meeting of the British Association for the Advancement of Science in Manchester on August 29.

Sir John, now Master of Churchill College, Cambridge, and formerly director of Britain's Atomic Energy Research Establishment at Harwell, spoke on the subject of "Investment in Science".

He gave as an example of international co-operation in science the foundation of CERN, the European Council for Nuclear Research, to which Britain contributed a quarter of the capital and operating cost for two large nuclear accelerators. The capital cost was £ 15,000, and the operating cost between £ 7,000,000 and £ 8,000,000 a year.

Sir John said: "CERN has turned out to be extraordinarily successful, both technically and has restored to Western Europe the possibility of working in the forefront of high-energy nuclear physics. Physicists from Britain, France, Germany, Italy and other European countries now build in their own laboratories extremely expensive and complicated equipment such as liquid-hydrogen filled bubble chambers, and move them to CERN where they are used by international teams. This collaboration has been made possible by adequate Government grants for travel and assistance for university scientists.

"We may, within two or three years, be faced with the problem as to whether to build a still more powerful nuclear accelerator, at much greater cost, to penetrate still deeper into the nuclear underworld. If there turn out to be strong scientific reasons for this, it may need, for economic reasons, to be built as a combined United States-European project, or even a world project."

Space Research

Space research was another expensive field of science, and already collaboration between Britain and the United States had enabled Britain to launch the first British satellite, using an American Thor rocket as a launcher. Within this satellite, quite a number of experiments were proceeding well at the present time.

They were likely soon to see the coming into being of the European Space Research Organization, which might well have a budget three times as large as that of CERN.

Sir John outlined the great achievements in scientific research in the past couple of decades—the foundamental physics of particles with the help of enormous accelerating machines; radio-astronomy pioneered on a large scale in Britain; solid-state physics leading to the transistor industry as well as fundamental knowledge of the properties of metals; the use of very low temperatures for immense magnetic fields needing no power; and amplification devices that produce the most powerful beams of light ever known.

In the life sciences, too, there had been great discoveries on the fundamentals of inheritance, leading even to the first step in the artificial production of genes, the units by which inherited qualities are conveyed.

New fibres, antibiotics, insecticides, fuel cells, computer, and oceanography came into Sir John's broad survey.

Record Attendance

This is the 124th annual meeting of the British Association for the Advancement of Science. It was last held in Manchester in 1915.

A record number of between 5,000 and 6,000 scientists are attending the meeting, which lasts a week and will present lectures by about 300 scientists from Britain and other countries. Thirty thousand Manchester schoolchildren have been invited to listen to various lectures, and students from France, Belgium, Denmark and Norway will also be present.

The meeting is being attended by representatives from India, Pakistan, Ceylon and Australia, and also by representatives of associations in the United States and some European countries.

TIT-BITS

Train Without A Driver

More than a million passengers have made journeys on the Moscow underground railway in trains that were driven by an electronic computer installed in the leading carriage In the near future all the trains of the Moscow underground will travel with empty drivers seats.

The trains travel at 44 mph along the Moscow circle line, stopping at each station and never a second behind schedule.

Wipe Out Mosquitoes

Siberians are less bothered by the cold in the winter than they are by the swarms for mosquitoes and midges which make life quite unbearable in the summer. Now they are to have a giant fly-swatter which will clear those irritating pests from upto 25,000 acres at a time.

For some time research workers at the Siberian branch of the Academy of Science have been trying to find a really effective counter to these insects, which are not only irritating but which are a barrier to the more rapid development of the area.

Sergei Novikov of the Institute of Chemical Kinetics and Combustion has offered a promissing method.

The insecticide is fed into gas stream issued from a big turbo-jet engine, mounted on a cross-country vehicle to form a huge aerosol cloud which will persist for atleast an hour.

This aerosol cloud is fatal to any mosquito or midge within three minutes. In a wind speed of 16 feet a second the cloud will travel a distance of over six miles in an hour and clear an area of 25,000 acres.

Siberians are hoping that the device will allow them to say good-bye for ever to the nets and insect repellent lotions which they have been using in attempt to get some measure of protection in the past.

DRINKING WATER FROM THE OCEAN

By Eckart Kuhlwein

"After the Second World War we have been endeavouring to assure a central water supply in all rural areas. As late as in 1950 one half of the population in Schleswig-Holstein, the northernmost of the states of the Federal Republic of Germany, was getting its water supply from their own wells or open ditches, ponds, lakes, and rain water cisterns. Today, however, only a shortage of drinkable water causes us any anxiety while the supply situation is otherwise in order". Mr. Suhr, the head of the State Office for Water Economy in the state of Schleswing-Holstein, for many years has been looking for practicable solutions of the shortage of water supply on the Halligen islands, the group of tiny islands off the West-coast of Schleswig-Holstein.

The Halligen islands geologically speaking are marsh land, and already in upper ground-water layers, salt water has become intermingled, which makes the water drawn from wells on the Halligen islands unsuitable for human or animal consumption. Genuine ground will generally be protected against the influx of salt water by impermeable layers of soil. The ground water of the marsh land, which is nearly on the same level with the ocean's surface, however, is continuously mixed with salt water penetrating at considerable expense, can be connected up to the sweet water resources of the higher dry land.

