

विज्ञानकर्मी

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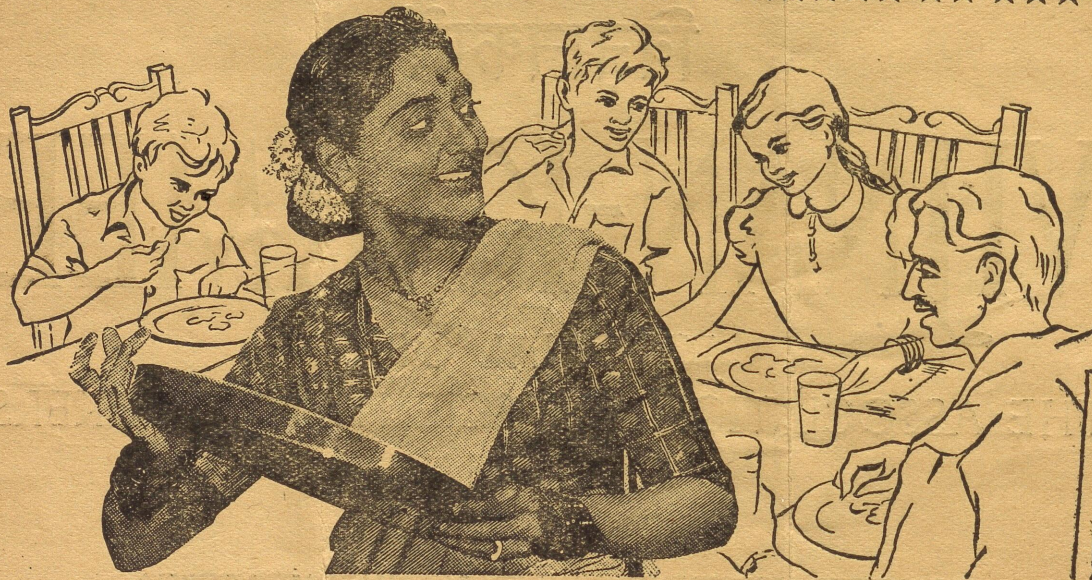
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*and other regular features*

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*Editor*

**Narendra Singh**



**The tastiest meal I'd ever cooked  
...and I didn't know why!**



It was just like any other mealtime. My husband was late as usual. The children had been sent to wash their hands and the baby had woken up in a temper.

At last they all sat round and I served the food. Then it happened!

Practically from the first mouthful there wasn't a sound. It looked like an eating match. I simply couldn't believe that this was the same family. What had I done *right*?

My husband had always been finicky about his food and the children had taken after their father. After lunch I sat down and thought back over the morning shopping. Vegetables?...nothing different there. Meat and fish?...from the usual shops. Then I remembered. There had been *something* different!

Only that morning I decided to try a tin of Dalda Vanaspati. My dealer had recommended it to me as the perfect cooking fat for frying, baking, and sweetmaking. 'Your family will love the way it brings out the *natural* flavours of food,' he said, handing me the airtight sealed tin.

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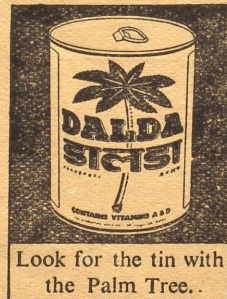
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# विज्ञानकर्मी

## VIJNAN-KARMIIE

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### Personnel For River Projects

IT is a matter of gratification that the Government of India have recently appointed a Committee to report on the requirements of technical personnel for the River Projects "now under execution and to be executed during the next 15 years". It is good that the Committee is directed to complete its task before the end of this year. We are also glad that the terms of reference assigned to this Committee are not only comprehensive enough but include such questions seriously agitating the public mind as the needs of personnel required for planning, construction and operation of these projects, steps needed to remedy existing personnel deficiencies, problems associated with the procurement of technical assistance from foreign countries and, lastly, a greater degree of coordination and cooperation between Central and State Governments on the one hand and Governments and unofficial bodies like the Universities etc. on the other. Since the commencement of the era of planned economy, this is the first time when the principles of planning are sought to be applied to the problem of personnel so essential for any planned development.

Much as we commend the effort of the Government to elevate the personnel problem in this field to a planned level, we cannot help thinking that full justice cannot be done to the terms of reference of the Committee in view of the isolation of the problem of personnel in River Projects from the broader one of personnel for all development projects. This isolation, we are afraid, will be detrimental to the objective of putting the problem of personnel in River Projects on a planned and organized plane. We are reminded of the Scientific Manpower Committee constituted years ago and the high hopes which it gave rise to in the heart of many a scientific and technical worker. The job assigned to that Committee was such that it required a continuously functioning organization to assess the needs from time to time and take steps to plan the available man-power for developmental needs. Even now it will not be too late for the Government of India to constitute a similar Committee

with wider terms of reference, including not only the personnel for River Projects but for all developmental projects.

Notwithstanding the limitations imposed on it by this isolation of a part problem from an integral whole, it is desirable that a positive attitude is taken towards the functioning of the present Committee which should be helped by one and all to grapple in the correct way with the important problems assigned to it.

The personnel problem in River Projects has a three fold aspect; at the university level, at the junior position level and at the level of the senior personnel on whom devolves the supreme responsibility of planning and execution of these projects. For attempting a solution of the issues at any or all levels, the first essential requirement is a manpower survey, the conduct and completion of which, we hope, will be given due attention by the Committee. Assessment of long term personnel needs has to proceed on the basis of continuity of planning of development. It is not enough to assume in principle such a continuity but vitally necessary that rough outlines of long term development are actually worked out.

While estimating the personnel needs in the years to come, the Committee should remember that it should assess not only the requirements of engineers but also the number of scientists that will be necessary like Geologists, Physicists, Chemists, Economists, Statisticians, etc. A consideration of the scientific content of the personnel problem on River Projects has always gone by default and it is hoped that the present Committee will not fail to devote its attention to this important question.

Considering the university education, it is now a well recognized fact that this does not equip one to shoulder the responsibilities of planning and construction. The method of imparting technical education in our universities is so out-moded and ineffective that one is entirely ill-equipped to tackle the problems which have been thrown up as a result of projects on a scale not so far witnessed in this country. The institution of separate graduate courses in the fields of Highways and Tele-communication in certain Indian Universities is a commendable step in the right direction. The example can profitably be emulated even in the field of irrigation and water power engineering. The institution of post graduate courses and research facilities at appropriate research institutes or universities can go a long way in assuring a fair level of competence in the fields of planning, design and research. Also, there is much that can be done by way of making about a year's practical work on some of the major projects a condition for the conferment of university degrees.