"On the Halligen islands, however, water supply is very short. The wells only give off a dark iron-containing brackish water; the rain water dripping off the roofs will be collected in the cisterns; however, it is insufficient by quantity, and not hygienic enough. Often it so happens that there is no rain for lengthy periods of time, then the valuable water must be carried to the islands in ships. Pellworm, one of the largest of the Halligen islands, in the near future will be connected with the continent by a water-supply line, which will cost no less than four million Deutsche marks. The pipeline will be of a plastic material which has proved to be suitable in many tests and experiments made in recent years. In spite of this system we are still looking for the winning of drinking water out of the salty ocean water, particularly for the Halligen islands", says Mr. Suhr.

Methods have been developed in many countries, some even a long time ago : in the Sahara, and in the Salt deserts of the United States of America de-salting equipment works with great technical success. The electro-dialysis method works electrolytically as an ion exchanger, whereby the salt dissolved in the ocean is separated from the liquid. The freezing method is another process of obtaining drinking water, it is frozen out of the salty ocean. The technical problems have been solved long ago, however, the costs of the necessary equipment are very high, indeed. The same also applies to current operating costs. "We cannot pay a subsidy for every liter of water that will be consumed on the Halligen islands. What we must do now, is to develop a long-term economic method for the de-salting of ocean water".

(*Continued on Page* 39)

THE GREATER UNIVERSE

By V. Ambartsumyan,

Member, U.S.S.R. Academy of Sciences.

The very fact that the bulk of matter in the Universe is concentrated in the stars, incandescent gigantic balls, comparable with the Sun in size, is very intriguing. The stars are huge nuclear reactors generating radiant energy. Some of them pour out the tens and hundreds of thousands of times as much energy as the Sun.

How is this energy converted into ra iations? This is one of the questions astrophysicists are at pains to answer.

Cosmic rays are impinging upon the Earth from the remote regions of world space. Sometimes they carry particles the energy of which runs into tens of Bev's. To take in this order of magnitude, it may be recalled that the energy of the particles accelerated by the big proton synchrotron at Dubna is smaller by a factor of several billions. Neither our solar system nor our Galaxy which consists of more than 100,000 million stars similar to the Sun has conditions to create particles of such high energies. Probably they reach us from other galaxies. But how do they acquire this energy—gradually or at birth? The search for an answer takes us deep into the Universe.

Origin of Radio-waves

Each galaxy embraces several billion stars and, therefore, sends out heavy fluxes of light energy in every direction. At the same time most galaxies are rather weak sources of radio emission, though some of them, it appears, emit radio waves comparable in strength with their light radiation. These are what is known as radio galaxies. They are few. This led astronomers a decade or so ago to the idea that radio galaxies were born out of a collision of two ordinary galaxies. We at the Byurakan Observatory, however, were of the opinion that a radio galaxy was a relatively short stage in the internal development of many super giant galaxies. This is why we can only observe scattered radio galaxies among the many thousands of ordinary stellar systems.

Soviet astrophysicists have traced out the origin of the radio waves reaching us from the depths of outer space, especially from radio galaxies. As has been found, these waves are emitted by electrons of very high energies, moving in magnetic fields Incidentally, a smiliar phenomenon can be observed in existing electron accelerators.

Where then do these electrons come from?

One of the radio galaxies known as virginis A (after the constellation Virgo in which it is observed) is outwardly similar to ordinary star clusters which do not emit any radio waves. However, a closer study has shown that emerging from its centre is a streak containing several blobs of cosmic matter.

Observations have shown that these blobs are sources of strong radio emission. Astronomers take it as almost proved that the central streak as well as the blobs have been squeezed out of the small central nucleus of the same galaxy.

Unfortunately, the nucleus of our Galaxy is shut from us by obscuring clouds. But radio waves pass through these clouds. It

has been found that intensive radio emission reaches us not only from the nucleus. The space around it swarms with high-energy electrons and is a source of radio waves, too.

Nuclei : Origin of Glactic Component

It should be noted that all huge regular galaxies have in their centres small nuclei in which the density of stellar population is several hundred thousand times greater than the density of star distribution in the vicinity of the Sun.

Putting it another way, the nuclei of galaxies can be, directly or indirectly, sources of high-energy particles. Two alternatives are possible here : either high-energy particles are squirted out directly from the nuclei of the galaxies, or the nuclei eject blobs of matter which can later serve as sources of high-energy particles. This, in turn, may be an indication that some unkown processes take place in the nuclei of the galaxies, producing particles of colossal energies.

The famous Great Nebula of Andromeda is the nearest galaxy in which it is possible to discern the central nucleus with certainty. it looks so small (for the Andromeda Nebula is more than 1.5 million light-years distant from us) that the details of its structure cannot be resolved even by telescopes of the highest magnification power.

Nevertheless spectroscopic studies of the area around the nucleus of the Andromeda Nebula, carried out by Munch of Mexico, have shown that incandescent gases are continually flowing out of its nucleus. The efflux is of the order of the Sun's mass per year - a very large quantity. A similar phenomenon has been observed in the nucleus of our Galaxy. To sum up, either incandescent gases may continually and for a long time issue from the nuclei of galaxies ; or powerful gaseous explosions of matter may take place inside the nuclei, giving rise to streams of high-energy electrons.

Observations seem to corroborate more and more the idea that the nuclei are centres where new galactic components are born.

It is equally clear that the conditions necessary for the processes we link up with galactic nuclei to take place should be entirely different from those which prevail in the outer space around us. This is why studies of the nature of the galactic nuclei is the most intriguing aspect in contemporary astrophysics.

Problems of Greater Universe

Problems of the Greater Universe are most closely related to those of the theory of elementary particles. How do particles of super-high energies behave when they move through rarefied interstellar matter and magnetic fields in outer space ? Are there any anti-particles in cosmic rays and in what amounts ? What elementary particles are the principal carriers of the huge energy which is concentrated in radio galaxies and gradually emitted in the form of radio waves ?

All these are problems in which the links between the two fields are salf-evident. But there are other problems where these links are hidden. For example, observations have shown that the upper limit to the mass of individual stars is approximately a hundred times the Sun's mass ; stars with a greater mass have not been registered. The very existance of this limit can only be explained on the basis of known properties of matter which, in the final analysis, are governed by the properties of elementary particles.

Scientists have already done some headway in this direction. By way of example, they have arrived at a paradoxial but very interesting result—the limiting mass depends on the numerical value the mass of the proton which is the basic elementary particle. Had the mass of the proton been smaller, the upper limit would have been higher.

Upperlimit of Galaxies

As follows from the research, the upper limit to the mass of galaxies is of the order of 1,000,000 million times the Sun's mass. It is not at all unlikely that this limit, too, will be traced back to the properties of elementary particles which play the principal role during the formative stage of galaxies. Therefore, it is natural for many astrophysicists to hope that future advances in the physics of elementary particles will throw light on the origin of galaxies and stars. Conversely, many properties of elementary particles can be revealed through studies of cosmic rays reaching us from deep space. For this reason interdependence between these two divisions of science will grow still closer.

In our search of the Universe we are discovering ever new galaxies in every direction. Some fifteen years ago we could only watch galaxies at a distance of three billion light-years from us. Today our optical instrument reach galaxies twice as farther from the Earth. Radio astronomists are able to reach still farther. Although we cannot determine the distance to many radio galaxies accurately, it is certain that light from some of them travels ten billion years or more before it arrives at our planet.

The increase in the magnification of telescopes has proved insufficient for us to penetrate as far as the limits of the Greater Universe, or Metagalaxy, as it is called by astronomers. It should be noted, however, that the term 'limits' in this context seems dubious.

'Red Shift' In Galaxies

In their studies of distant galaxies astronomers have run into an unusual phenomenon. The farther a galaxy, the more its spectral lines are shifted towards the red end of the spectrum. This 'red shift' is due to the Doppler effect. If an object moves away from the observer, its spectral lines shift towards the red end ; if it moves towards the observer, its spectral lines shift to the violet end. This effect increases with the speed of motion.

The speed at which the galaxies are receding has turned out to be proportional to their distance. Galaxies three billion light-years distant are receding at 70,000 kilometres per second. According to a recent measurement, one of the radio galaxies some six billion light-years distant is receding at approximately 140,000 kilometres per second, or at half the velocity of light. What one can infer is that the Metagalaxy is expanding.

Idealistic philosophers see in this phenomenon proof that the Universe started expanding from a single point, which is, in their opinion, evidence that the Universe has been created.

Problem of Expansion

In point of fact, there is nothing supernatural in the expansion of the galaxies. Scientists witness in the Universe various system of celestial bodies differing from one another in the nature of motion taking place inside them. Some of them are stable, others are not. An example of a stable system is provided by the system of planets rotating about the Sun. The Earth has completed many

billion orbits around its luminary and will in all probability, remain a member of the solar system, as will the other planets, for a long time to come. As stable are double stars, i.e. systems consisting of two suns.

However, what we call star clusters consisting of hundreds and even thousands of stars are appreciably less stable. According to some scientists, each of these stars can only complete a small number of circuits about the centre of gravity of a given cluster before it disintegrates.

Atlas of Double and Multiple Galaxies

In larger celestial systems instability is still more pronounced. B. Vorontsov-Velyaminov of the USSR has compiled an excellent atlas of double and multiple galaxies which forcefully demonstrates the instability of such large stellar systems.

Of special interest are the data relating to some associations of galaxies existing in the Metagalaxy. As has been found, many of them are disintegrating. This is borne out by the fact that some constituent galaxies in these associations travel at a very great velocity relative to one another.

In the opinion of many astronomers, this is an indication that when a given association was formed the constituent galaxis were imparted extremely high velocities and Newton's force of attraction has proved insufficient to hold them together from the outset. Similarly, the Metagalaxy is expanding because some of its members received very high velocities. In a word, science has gleaned enough information to prove that there is nothing supernatural in the fact that the Metagalaxy is expanding. Indeed, Einstein's general theory of attraction makes it possible for us to explain theoretically that very largy systems of cosmic masses, comparable with the Metagalaxy, should be unstable by virtue of the very law of attraction formulated by Einstein.

In recent years Soviet astrophysical observatories, have been equipped with new powerful telescopes which can penetrate deep into the Unknown. Among them special mention should be made of the 2.6-metre telescope at the Crimean Observatory and the 1-metre wide-angle telescope at the Byurakan Astrophysical Observatory. The initial series of observations made with these unique instruments have proved that further accumulation of new data can reveal unknown phenomena and explain the known ones. We Soviet astrophysicists are convinced that the near future will bring with it further advances in the study of deep space.

MECHANISM OF VIRUS INFECTION

By M. Yanovskaya

Virus particles which have been proved to be "dead" and incapable of reproduction in a living cell will again take part in reproduction if living virus of the same type are introduced into the cell.

The discovery-made in the medical science last year—may prove a major step along the road to abolition of virus-borne infections, which include colds, influenza, smallpox and many other common diseases.

Accidental Discovery

Like many discoveries in science the first clue was provided by an accident.