All this does not obviate the desirability of training in the field; it is, therefore, imperative that training is imparted not only in the Universities but even on actual constructional jobs in variety of spheres. Refresher courses at

all levels on Projects at periodical intervals will go a long way in raising the technical efficiency of the personnel. Moreover, it is not all the project administrations that have well equipped libraries and laboratories at construction sites. Provision of such facilities is a great necessity to keep the technical knowledge of those engaged on work up-to-date. The progressive training of the "higher planning staff, capable in due course of assuming positions of the highest trust and responsibility" can be a success only when bold policies of promotion of talent are followed, unhampered by considerations other than merit.

Then, there is the knotty problem of the role of foreign experts in these Projects. While it is true that in a few projects there exist difficult conditions in tackling which foreign assistance will be a great asset, we wish to under-line that this difficulty is not a general one but only exists in a few and special situations in view of their unprecedented proportions and complexity of problems. Even in these, in the ultimate and long term interests of the country, it is necessary to see that the technical assistance from foreign sources goes to ensure to wipe out the present organizational and technical deficiencies but not to perpetuate them. This is best achieved by recruiting suitable foreign technical talent in an advisory capacity but not executive. The executive responsibility should unmistakably rest on Indian shoulders. It is a matter of regret that this elementary principle in the procurement of foreign technical assistance has not been adhered to with the strictness and rigidity which the situation demands. There is a great deal that can be done by the Committee in this field by pointing out the numerous executive positions at different levels where there is absolutely no necessity of foreign personnel.

Most vital of all is the question of congenial conditions of work, security of service and adequate scales of pay for the personnel. It is an unfortunate anomaly that the pay scales on these projects at any level do not measure up to the corresponding ones on the administrative side. While such a set up might have suited alien interests in the past when administrative emphasis was not on developmental questions but on "maintenance of law and order", it is necessary now that this anomaly should be removed as early as possible, consistent with the changed set up of conditions and modern emphasis on welfare projects as the basic foundation of a stable democracy. There is a great deal that can be done to shorten and systematise the hours of work on a majority of the projects. The completion of a project should not result in throwing a number of trained hands out of employment. Nor should they be allowed to drift for themselves from project to project as at present. The constitution of a permanent service cadre for these personnel and a Central coordinating agency with powers to move them from project to project irrespective of territorial or regional considerations are some of the measures urgently called for to ensure security and continuity of service.

Often has it been said that we are not building a project here or a project there; we are building a Nation. The translation of this true and noble concept into practice largely depends on the earnestness and thoroughness with which the Committee discharges its responsibility.

## Report Of The Second Reviewing Committee of the C. S. I. R.

*A Review*

**Baldev Singh**

**T**HE Prime Minister of India, in his capacity as President of the C.S.I.R. appointed a Reviewing Committee with Sir Alfred Egerton, Emeritus Professor, Imperial College of Science & Technology, London, as chairman, 'to appraise the researches, both pure and applied, conducted at the National Laboratories and sponsored at universities and other research institutions and suggest lines for future development and report generally on the organisation and working of the C.S.I.R.' Between 18th February and 9th March, the Committee visited 11 National Laboratories and 6 other All-India Research Institutes and held discussions with the Directors and Chairmen of the Advisory Boards of some other institutes. On the 3rd April, the Chairman submitted a 98-page report to the Prime Minister embodying the Committee's views on the working of the C.S.I.R. along with their suggestions.

### Need for Review

Such a review of the activities of the C.S.I.R. and other Research Institutions was both timely and necessary. The Government of India, under the enlightened leadership of Shri Jawahar Lal Nehru, has been fully alive to the role of science in national development. Under a planned economy, this role assumes a highly significant importance in becoming a major factor and instrument for progress in all spheres. Since its inception, the present government has given considerable encouragement and financial support to scientific research and development. As such, the government and the people of India are entitled to an objective appraisal of the state of Indian Science. An evaluation of the achievements and shortcomings could also stimulate a thoughtful approach to its future planning and progress, help encourage useful trends and eliminate weak spots.

While stating that their terms of reference concerned them mainly with the working of the C.S.I.R., the Reviewing Committee

have rightly viewed it in the context of the country's development and have devoted an entire chapter to 'Science in Relation to India's Problems' (p 3 to 7). They recognise that 'India's problems are very different to those in highly industrialised countries.....' (p. 4). However, it is precisely when judged from this aspect that the Committee's recommendations fail to hit the mark. The problems of Indian Science, such as a judicious selection of problems for applied research and speedy utilisation of the results for industrial expansion; organisation and re-orientation of scientific research as to give it greater originality and meaning in the national context; the problem of the 'Health' of science in the teaching institutions and universities, are matters requiring an intimate knowledge of the actual state of affairs of Indian Science, and an awareness of the socio-economic conditions of the country and its needs. With the highest regard for the scientific genius and sincerity of effort of the foreign scientists, it would be unfair to expect this knowledge of them.

There can be no question of the Committee's competence or judgment in matters scientific. It is a pity that the Committee had so little time at its disposal and states 'that a rapid inspection was all that was possible in the time available' (p. 2). The Committee would have had a better appreciation of the problems and conditions of work in the research institutes in India, if they could have the views of the rank and file of research workers who actually handle research. Here again the Committee frankly states that 'The visits had to be very rapid and the time which could be given was not at all related to the variety and importance of the many interesting features of the work of the laboratories which the staff of the laboratories and institutes were eager to show us' (p. 9). Notwithstanding these limitations, the Reviewing Committee has in its report succeeded in bringing into sharp focus a number of scientific and socio-scientific problems affecting Indian research.

### Expenditure on Research

Dealing with expenditure on scientific research, the Committee notes that under the First Five-Year Plan, wherein the useful role of science in achievement of 'maximum possible increase in agricultural production and preparation for substantial industrial expansion', has been recognised, the allotment for research is only a fraction of the 2.5% of the total outlay under the heading "Miscellaneous", (p. 3). It remarks that 'The expenditure by government on research in the universities of India (including the two higher technological institutes) and in other directions (medical and agricultural research etc.), is not of such great amount that the central government need fear in any way that the total expenditure on research is too high. The expenditure by industry is clearly quite small in comparison with that of industrially developed countries and more total expenditure on research rather than less would seem to be needed, if modernisation of industry and building up of efficient research centres are to be quickly achieved. The total expenditure on research in India in relation to the national income is very much smaller than in U.K. or U.S.S.R.' (p.9). Figures of expenditure on scientific research in U.K. and

U.S.A. by government, industry and the universities have been quoted and should provide a fitting answer to those shortsighted unthinking critics who never tire of bemoaning the vast (!) amounts expended on research in India.