Tissue culture in which a virus was being grown was overheated. When a laboratory worker, injected the virus into various cells it would not reproduce—it was to all appearances dead.

Living virus was injected into the same cells, "labelled" to distinguish it from its predecessor. It was amazing to find that the dead virus was now co-operating with the living virus in reproduction. No matter how often the experiment was repeated the result was the same.

Stimulated

By some process not yet understood, the dead virus is stimulated by the living virus to produce raw material which the latter then uses to multiply itself—there is a re-combination of the living and the "dead."

Work is now proceeding to establish the mechanism of this quite unexpected process, which may provide the key to other aspects of virus development and so to more active control over virus infections.

For 18 years, Professor Zhdanov has been attacking the problems of virus infection of living cells and now ranks among the world's leading workers in the field.

He has done a great deal to establish how virus particles enter the cell.

It was known that a virus particle is a nucleic acid surrounded by a protein sheath. It was discovered, however, that before penetrating the nucleus of a cell, the virus particle frees itself of its sheath.

In the nucleus, where it reproduces, the virus particle consists of "naked" nucleic acid.

While studying the influenza-like Senday virus, it was discovered that in susceptible cells, Senday virus 'casts off' its protein sheath and disappears from the field of vision for four hours.

Where are they ?

It was known that during this time the virus particles multiply and then leave the cell. It was known also that the protein sheaths protect the virus particles and help them to "wiggle into" the cell. But where were they for four hours ?

Radioactive phosphorous, sulphur and carbon were introduced; sulphur and carbon "settled down" in the protein sheath, while the phosphorous settled in the nucleic acid of the virus.

The scientists could now see that the proteins were left outside the cell and only the nucleic acid penetrated into its nucleus.

The virus is not in need of its sheath inside its wet-nurse-the cell ; it is safe there.

and the sheath would only hinder the reproductive action of the nucleic acid.

The picture is quite different when the virus is outside the cell, where the protein protects it from harmful effects, especially if the virus changes its host and is obliged, sometimes for quite a long time, to live in the external medium.

So, before leaving the cell, the virus itself produces a protein sheath and loses it again as soon as it has invaded a new cell.

Force of Habit

A new series of experiments was begun to find the mechanism of this phenomenon.

It was discovered that the cell itself destroys the sheath of virus particles—to its own disadvantage.

Had the virus been wearing its "garment" it would not have been able to reproduce.

Why does the cell help the virus in this way? It does it from sheer force of habit.

The defensive forces of the organism are specially adapted to grasp and decompose, to destroy proteins which have penetrated the cell.

Adapted

In the process of evolution the virus has not only adapted itself to this quality of the living cells, but has even made them serve it.

The cell continues to destroy the virus's protein sheaths, despite the fact that the substance beneath them—virus nucleic acid—is its worst enemy.

However, the results obtained are only the very beginning of solving the problem. They provide answers only to a few questions—but they are enough to predict the remaining answers with certainty.

Four stages

The process may be divided into four stages:

Penetration of a virus particle into a cell
Synthesis of components within the cell necessary for new particles.
Reproduction of the particles.
Their emergence from the cell.

Upon gaining the entrance into the nucleus, virus nucleic acid starts reproducing new virus particles—its action being fatal to the cell.

Reproduction is the right word for it. The virus begins by forming all the components necessary for great numbers of future virus particles and then proceeds to compose them—i.e., to creat new viruses.

A single virus particle enters the cell, but dozens or hundreds leave it.

Takes command

Virus nucleic acid takes over command of the cell and the management of the whole cellular apparatus.

A synthesis of hereditary virus substance occurs instead of the synthesis of hereditary cellular substance—instead of the synthesis of the cellular protein, a synthesis of the virus' protein sheaths; instead of cellular reproduction, reproduction of virus particles.

The cell turns into a virus factory: the raw material produced by the cell is captured and remade by the virus.

When it has completely destroyed the cell, the virus invades another susceptible cell.

"Susceptible cell" means a cell which can free the virus. Some cells free influenza viruses from their protein sheaths, others the polio virus, still others the measles virus.

Root of the trouble

The root of the trouble is that the cell

(*Continued on next page*)

PRESS NEWS

'MAM IN SPACE' SYMPOSIUM OPENS IN PARIS

One hundred and fifty scientists from nineteen countries met on Oct. 29 at Unesco House in Paris for the opening session of an international symposium on basic environmental problems of man in space.

The symposium, to last through November 2, has been organized by the International Astronautical Federation and the International Academy of Astronautics with the support and cooperation of Unesco, the International Atomic Energy Agency and the World Health Organization.

Speaking at the opening session, Dr. Hilding A. Bjurstedt, director of the Laboratory of Aviation Medicine at the Royal Caroline Institute in Stockholm and chairman of the symposium's organizing committee, called the meeting proof that "the space age is enlisting the best efforts of scientists from all countries and disciplines".

This theme of cooperation was then emphasized by Mr. Rene Maheu, Acting Director-General of Unesco, who declared that "It would be unimaginable that space research could develop without a broad technical collaboration among scientists from countries participating in it". Turning to the role of United Nations' institutions in this and other forms of scientific research, Mr. Maheu said:

"It must be stated again that scientific truth escapes ideological conflicts and that research, unless it is to be harmful to itself, calls for a concerted effort of thinking, organization, achievement and diffusion which can only be accomplished by international organizations."