### Centres of advanced Research

Answering a much-debated question about the advisability of establishment of these centres of advanced research, the Committee states 'The policy of the Council to establish these national laboratories and institutes has, in our opinion, been fully justified. They have already given good service and substantial gains have been achieved..... Their existence will be justified to an increasing extent' (p vi). Also 'The laboratories and institutes greatly widen opportunities for young research workers as well as for making use of young talent'. Anticipating a possible difference of opinion, the Committee presents a positive aspect in saying that 'For the value is that now that these laboratories are in existence, they can do much not only to modernise the industries but also to develop national resources', and that 'the question whether India's industry is at present large enough to require such a fine set of laboratories is easily answered. Firstly, the number of laboratories in industry is few and the laboratories will supply a common need and secondly, they are needed to help in India's industrial expansion and will not be any too large when the expansion takes place.....'(p.7). The question today is not about the right or wrong of the policy of establishment of these research institutes but of their maximum utilisation for national development.

The Committee has defined the dual role of these laboratories as (a) centres for advanced fundamental and applied research and (b) centres for experimentation and adaptation of known processes to suit Indian raw materials and conditions. The Committee has indicated that 'Fundamental and applied research best go hand in hand. It is wise not to tie the research programme of an institute too completely to practical problems but to encourage fundamental research work being done along with the researches of more immediate direct application' (p. 67). The extent, quality and

type of industrial research done in these laboratories cannot but bear a relation to the extent and progress of industrialisation in the country. Moreover, the industry must show keenness to utilise the talent and facilities provided by these laboratories. As industrialisation progresses and research consciousness in industry grows, the research institutes will become increasingly useful and important to industry.

### Utilisation of Results of Research

The question of speedy utilisation of the results of applied research undertaken by the institutes is important. In fact, their quick applicability or the stimulus they may provide for starting new industries should be the criterion for selection of the research programmes of an applied nature. The Committee has rightly stressed that 'It is of small avail to set up a number of research institutes beautifully equipped if the results of their work cannot quickly be used' (p. 70).

Looked at from this angle, it is disturbing to note that as many as 103 completed projects reported ready for development have not so far been utilised (Appendix II, p. 87-90.) One may readily concede the Commission's contention that 'There is actually a large gap—a difficult gap to traverse—between a process which is proved to be a success in the laboratory and its full scale operation' (p. 70). The Commission also poses the question as to 'whether conditions in industry are such that the results of researches done in the institutes can be quickly developed and utilised', (p. 70) and tacitly suggests that 'If economic conditions and laws are such as to make industrialists shy of the development of promising processes, then it would seem that such conditions should be modified, for it is no use encouraging research for the purpose of expanding industry, if that expansion is resisted owing to lack of incentives' (p. 71). As a solution for this, the Commission has recommended greater emphasis and extension of facilities for pilot plant work in the national laboratories and speedy establishment of the proposed Research Development Corporation which would 'arrange about the licences relating to patents taken out by the laboratories and the finding of suitable firms to

undertake the development' (p. 71). However, the Commission appears to have overlooked an important aspect of this problem. A closer scrutiny of the completed projects would show that in some cases the reason for their not being utilised is their nature itself. Availability of raw materials, technical know-how, figures of import, production and consumption of the product are some of the factors which should be taken into account before a research programme is initiated. A completed research project which does not fit in with the realities of the socio-economic situation can have no chance of commercial development. Another factor is the existing gap between research and industry—the two following their paths independently of each other. Improvement of existing liaison machinery between the two, greater attention to pilot plant work in the National Laboratories and even the efforts of the Research Development Corporation may be of strictly limited avail. To be productive, industrial research must arise out of the requirements of industry and its results ploughed back into industrial usage as speedily as possible.

### Industry and Applied Research

It should be advisable that research programme of applied nature be taken at the initiative of industry itself. A greater representation of industry on the research committees of the C.S.I.R.—frequent exchange of technical and research personnel between the research institutions and industries; a cess on industry itself to finance applied research; representation of technical and research personnel of the research laboratories on the management panels of the industry and frequent survey and report by joint committees of industry and research personnel on the progress of industry and how research could help its development, are some measures that could be suggested to improve the existing state of affairs. In this connection, industry would be well-advised to note the Commission's opinion that till the industry employs well-qualified scientific and technical personnel, chemical engineers, chemists etc., and provides them with congenial working conditions—there could be little hope for any progress by the industry (p. 72).

Contrary to the Commission's hinted

opinion, incentives in the form of economic laws and conditions are not lacking as may stand in the way of any enterprising industrialist in making use of research to promote industrial expansion. More than anything else, the outmoded, conservative and short-sighted outlook of a large section of the Indian capital, which looks for quick and high profits and lacks the vision of building a healthy industrialised economy for the country, is responsible for the shyness the industry has shown in taking a positive attitude to research.

### Fundamental Research

The existing industrial conditions in India narrow down considerably the scope of applied research. Whereas fundamental research need not be undertaken as an easy escape from the embarrassing realities, it is bound to constitute a vital part of the programme of these institutes. A plea for greater originality and a freshness of approach to fundamental research in preference to a mere extension of work done elsewhere may not be out of place. The reviewing Committee has emphasised that in fundamental work quality counts. The Commission hopes that in some branches of research, these institutes should in the near future become the forefront of scientific advance, where 'investigators from other countries will be wanting to come to work in it or consult it.' (p. 68). It is satisfying to read the Committee's opinion that 'some of these institutes are well on the way to reach this happy position' (p. 68).

### Organisational Aspect

The Committee has made some valuable suggestions with regard to the organisational aspect of scientific research. It points out that 'The most important factor in the success of research laboratories is the quality of the staff.'

#### *Role of the Director*

'The Director has a particularly important role' (p. 62). For this role, the Committee emphasises that 'the Director should be a man of standing and experience in his own branch of science or technology, should not be erratic in administration and should have the ability to inspire harmonious team spirit and initiative among his staff. It is important that he should have as little time as possible taken up in petty matters of administration,

which can be dealt with by a personal assistant or deputy' (p. 62). In the matter of running expenses, the Committee 'recommend that the Directors should be given as much autonomy as possible in handling of the funds placed at their disposal for the running of the work.' (p. 63) With five out of the twelve National Laboratories functioning with highly paid foreign scientists as Directors, it would be a costly waste of valuable talent to let their time be wasted on administrative matters, rather than be utilised in the training and guidance of Indian personnel for specialised research. Annoying delays and irksome difficulties arise at times since the powers of Directors in the matter of disposal of funds are strictly limited. It is common knowledge that the above-pointed defects exist and have at times seriously hampered the progress of research in the Laboratories. The Committee is of the opinion that 'the Central Executive should leave as much detailed administration as possible in the hands of the various institutes, acting in a coordinating and guiding capacity' (p. 14). Autonomous working to the maximum extent without day to day interference by the central authority or the government agencies would greatly add to the efficient and speedy progress of work in the various institutes.

#### *Research Committees*

Commenting on the functioning of the Research Committees, the Reviewing Committee recommends that their number be kept within bounds and they should be terminated when their work is not useful enough to warrant at least two or three meetings a year (p. 64). Greater attention is urgently needed to the working and usefulness of the Research Committees, if they are to be effective instruments for the promotion and progress of sponsored research. At present, there appears to be no living link between these committees and the research under their charge and a way must be found to establish this.

#### *Autonomy*

The Committee has commended the autonomous character of C.S.I.R. saying that 'It is fortunate that the C.S.I.R. is an autonomous body, so that the choice of staff and the conditions under which work is carried out are the Council's responsibility' (p. 64-65).

Unfortunately, this autonomous character, so important for the proper functioning of a research institute, does not obtain for a number of research laboratories outside the jurisdiction of the C.S.I.R. Some of them continue to be managed as government departments, subject to official interference in the matter of appointment of staff, day to day working and management. This seriously impairs their efficient working and urgent steps are needed to restore to them an autonomous character or link them suitably with the C. S. I. R. Moreover, notwithstanding the autonomous character of the C.S.I.R., its internal functioning in regard to the relation of the Central Executive and the research institutes is not free from the usual red tape defects of a government department.

#### *Pay Scales of Staff*

Regarding the salaries and scales of pay of the Research staff, the Committee says 'The scales of pay also seem to us to be satisfactory except that there may be need for some latitude for higher starting salaries in special cases.....' (p.65). Apparently, the Committee were not posted with the actual state of affairs, for, the salaries and conditions of service of the junior research staff of the C.S.I.R. and still more so, of the research workers engaged on various research schemes sponsored by the B.S.I.R., are very far from satisfactory. Their scales of pay are much lower than those of other scientific workers with similar qualifications in teaching institutions or administration, and a large number of them continue to be in temporary employment even after several years of service. The contract nature of service under C.S.I.R. for scientific research staff modelled on lines in U.S. and U.K. (where there is no dearth of employment opportunities for scientific personnel) does not offer security of tenure, so necessary under Indian conditions. The Committee's statement in this regard unfortunately does not correspond with facts.

The Committee have done well to point out that research employment cannot be treated at par with routine government service and that 'promotion should take into account capacity and application. The establishment cannot well afford to lose its experienced men, and it cannot retain them unless a certain

security of tenure can be provided.' (p. 65).

#### **Universities and Laboratories**

Universities and National Laboratories constitute important centres of scientific endeavour and the necessity of cordial relationship and close collaboration can hardly be over-emphasised. Sound health in respect of teaching and training for research in the universities is essential to feed the National Laboratories, which in their turn provide opportunities for the abilities of the youth. At present no vital links exist between the National Laboratories and the Universities and the Committee's recommendations should help to establish these. The Committee have 'suggested that some members of the staff of the laboratories should have opportunity to undertake some teaching of their subject at post graduate level in neighbouring universities etc., and that the universities should in turn send some graduates with special aptitude for research to work in the well-equipped national institutes' (p. 65). The Committee appears to have been given to understand that 'arrangements have been made between certain universities and national laboratories that post-graduates in special cases can carry out their research work in the laboratories and obtain thereon a Ph. D. degree' and recommends that 'some post-graduate studentship grants should be available to the university to award for this purpose and one or two studentships might also be available for offer by each of the laboratories and institutes' (p. 66). It may be pointed out that the above-referred arrangements are in a highly unsatisfactory state and in case of some laboratories, non-existent. The relations between some universities and research laboratories vary from active hostility to studied indifference to each other's existence. The Commission has laid a much-needed emphasis on harmonious collaboration between the Universities and the research institutions and their recommendations if carried out should help in its promotion.

#### **Appoint an Indian Committee**

In considering the Reviewing Committee's efforts, two facts must be kept in mind—firstly, in the limited time at the disposal of the Committee, an appraisal of the pure and applied researches carried out by the National

( See page 16 )

## Scientific Research in Agricultural Industries

H. C. Bhattacharya

**S**CIENTIFIC research in the various phases of an agricultural industry must necessarily be co-ordinated in its different aspects so that such research may be channelised in the right direction and the results of research may be usefully applied in the fields and factories in the shortest time possible. This task of co-ordination involves planning for short and long term activities both in the agricultural and industrial spheres, and also the linking up of the gap between agriculture and industry.

### Administrative Structure

The "First Five Year Plan" has charged the standing scientific committees of the Indian Council of Agricultural Research (I.C.A.R.) with this task in so far as the agricultural sphere is concerned. The Technical coordination Committee under the Ministry of Natural Resources and Scientific Research has to shoulder similar responsibility in the development of mineral resources and it appears that the Council of Scientific and Industrial Research is the machinery for co-ordinating research activities in the industrial sphere. But, in so far as an agricultural industry is concerned, the respective Development Councils will perhaps do the same, as one of their prescribed functions is to promote or undertake scientific and industrial research and to collect and formulate statistics. In view of the fact that the Development Council instituted for a particular industry is also responsible for establishing liaison between the public and private sectors, it has, perhaps, also to fill in the gap between research activities in the agricultural and industrial spheres. With this background of the administrative structure of the research activities in an agricultural industry, let us look into the possibilities of the advancement of fruitful scientific research in this domain.

### Agricultural Industries

Under this category may be classed the cotton, jute, tobacco, sugarcane, oilseeds, cocoon and other commercial crops. As an example, we may consider the problems concerning sugarcane agriculture and cane sugar industry. It is believed that the problems of other agricultural industries would more or less be similar.

### Research In Agricultural Sphere

#### *Cropwise Research*

As mentioned before, the I.C.A.R. has been entrusted with the task of co-ordinating

agricultural research throughout the country. Some aspects have been recommended in the plan for the consideration of this body ; for instance, whenever any research station is working under a Commodity Committee, the same staff should also carry out research in respect of other crops in the area. As a matter of fact, this idea came from the Royal Commission on Agriculture in 1929 and from Dr. Stewart in 1946. The I.C.A.R. as a central body administering agricultural research must necessarily see that agricultural research comprises all crops grown on a particular soil, in the interest of all round agricultural development. But, it appears that, for achieving quick results, cropwise administration of research may yield more satisfactory results, as already some Commodity Committees are stated to have done useful work.