Professor E.A. Brun of the International Astronautical Federation pointed to the importance of the symposium in furthering the close collaboration which space research has created between biologists on the one hand and physicists and engineers on the other. Dr. Theodore Von Karman, director of the International Academy of Astronautics, expressed the hope that the symposium will "clear many doubts concerning space flight and coooperation in space science".

The opening session concluded with remarks by Mr. D.W. Pearce of the International Atomic Energy Agency and Mr. R. Pavanello of the World Health Organization.

(*Continued from previous page*)

destroys the virus' protein sheaths. It is possible to break it of this bad habit?

"There is probably nothing impossible in it," says Victor Zhdanov a prominent worker in this field. "Susceptible cells probably may be turned into insusceptible ones.

"How it is to be done depends on us solving the problem as a whole—we have only scratched the surface, the problem remains to be solved.

We do not yet know how virus particles reproduce in the nucleus or how nucleic acid moves from the centre of the cell to its periphery.

But the main thing is that we are on the right trail."

INTERNATIONAL OCEANOGRAPHIC COMMISSION APPROVES EXTENSION OF COOPERATIVE RESEARCH AT SEA

A new international oceanographic investigation and wider exchange of data gathered by all scientists at sea were among the steps approved by the 44-nation International Oceanographic Commission which has just ended its second session at Unesco House in Paris.

The investigation will take ships from at least seven nations into the tropical Atlantic next year to study its currents, living resources, temperatures and other factors with a bearing on this region's possibilities as a major fishing-ground.

These were the highlights of the Commission's meeting attended by over 100 delegates from member countries along with observers from eleven non-member countries and twenty-three international organizations. Dr. William M. Cameron, director of oceanographic research for the Canadian Department of Mines and Technical Surveys, was elected to serve as chairman of the commission Named as vice-chairmen were Captain Luis R.A. Capurro, chief of the Argentine Navy Hydrographic Service, and Vice-Admiral V. A. Tchekourov, chief of the U.S.S.R. Hydrographic Service.

In other recommendations, the commission urged that more emphasis be placed by the International Indian Ocean Expedition on data needed for fisheries and it approved two regional surveys: one by China, Japan Korea, the Philippines and Viet Nam of the Kuroshio Current (the current that is the counterpart of the Gulf Stream in waters off these countries) and a second by Argentina, Brazil and Uruguay of the South Atlantic.

The results of the commission's meeting were summed up at a press conference by Dr. Roger Revelle, science adviser to the United States Secretary of the Interior and director of the Scripps Institute of Oceanography.

He pointed out that widespread agreement on the use of two world data centres (one in Washington and the other in Moscow) means that "oceanographic data will not be hoarded but shared for the benefit of all mankind."

Then he offered some background on the investigation of the tropical Atlantic which is intended to sweep this ocean from the bulge of Brazil to the Gulf of Guinea. Scientists believe that the Gulf of Guinea may prove to be a new fishing-ground, similar to Peruvian waters in the Humboldt Current where Peru has raised her annual catch from 100,000 tons four years ago to 6,000,000 tons at present, thereby becoming one of the world's top three fishing nations along with Japan and the Soviet Union. "This may well happen in the Gulf of Guinea," stated Dr. Revelle.

The tropical Atlantic investigation will be carried out in two phases next year-one in winter from mid-February to early April and then a two-week summer campaign in August.

ASSOCIATION NEWS

Dear Sir,

I am giving below a true copy of the personal appeal to all the Scientists from Acting President of ASWI, Dr. S. Husain Zaheer as well as a copy of his letter to the Prime-Minister on behalf of the scientists in CSIR and a reply thereto from the Prime-Minister for information.

I hope we all reciprocate his feelings and do not consider any type of sacrifice big enough required from us at this hour of our motherland. A separate 'Appeal' ha already been issued earlier by the Central Office.

I shall be obliged if you could kindly circulate the above for information of all the members in your Branch/Unit/Affiliated Organisations.

Thanking you,

Yours faithfully,
(A. K. SINGH)
GENERAL SECRETARY

Copy of DO No. DG/PS/62-- dt. 24th Oct., 1962 from Dr. S. Husain Zaheer, Director General, CSIR, Rafi Marg, New Delhi, to the Heads of all the National Laboratories/Institutes.

My Dear

In the present crisis and the danger which our country is facing, I feel it is the bounden duty of *every one* working in the Council of Scientific and Industrial Research to give his utmost in the service of the country and work under a sense of urgency and emergency, when all *personal* considerations of gain and comfort must fade away in the background. I therefore request Directors of National Laboratories and Institutes to call immediate meetings of their staff etc., to enthuse them for greater effort at work and to create patriotic sense of service in the national emergency.

The following action is recommended :—

(i) Hours of work be increased by at least one hour per day.

(ii) Holidays, excepting Sundays, be reduced to half their present numbers. This may be done keeping local conditions in view by each institution.

(iii) All leave except on account of illness or serious personal emergency should be cancelled.

(iv) The greatest possible economy should be exercised in all our expenditure, especially in the use of public utilities where there are shortages.

(v) Every one must contribute at least ten percent of their salary to the Provident Fund or National Savings.

With my kind regards,

Yours sincerely,
Sd : S. Husain Zaheer

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

D.O. No. P/DG--N--1 (3240) Rafi Marg,

DIRECTOR GENERAL New Delhi dt. October 23, 1962.