Turning our attention to sugarcane research, if we start with the soil and consider it in relation to all the crops which it is asked to grow, then the sub-tropical sugar belt of Northern India may tend to disappear gradually, as emphasis will logically be placed on the more important food crops which are congenial to the soil and climate of that region. Whether such an eventuality would be permissible in the existing position of short supply of such an important food material as sugar, can well be imagined. Therefore, it would, perhaps be profitable to maintain the cropwise emphasis of research in the case of certain crops, though it does not matter through which agency, this is done. Whereas agriculture in general should indeed develop in a balanced manner, in cases of these important agricultural commodities in which admittedly useful work has been done by the Commodity Committee, the research work should be allowed to continue in a concentrated manner, wherever it is possible. The allocation of funds for such purposes

should also continue at its present level, if it is not possible to increase it in the proposed scheme of balanced development.

#### *Utilisation of research*

Another aspect which calls for immediate consideration of this co-ordinating body is that there shall be no hindrances in the way of application of well-tried results of research, in the field or factory. This may be illustrated by an example from the domain of sugarcane research. A successful harvesting schedule for sugarcane crop has been propounded by an eminent agricultural scientist. It has been tried out in research farms and also in a commercial firm with satisfactory results. An average sized factory of 1000 tons per day capacity can make an additional profit of 3 lakhs of rupees per season if it adopts the recommended schedule. But the co-operative societies in charge of distribution of sugarcane in U. P. and Bihar find it difficult to follow the schedule of maturity in the reserved area, simply because every cultivator will insist on having priority in the matter of supplying his cane whether it is mature or not, so that he may have the cash money in his hand as early as possible. Thus it is seen that, sometimes, well-tried results of research become fruitless for no fault of the research worker or no defect in the research programme. It will perhaps be necessary to make adequate provision of funds while planning the programme of research for the propaganda that may be necessary for popularising the results of research among the growers or factories.

#### **Research in industrial sphere**

Research in agricultural industries is planned to be looked after by the Development Council. The supply of the right type of raw material is indispensable for the proper development of the respective industry. Therefore, there will have to be close co-operation between the researches carried out on the agricultural aspects and their relative industrial aspects. As such there will have to be close co-operation between the activities of the I.C.A.R. and the Development Council so that any research project undertaken in the industrial sphere may yield dependable results.

#### *Pilot plants*

Another important aspect of industrial research is that pilot plants must be made

available for smoothing out kinks of the laboratory results. Not only that. As has rightly been pointed out by the Council of Scientific and Industrial Research, in some cases, semi-commercial or proto-type trials may be necessary before the soundness of a new venture could be definitely established. How this aspect will be administered by the National Research Development Corporation of India in the case of an agricultural industry will be watched with keen interest by all research workers particularly those whose laboratory or pilot plant results are awaiting development on a large scale. In this matter, co-ordination of work between this corporation and the Development Council will be as important as that in the agricultural research. Coming again to research in cane-sugar industry, it may be stated that some very promising new techniques evolved in scientific and technological institutions have had to look to the benevolence of the industry for even pilot-scale study which ought to be done in the institutions themselves. The development of by-product industry in sugar has been slow due to lack of facilities in this respect. The application of results of research in the manufacture of sugarcane wax is an instance in point. It seems desirable that those industrial concerns which make a really substantial contribution in this respect, should be offered special facilities. For example, their contribution for research should be treated as normal business expenditure and exempted from income tax under section 10(2)XIII of the Indian Income-tax Act. The Development Council concerned with the particular industry might, by such considerations shown to the industry, encourage private concerns to undertake pilot, semi-large scale or commercial scale trials of promising results of research.

It will be clear from what has been stated above, that the task of co-ordinating research activities in the various phases of an agricultural industry in this country is really onerous and that it calls for an all-out cooperative effort, for which the outlines as given in "The First Five Year Plan" must be elaborated, examined and given effect to with such expediency as will enable our country to keep pace with other nations in the matter of all-round scientific and technological advancement.

# Albert Einstein

Leopold Infeld

I remember my last visit to Einstein's home, just before I returned to Poland. I told him about my plan to go back to my native country. He understood the reasons for my doing so.

I then took leave of the man to whom I owe so much, who showed me great kindness as he does to everyone who comes in contact with him. Indeed, I probably owe him my life. Had he not invited me to come to him in 1936, I would no doubt have been one of Hitler's six million victims.

## Rise to Fame

I heard Einstein's name for the first time as an undergraduate student in Cracow (Poland) during my second year of studies. At the end of his lectures in mechanics, my Professor devoted the last two hours to the Special Relativity Theory. Later, while studying the Relativity Theory from the original MSS (there were no books on it at that time), I thought much about the genius and imagination of its inventor. With the exception of some specialists, no one knew Einstein's name at that time (1917).

Then suddenly, almost overnight, Einstein's great fame began. At this time I was a school teacher in a small Polish town and I did what hundreds of others did all over the world. I gave a public lecture on the Theory of Relativity and the crowd that queued up on a cold winter night was so great that it could not be accommodated in the largest hall in the town. Einstein's photograph appeared in many newspapers, and to my astonishment, I saw a face more that of an artist and a prophet than that of a scientist.

I saw Einstein for the first time in Berlin in 1921, when I was pacing the streets, trying my best to become a student at the University where Planck, Laue and Einstein lectured. I felt unhappy, because I knew nobody. I was lonely, as one can feel lonely only in a great hostile city. For weeks I waited for appointments with people—only to find how little they cared whether or not I was accepted

by the University of Berlin. Yet at that time this seemed to me the decisive question of my life. In desperation I rang up Einstein and, to my great astonishment, was asked to come right over.

## A Smile and a Cigarette

Kindness is a difficult thing to take when it comes suddenly against an icy background of hostility and indifference. Einstein greeted me with a smile and offered me a cigarette, talked to me as an equal and showed a child-like trust in everything I said. My short interview was an important event in my life. Instead of thinking about his genius, about his achievements in physics, I thought then and later about his great kindness, about his loud laughs, about the gentle way he talked, about the brilliance of his eyes, about the clumsiness with which he looked for a piece of paper on a desk full of papers, about the queer mixture of great warmth and great aloofness.