My dear Prime Minister,

On behalf of scientists in C.S.I.R. who comprise a large body of Indian scientists, I send you this message of solidarity and devotion at this hour of peril for the nation You have been a great Captain of our people in many struggles during the past 40 years and we are confident that you will lead us to victory in this battle for the territorial integrity of our land. Ever since the advent of freedom, both Science and scientists in this country have thrived under your fostering care and have gained both in stature and dignity. It is now our testing time, the time when we should render unto you what we have received from you and the country.

The shock of this wanton aggression is too sudden, but one thing is quite clear that the scientists must think more clearly and work much harder in the coming months. We assure you that whatever exertions, sacrifices or denials you or our Vice-President, Prof. Humayun Kabir call upon us to undergo, we will not flinch before our duty. Both as the Head of C.S.I.R. and as an old soldier under your flag during the national struggle, I will not hesitate to impose any task or sacrifice on myself and my fellow-scientists under C.S.I.R. which you demand from us in this great ordeal for our country.

Affectionately yours
Sd : S. Husain Zaheer

Shri Jawaharlal Nehru,
Prime Minister of India,
Prime Minister's House,
NEW DELHI

No. 1734--PMH/62

PRIME MINISTER'S HOUSE
NEW DELHI
October 23, 1962

My dear Munne,

Thank you for your letter of October 23rd which I appreciate very much. I hope you will convey my deep appreciation to the other Indian scientists also. I am sure that our scientists will do their utmost at this crisis we have to face.

Yours affectionately,
Sd : Jawaharlal Nehru

Dr. Husain Zaheer,
Director General, CSIR,
NEW DELHI

W·F·S·W News

WHAT IS THE W. F. S. W.?

The World Federation of Scientific Workers is an international body which links organisations of scientific workers. It constitutes a unique meeting ground for scientific workers from all parts of the world to exchange views and to act together on problems of common interest.

History

The W.F.S.W. was founded in 1946 on the initiative of the Association of Scientific Workers in the United Kingdom and others. The Inaugural Conference was held in London on 20-21 July, 1946.

The first President was Professor F. Joliot-Curie who held the post until 1957, when Professor C. F. Powell succeeded him. The *Constitution* and *Charter for Scientific Workers*, adopted by the Federation soon after its foundation, are its two basic documents to which all its affiliates subscribe.

Aims

The aims of the Federation, as laid down by its Constitution, are as follows :

(a) To work for the fullest utilisation of science in promoting peace and the welfare of mankind, and especially to ensure that science is applied to help solve the urgent problems of the time.

(b) To promote international co-operation in science and technology in particular through close collaboration with UNESCO.

(c) To encourage the international exchange of scientific knowledge and of scientific workers.

(d) To preserve and encourage the freedom and co-ordination of scientific work both nationally and internationally.

(e) to encourage improvements in the teaching of the sciences and to spread the knowledge of science and its social implications among the peoples of all countries.

(f) To achieve a closer integration between the natural and social sciences.

(g) To improve the professional, social and economic status of scientific workers.

(h) To encourage scientific workers to take an active part in public affairs and to make them conscious of, and more responsive to, the progressive forces at work within society.

The Charter for Scientific Workers

The Charter is a concise statement of the responsibility of scientific workers and of the conditions which must be provided to safeguard the freedom, the advancement and the social utility of science. The headings of its seven sections indicate its scope :

1. Responsibilities of Scientific Workers.
2. Status of Science and Scientific Workers.
3. Opportunities to become a Scientific Worker.
4. Facilities for Employment.

5. Conditions of Work for Scientists.
6. Organisation of Scientific Work.
7. Special Needs for Science in Underdeveloped Countries.

Structure and Finance

Organisations affiliated to the Federation are of two types : trade unions, and independent associations of scientific workers. There are Affiliated Organisations in 22 countries : Albania; Bulgaria; Cameroon; China; Cuba; Czechoslovakia; Denmark; France; Federal German Republic; German Democratic Republic; Hungary; India; Japan; Korea; Mongolia; Poland; Portugal; Rumania; United Kingdom, United States of America; Union of Soviet Socialist Republic, Viet-Nam.

There is also provision for Corresponding Members in countries which have no Affiliated Organisation—ten countries to date. The *Constitution* ensures that no Affiliated Organisation, however large in numbers, can gain undue influence to the detriment of the numerically weaker.

The *General Assembly* is the supreme governing body of the Federation and meets every two or three years. Between these meetings an *Executive Council* is responsible for leading the work of the Federation. Since regular meetings even of the *Executive Council* are difficult to arrange. Its powers are delegated to the *Bureau* which meets slightly more frequently. The affiliation fees of member organisations are fixed by the General Assembly, which bases its assessment on 1.5 per cent of the amount raised by subscriptions of those of their members who are qualified scientific workers. Affiliation fees of Corresponding Members are also fixed by the General Assembly (at present £ 1 a year).

Below are extracts of the summary of reports on activity in 1961 given to the 7th General Assembly in 1962 :

Activities on salaries and conditions of work

All the Affiliated Bodies are active, so for as their constitution permits, in safeguarding the salaries, holidays, pensions, health services and housing of their members. In Bulgaria the Union organises holidays for its members in rest-homes by the sea and in the mountains. It has built some blocks of flats for members. The Danish organisation has secured 50% higher payment for lectures on the radio and an increase of 20% in authors' royalties. The report from Poland gives detailed figures for the changes in salary introduced at the end of 1961. In Great Britain the report states that in spite of difficulties, general salary increases have been secured in most fields of employment. Improvements in hours of work and annual holidays have been made. Efforts are being made by the British organisation to increase the three weeks' annual holiday to four weeks in the engineering industry. In the U.S.S.R. wages were regulated in agreement with the Union for a number of those employed in institutes of the Academy of Science and in higher educational establishments. A shorter working day was secured in 1960, without any decrease in wages, for a number of members in research establishments and colleges of higher education.