I did not see Einstein for the next fifteen years. I had a few letters from him on scientific matters, always full of kindness. To me, as to others, he never refused help when it was needed—always writing with simplicity and grace, never with impatience. Now, while writing these words, I am well aware that I was one of the very many who bothered Einstein with their scientific or personal troubles. I do not feel happy now, that upon my publisher's advice, I asked Einstein to write a few words about my first book—just a sentence or two. Instead I received a full

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*This article is reproduced from the W.F.S.W. Bulletin for July, 1954. Mr. Infeld is a member of the Executive Committee of the W.F.S.W. IN 1936, he became the collaborator of Einstein at Princeton (USA). He went on a visit to his native country, Poland, in 1949 and was profoundly impressed. He decided to stay and was given the task of organising the theoretical section of the Institute of physics.*

introduction, written with warmth and sympathy.

I went to America upon Einstein's invitation in 1936. For the next two years, I worked with him and saw him almost every day. We talked about physics; we wrote two papers and a popular book; we discussed hundreds of things: the Spanish Civil War, the Jewish problem, Idealism versus Realism in philosophy, and many others.

### Intensity of Internal Life

There are innumerable stories about Einstein, some of them true, some invented. They show that he is witty or unworried, or trusting or absent-minded; that he bursts quickly into loud laughter, plays with his hair, or goes without socks or tie. But none of these stories give a clue to Einstein's character. In trying to understand him it is difficult to proceed in an inductive way—that is, from facts or incidents to his personality. As in theoretical physics, so in writing about Einstein, the deductive method seems quicker and simpler; the development from theory to particulars. The "why" of such an approach is fairly obvious. Material facts matter less in Einstein's life than in anyone else's. The world of his sense impressions, of cold, hunger, pain, is dulled by the great intensity of his internal life. The adventure of Einstein's life is that of his mind.

Once, as Einstein and I walked across the Princeton campus towards his home, discussing questions only loosely connected with physics, I asked Einstein why he thought his fame had become greater than that of any other living scientist, perhaps greater than that of any scientist in the past. I remember vaguely that the question did not seem to interest Einstein, that he did not say anything striking or worth recalling.

When Einstein explains his theories, the thought of impressing anyone is as absent from his mind as water from the moon. He expresses his ideas slowly, thoroughly, repeating essential points, answering questions patiently, never assuming that his listener is either bright or dull. He speaks as though his object were to make the ideas clear to his own mind. The overtone "I did it, wasn't it clever of me?" is simply not there. Einstein may praise his work but only like a man who by accident has stumbled upon a priceless gem, never like a man who created it by the

work of his own hands.

Many times while we worked together, I marvelled at the depth of his thoughts, at the breadth of his vision and, above all, at the tenacity with which he clings to his problems. (Einstein often remarked to me that research ability is essentially a matter of character). Yet all these things seemed to me the less important the longer I worked with him. As great as Einstein is as a physicist he is equally great as a man.

### Great As a man

When one comes in contact with him, one is not overwhelmed by his greatness as a scientist. This greatness is engulfed by the greatness and strangeness of his whole personality. Einstein is unlike anyone else. And perhaps this simple fact is the real clue to his fame. The real clue is not the spectacular discovery of the bending of light rays. If this were so, why should this fame persist in a quickly changing world that forgets to-day its idols of yesterday? It must rather be his inner greatness, which the people of the world somehow sense and need for their comfort.

It is not difficult to comprehend Einstein's distaste for bullying, for pushing others around, or his readiness to defend any just and decent cause. Yet even this is not as simple as it seems. One would be tempted to think about someone sensitive to the outside world and to wrongs done, someone who suffers when he hears of violence or injustice. Yet such a picture would be entirely misleading. I do not know anyone as lonely and detached as Einstein. His extreme kindness, his decency, his straightforwardness in dealing with men and social ideas is, in spite of all the appearances to the contrary, impersonal and aloof. His heart does not bleed, his eyes do not cry, yet his deeds are those of a man whose heart bleeds and whose eyes cry.

Another limitation created by his aloofness is the lack of knowledge of the real life around him. This makes it unavoidable that sometimes people misrepresent to him causes which are worthy of his support; or making use of his kindness and aloofness they induce him to support causes which should not be his. Yet in the end he almost always speaks in the name of humanity. His own great honesty

## Late Prof. K. N. Bahl

Dr. M. L. Roonwal

THE passing away at the age of sixty-three on the 21st of April 1954, of Professor Karm Narayan Bahl at his residence in Lucknow will be mourned by Zoological and Educational circles all over India and elsewhere. His death is a serious blow to Zoology in the country, for wherever zoology is taught in India, Professor Bahl's name is a household word because of his brilliant fundamental researches on Indian earthworms and also because of his founding and editing, for nearly a quarter century, the series of books known as the *Indian zoological Memoirs*. Practically his entire teaching career was spent in the Zoology Department of the Lucknow University which he raised to a high pitch of efficiency.

### Early Education

Born on 14th February 1891 at Multan in the Punjab, Professor Bahl was educated at the Government College, Lahore, where he took his M.Sc. in 1913, securing a first class. In 1920, he was awarded the D.Sc. by the Punjab University for his discovery of a new type of nephridial system, which he termed the 'enteronephric', in the common Indian earthworm. He then proceeded to England where in 1921 he obtained his D. Phil. from the Oxford University where he worked in the laboratory of Professor Goodrich. On his return to India he was appointed Reader and Head of the Zoology Department at the Lucknow University in 1921, and was Professor from 1923-51. In 1938 he was awarded the D.Sc. by the Oxford University for his zoological researches.

His entire career, summed up below, was devoted to University teaching and research, but in later years he devoted some time to advisory and administrative work—the former as a member of the Government of India's University Commission and the latter as the Vice-Chancellor of the Patna University:— (i) Demonstrator and Assistant Professor of Biology, Government College, Lahore (1911-14); (ii) Professor of Zoology at the St. John's College, Agra

(1914-16) and Muir Central College, Allahabad (1916-19); (iii) Demonstrator in Zoology, Oxford University (England) (1919-21); (iv) Reader and Head of Zoology Department (1921-22) and Professor (1923-51) at the Lucknow University, Research Professor—Lucknow University, (Sept. 1951) and (v) Vice-Chancellor, Patna University (1951-52).

### Numerous Honours

Many honours were bestowed upon him. He was the President of the Zoology Section of the Indian Science Congress (1924), the Foundation Fellow and President (1933-35) of the National Academy of Sciences, Allahabad; the Foundation Fellow and Vice-President (1931-33; 1951-53) of the National Institute of Sciences of India; President "Vijnan Parishad" Allahabad (1936-38); Fellow of the Asiatic Society of Bengal, Calcutta; Foundation and Honorary Fellow (1952); Editor (1948-52), President (1950-52) and Vice-President (1953 till death) of the Zoological Society of India. He received, in 1942, the Joy Gobind Law Memorial Gold Medal of the Asiatic Society of Bengal, Calcutta, "for notable researches in Asiatic Zoology". At the instance of the Government of India, in 1946, he visited and lectured before several Universities and research Institutions in England and the United States. In 1948 he

and intellectual integrity were clearly shown when he advised American intellectuals last June not to testify before McCarthy's committee in these words:

"I can see only the revolutionary way of non-cooperation. Every intellectual who

is called before one of the committees ought to refuse to testify—that is he must be prepared for jail and economic ruin, the sacrifice of his personal welfare in the interests of the cultural welfare of his country."

visited Beirut as a member of the Indian Delegation to the UNESCO Conference. From 1948-49 he served as a Member of the University Education Commission of the Government of India.

### Contribution to Zoology

It is difficult to overestimate Professor Bahl's influence, both as a teacher and as a researcher on the progress of Indian Zoology. He was a superb teacher, his lectures being marked by remarkable lucidity and simplicity which captured the imagination of the students. His researches are marked by features which often characterise all outstanding scientific work, namely, a clear grasp of the fundamental problem, the instinctive selection of the right animal, the development of simple but effective techniques, and finally a lucid, succinct and logical presentation of the results in faultless language. The elucidation of the structure, development and physiological function of the excretory system of earthworms may be regarded as his most important contribution. His tastes, however, were catholic and he worked out with great skill the details of pairing and egg-laying in the snail *Pila* and the structure of the skull of the reptile *Varanus*.

He was the founder and the editor of the now famous series, *Indian Zoological Memoirs* on Indian animal types, in which eight volumes, some of them running into four editions, have so far been published. The publication of these *Memoirs* is a land-mark in the history of Indian Zoology as they provide the basis of graduate and post-graduate teaching of morphological zoology in India in so far as the invertebrates are concerned.

### General

Professor Bahl was short of stature (barely 5 feet 5 inches) and stocky in build, and was a man of active habits and pleasing temperament. Until two years before his death, his sixty and odd years rested lightly upon his shoulders—the hairs of his head were still largely black and his step light and firm. But in 1952 his heavy duties at Patna proved too much for him, and he suffered a nervous breakdown from which he never completely recovered. He is survived by a devoted wife, three sons and a daughter.

Besides editing the eight *Indian Zoological Memoirs*, of one of which (*Pheretima*) he was himself the author, Professor Bahl published 25 papers.

( Continued from page 10 )

Laboratories could not be undertaken with any degree of thoroughness, and secondly the Committee's outlook was strictly limited due to their lack of familiarity with the socio-economic factors affecting research in this country. In fact, a Committee consisting of representatives of Indian science and industry, if called upon to undertake a thorough study and appraisal of researches carried out by the National Laboratories and other research institutes, would have done so with a greater sense of realism and would have also felt themselves responsible for implementation of their recommendations. They could also keep under constant review any improvement or otherwise brought about by their recommendations. It is difficult to appreciate the reasons which actuated the government to entrust this time-consuming task of such great importance in the hands of foreign

scientists, however eminent, when they could not be expected to have time to do a thorough job. Even at this stage, the Government would be well-advised to appoint a committee of the representatives of Indian science, industry and scientific workers which could take the Egerton Committee's Report as their basis and apart from fulfilling the terms of reference with greater thoroughness, could also examine the position of science teaching in the educational institutions and universities, the place of regional laboratories and national laboratories in the context of the country's development, the building up of an industry for supply of apparatus, instruments and equipment to meet the needs of the research institutes, and a scrutiny of the research programmes keeping in view the socio-economic factors of the Indian situation.

## Book Reviews

### "Science and Industry in the Nineteenth Century"

By J. D. Bernal

*Routledge and Keganpaul Ltd., London, 12s. 6d.*

THE incessant efforts of Prof. J. D. Bernal to focus the attention of scientific workers and other members of the society, to understand the interrelationship between science and society has added one more significant volume to his illustrious works on such topics viz., "Social functions of science"; "Freedom of Necessity" "Science for Peace and Socialism". The present volume is entitled "Science and Industry in the Nineteenth Century".

#### Nature of the Problems

The book comprises of two essays. The first essay "Science and Industry in the Nineteenth Century" is divided into six chapters. In the introductory section of the first essay, Prof. Bernal dismisses, as an academic question, the idea of discussing how far the scientists themselves are responsible for the consequences of either good or evil of the discoveries and application of science in society. He asserts that we need the solutions to deal with our day to day problems and for planning the most immediate future, for we live in an age where science is recognised as a means of life or death for civilised society. He shows how this problem can be safely solved only by a study which takes into account how the present grew out of the past; for science and technology are pre-eminently traditional social institutions depending for their very existence on an accumulated stock of facts and methods. With this background, he starts to examine the relation of science and technology or more widely science and industry in an era like the nineteenth century when these relations were simpler than they are now.

The task of finding the relations between them is by no means an easy one. Science is still a somewhat unfamiliar part of social life and so it is very difficult for others to realise the changes that have taken place in them. Consequently many intelligent non-scientific people still think of science as it appeared to be in the nineteenth century as the product of individual efforts of men of genius instead of, as it now is, a highly organised new pro-

fession closely linked with industry and Government.

#### Economic Laws

Nineteenth century witnesses a period of expansion in all spheres of society—expansion of population, of manufacturing, of trade and of knowledge. In their time these increases seemed unlimited, they were taken to herald the achievement of a universal progress that was reflected in the World of Nature itself by the great generalisation of evolution. With the advent of free trade capitalism in the mid-century, economics was deemed to have found its true laws. By abandoning all restrictions, a Laissez-Faire liberalism would achieve the best distribution of wealth by the automatic operation of the laws of market.

What actually happened as we know, was very different. Far from producing peaceful progress, the nineteenth century ushered in the transitional period of upheaval and violence of the twentieth century. This revolution was an implicit consequence of the great new productive forces released by the scientific and technical advances achieved in principle in the eighteenth century but realised on a large scale in practice only in the nineteenth century. A brief account of the main line of scientific advance in all its branches made during the nineteenth century is well delineated in this section.

#### Energy

Chapter two deals with one of the far reaching discoveries in the physical science in the nineteenth century—the discovery of the

First and the Second laws of Thermodynamics. These are associated with the names of many men of science some of whom were almost forgotten, but Prof. Bernal pays due credit to everyone of them. A fascinating account of the utilisation of energy (thermal) for locomotion is described nicely. The idea of energy has gradually come to take the place of that of matter as the source of human well being or even existence. The wealth of countries is measured not by the gold they own but by the number of horse-power available to each of their citizens. The winning of material wealth itself—food from the fields, metals from the ground—is seen to depend on the energy available. Coal, oil, the sun and now the atom are valued for the energy they can produce. All this would be unthinkable but for the work of those who in the early nineteenth century separated out the concept of energy from the confusing variety of its manifestations.