Work in relation to the planning of science

The planning of science figures largely in the report from Czechoslovakia. Following the international symposium in Prague on "Planning in Science" there have been many lectures, discussion and publications on this subject.....The newly formed French orga-

nisation has also devoted a large part of its attention to the planning of science. It is organising a discussion with the title "The requirements for research." Planning in science has also been discussed in the G.D.R. The British organisation is endeavouring to prepare a major policy statement on the principles which should guide the planning of expenditure on scientific research and development.

Work on the popularisation of science

The spreading of scientific ideas and attitudes of mind among the population at large is one of the most important activities of many of our Affiliated Bodies. In Bulgaria the Affiliated Body holds lectures for the general public in Sofia and all the large towns of the country. It also publishes reviews directed towards the popularisation of science. In Cuba members of the Association of Scientific Workers have taken part in the campaign to wipe out illiteracy and have given special lectures to improve the secondary school teaching. The recently formed Association for the diffusion of Science and Technology in Viet-Nam attaches great importance to raising the scientific and technical level of the working people... It publishes a quarterly review on popular science with an edition of 100,000 copies.

Activity directed against war preparations

Some of the reports describe the great efforts which certain Affiliated Bodies have made to carry on propaganda against war preparations. Some reports stress the need for international exchange and better mutual understanding between the peoples of different countries.....

International exchanges of scientific workers

Most of the reports describe great activity in connection with exchange visits of delegations and of individual scientists. Since the last General Assembly there has clearly been a considerable increase in contact between scientists of different countries. The reports show that the W.F.S.W. has helped considerably in achieving this result.

Publications

The publications of Affiliated Bodies form an important part of their total activity. In Bulgaria two reviews entitled *Scientific Life* and *Langu ge* and *Literature* are produced. The monthly journal *Vijnan Karmee* has been published regularly in India by the Indian Association of Scientific Workers. The British A.Sc.W. has issued a bi-monthly journal and produced two pamphlets entitled "Science and Education" and "A National Fuel and Power Policy." The Soviet Affiliated Body produces a publication entitled *The Teachers' Newspaper*. In Viet-Nam the publishing aspect of the work of the Affiliated Body is very important. Apart from a quarterly reiew, 120 brochures and 300 documents have been issued.

Relations with the W.F.S.W.

In almost all of the national reports approval is expressed for the activity of the W.F S.W. The action directed towards stopping atomic tests, towards introducing a treaty which would ban tests, and general disarmament is warmly supported. The help given by the W. F.S.W. to national organisations in facilitating the exchange of delegations and of individual scientists is also approved of. The W.F.S.W. has reason to be especially grateful to the Bulgarian Union of Scientific Workers for their initiative and generosity in building an international holiday centre for scientists near the beauty-spot called Varna on the Black Sea coast.

HOW THE FEDERATION FULFILLS ITS AIMS

International scientific collaboration

The Federation has frequently intervened on questions of secrecy in scientific matters, in favour of the free exchange of scientific material, and in the struggle against all actions such as the withholding of visas, which restrict the participation of scientists in conferences, discussions and international meetings. The Federation exchanges information regularly with the Department of Non-Governmental Organisations of the United Nations Organisation and the specialised agencies like UNESCO, ILO and WHO. It was invited as a non-governmental organisation to send observers to the Geneva Conferences on the Peaceful Uses of Atomic Energy, held in 1955 and 1958.

It is a member of the Union of International Associations.

Promotion of the peaceful uses of science

When the Federation was founded the problems posed by the development and use of weapons of mass destruction, and the atomic bomb in particular, were first facing mankind. Since then the Federation has repeatedly taken its stand against all such misuse of science.

With the development of the hydrogen bomb and the hazards arising from nuclear tests the Federation's activity has greatly increased in this respect. It has issued press statements, letters to the UN and to the Heads of State of the major powers, and arranged a delegation to the Geneva conference on tests.

Leading members of the Federation have played a prominent part in the Pugwash conferences.

Among the early activities of the Federation were meetings held in memory of Paul Langevin (London, May 1947) and Lord Rutherford (Paris, November 1947).

The Federation has organised several international symposia in conjunction with its General Assemblies. These include :

"Science and Planning," "The Training of Students in Science and Technology" (Helsinki, 1957); "Science and the Development of the Economy and Welfare of Mankind" (Warsaw, 1959), in which 150 scientists from five continents took part; "Higher Scientific and Technological Education" (Moscow, 1962), arranged jointly with Soviet educational establishments. In these last two symposia particular attention was paid to the way in which science could help newly developing countries.

Status and Rights of scientific workers

The Federation helps the activities of the Affiliated Organisations in this field by: the exchange of information, the organisation of systematic surveys, co-operation with international organisations like UNESCO and ILO, the organisation of regional conferences in which both affiliated and non-affiliated bodies can study problems of common interest to a particular region.

Publications

Scientific World is the Federation's quarterly journal. It is published in six languages: English, Chinese, French, Russian, German and Spanish. Scientists from all over the world write for it on a wide variety of subjects, including : outstanding new developments in science and technology , science and the newly developing countries, the organisa-

tion and planning of science , problems of nuclear energy, international co-operation in science , problems of the teaching of science, the training of scientists and technologists, activity of the Federation and its Affiliated Organisations.

The Bulletin is an occasional publication covering news of the Federation in more detail.

Science and Mankind is the general title of a series of books devoted to special subjects. Volumes published so far are.

"Hunger and Food" (ed. J. de Castro, 1959)

"Science and Health" (ed. L. Rajchman, 1961)

"Science for a Developing World" (an account of the 1959 Warsaw Symposium by J. D. Bernal, 1962).

Nuclear Hazards Newsletter is an occasional publication containing important statements from many sources on nuclear energy and the abolition of nuclear weapons and their testing.

Pamphlets : In 1956 a pamphlet on nuclear dangers entitled "Unmeasured Hazards" was published in 12 languages.

Drinking Water from the Sea

Continued from Page 26)

The first electro-dialysis waterworks will soon be commissioned on the island of Pellworm as an experimental pilot plant. The conservative Pellworm peasants and fishermen, however, have as yet to be convinced of these new methods. At any rate they still rely on their cisterns, which due to the rainy summers in the past two or three years have always been sufficiently filled. Water is a most important problem that German scientists continue to tackle, not only because of threatening water shortages in Germany, but also because in this manner they can help the many young nations in Asia and Africa suffering from ever greater difficulties to supply their people with sufficient drinking water.

21. Lektion

Dear friends !

To-day let us imagine that Prem has succeeded in his efforts and is going to Germany : Having arrived, he goes to look for a lodging. Listen now to Prem :

Prem : Guten Tag ! Sie haben ein Zimmer zu vermieten. Ist das Zimmer noch frei ? Kann ich es sehen ?

Hausfrau : Bitte, treten Sie ein ! Ich zeige es Ihnen. Das Zimmer ist sehr schön.—Gehen Sie durch diese Tür, bitte ! Das Zimmer liegt gleich neben der Wohnungstür.—Hier ist es ! Sehen Sie ! Hier rechts an der Wand ist das Bett mit dem Nachttisch. Am Fenster steht der Schreibtisch. Das Frenster geht nicht zur Strasse, sondern zum Garten. Das Zimmer ist sehr ruhig, Dort hinten steht eine Couch, ein Sessel und ein Tisch. Sie konnen abends dort bequem sitzen und lesen, denn ich stelle Ihnen noch eine Stehlampe in die Ecke. Sie haben hier auch einen Radioapparat. Sie können also auch Radio hören.

Prem : Ist dieser Schrank dort ein Kleiderschrank ?

Hausfrau : Ja, Ihre Kleider können Sie in diesen Schrank hängen. Sie haben dort auch genug platz für Ihre Wäsche.

Prem : Haben Sie auch Zentralheizung ?

Hausfrau : Leider nicht. Aber dort steht ein Ofen. Er heizt das Zimmer sehr gut. Dort links hängt auch noch ein Regal für Ihre Bücher.

Prem : Und wo ist das Waschbecken ?

Hausfrau : Zum Waschen können Sie ins Bad gehen. Ich bin allein in der Wohnung. Das Bad ist also fast immer frei.—Meine Putzfrau kommt täglich und räumt das Zimmer auf. Sie kann auch Ihre Wäsche waschen.

Prem : Gut, das Zimmer gefällt mir. Was kostet es im Monat ?

Hausfrau : Die Miete ist nicht hoch. Sie bezahlen im Monat für das Zimmer mit Heizung nur 85 DM (Deutsche Mark). Sie können auch Frühstück bekommen, dann zahlen Sie im Monat 30 DM mehr.

Prem : Das ist nicht zu viel. Ich miete daz Zimmer. Kann ich schon heute einziehen ? Dann hole ich jetzt meine Koffer vom Bahnhof. Ich zahle die Miene sofort.—

Hausfrau : Danke ! Hier ist die Quittung.—Auf Wiedersehen !

allein	alone	also	so, therefore
aufräumen	to tidy up	bekommen	to get
bequem	comfortable	bezahlen	to pay for
einziehen	to move in	fast	almost
fertig	ready	gefallen	to please, to suit one's taste, like
gleich	directly		
heizen	to heat	die Heizung	heating
hoch	high	holen	to fetch
das Kleid/er	dress	der Kleider-schrank	wardrobe
mehr	more	die Miete/n	rent
mieten	to rent	der Nachttisch	bedside table
der Ofen	stove	der Platz	room
die Putzfrau	charwoman	die Quittung	receipt
das Regal	shelf	ruhig	quiet
der Rundfunk	radio	der Rundfunk-apparat	radio-set
der Schrank	cupboard	sofort	at once
der Schreibtisch	writing table	die Stehlampe	standard lamp
täglich	daily	vermieten	to let
waschen	to wash	das Waschbecken	wash-basin
die Wäsche	laundry, undercloths shirts etc.	die Zentral-heizung	central heating

Exercises : Bilden Sie Fragen mit "woher ? wo ? oder wohin ?

Mein Bruder studiert in Deutschland.
Wir gehen in unsere Wohnung.
Um 9 Uhr sind wir in der Schule.
Robert und Peter kommen von der Universität und gehen ins Cafe.

Exercises : Ergänzen Sie die Endungen.

Dies—Hut ist neu.
Ich finde dies—Brief nicht.
Ich nehme dies—Zug.
Heute abend wollen wir in d—Kino oder in d—Theater gehen.
Sein Haus ist neben unser—Haus.

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