### Chemistry

Chemistry is described in the third chapter as the dominant science of the nineteenth century. A large number of chemical industries were developed including that of Fermentation. The contributions of Pasteur shattered the earlier view and boldly put forward that the living yeast was the essential agent of the fermentation process. Pasteur's scientific career contains example after example of interaction of scientific discovery and technical progress. The combined attack of Pasteur's bacteriology and Claude Bernard's chemical physiology was to transform medicine from a venerable tradition into science. Now the doctor could for the first time in history intervene with understanding to help the curative process of nature and some times succeed where nature alone was bound to fail.

It was during the early part of the nineteenth century that chemists had come to recognise that there was nothing mysterious or fundamentally different about the chemistry of living matter. Liebig and his associates carried out extensive researches on animal and human nutrition. He divided the nourishment of animals and man into the now classical fats, carbohydrates and proteins and brought out how the first two were

burned up as fuel while the last provided for the repair of the mechanism. This proved a sound quantitative basis for the whole of agricultural chemistry.

### Steel

The age of steel forms the subject matter of the fourth chapter. Prof. Bernal has clearly shown how economic and technical factors combined to make the steel age the prologue of a new period of wars and revolutions. An intelligent analysis of the science and technology of steel manufacture and the original discoveries of Bessemer, Siemens, Martin, and Gilchrist Thomas gives the detailed picture how fundamental principles are made use of in the manufacture, though some times there will be belated recognition. Prof. Bernal holds the opinion that steel came in at a time when capitalism was already fully developed. Indeed the process involved in its making could hardly have been financed at an earlier period. The capital required was far greater; only the largest firms could survive and even these were forced to amalgamate. Steel kings like Carnegie, Schneider, Krupp and Vickers began to dominate the industry and the stage was set for the cartels and monopolies of the next century. Steel in one form or another was making up much of the capital export that characterised the new imperialism by which the industrial countries were extending their grip on the undeveloped areas of the world. The age of steel was to prove far more warlike and disturbed than the first age of iron, so accursed by the poets of Greece.

### Electricity

Chapter five deals with electric light and power. Electrical Engineering is undoubtedly the creation of the nineteenth century. The fundamental aspects of electricity and its sister sciences were thoroughly investigated. Once the distribution of electricity on a large scale was proved to be feasible and immensely profitable, there came a new demand for large efficiency power sources leading to the use of the water turbines. The practicability of the electric communication, transport, etc. were already in vogue. The electronic industry of the twentieth century with its radar and television is the nursery of modern physics providing

the money and the requirements for professional training that keep physical laboratories full. It owes almost everything to the incentive that led to the development of the first practical electric lamp of the nineteenth century.

### Science and Society

In conclusion (in the sixth chapter) Prof. Bernal observes that we find in this nineteenth century the close association in place and personalities between the social transformation brought about by the capitalistic economic system and the development of science. We note that science at the beginning of the century depended for its existence on the new industrial forces while at the end it had so grown that it could be used to create new industrial forces. This large scale scientific industry was in turn to produce economic and social strains which were to threaten the system that gave them birth.

We are now in the midst of a struggle which is evidently a major turning point in the history of mankind. In whatever form it may show itself, it is fundamentally one to determine whether the new forces, that science has shown men how to use, will be utilised in an orderly way for the benefit of all or will be monopolised and directed as they have been in the past for the benefit of a few. Prof. Bernal gives a positive optimistic picture when he guarantees that, in the long run, the constructive rather than the destructive use of science is bound to prevail. The human potential available to a society where the whole population is educated to think and work together scientifically vastly exceeds the power of any elite bent upon pressing their position by the elaboration of the most efficient means of destruction.

### Molecular Asymmetry

Chapter seven forms the second part of the book dealing with the subject "Molecular Asymmetry". It was prepared as a lecture given in 1946 at the Congress of Commemoration of the fiftieth Anniversary of the death of Pasteur. Prof. Bernal describes this crucial discovery as of the greatest of the nineteenth century. It is a classical case of the convergence of ideas from various fields—

chemical, crystallographic and physical—to reveal a new property of matter—molecular asymmetry. He gives a vivid picture of the actual history of the great discovery, its antecedents and its consequences. The grand old tartar industry was vitally helpful to the young and brilliant scientist to see something new which others had missed. Prof. Bernal gives extracts from Pasteur's original and unedited note books on the discovery. He expounds so beautifully how a discovery is a beginning as much as an end in science and from that of molecular asymmetry whole new sciences such as stereo-chemistry and bacteriology were to rise. After sketching the contributions of Pasteur, Prof. Bernal orients all the relevant facts to one of the most important aspect, that molecular asymmetry is directly related to the problem of life. Pasteur's thought was determined by a clearly fixed idea of the essential difference between living and lifeless things. He was fighting relentlessly against the ideas of Wohler and Liebig who wanted to reunite the two kingdoms—organic and inorganic. It was one of those dialectical quarrels where both sides are right and wrong at the same time.

We are now beginning to see that this dialectical opposition of the nineteenth century is explainable in terms of modern structural chemistry. It is in the study of the structure of molecules that we will discover in time, the means of controlling the living world and of understanding its origin.

### Conclusion

Prof. Bernal's serious complaint of the delay in the understanding, appreciation and application of the fundamental principles of science against the socio-economic factors in a given epoch may not be palatable to many scientists of conservative nature. This hiatus represents a parallel in this history of ideas to the economic obstructions that held up the development of technical invention in the same period. The whole theme is one of a close knit bunch of strands in the history of science and technology in the nineteenth century.

Prof. Bernal hits his arguments with unimpeachable factual data. This has obviously forced him to introduce a large  
(See Page 25)

## Association Activities

### V. K. Fund Appeal

In the July issue of the Journal, we have appealed for collections for V.K. fund with a target of Rs. 5,000 by the end of the year. We are glad to announce that the response to this appeal has been very encouraging. Individual donations have been pouring in. The Calcutta Branch deserves to be commended for taking a pioneering lead in discussing this appeal at one of the recent meetings of the Branch executive and taking a decision to make a vigorous effort for the realisation of the target.

Notwithstanding this, the situation leaves much scope for improvement. This collection drive should be made one of the most important tasks before every committee, whether of the Branch or region or unit and should be viewed upon as a lever in building up the Association.

**The importance of this will be realised when it is remembered that there will be absolutely no money to bring the September and October Issues of the Journal. The Journal will live if this collection drive is given the top priority and the attention which it deserves.**

**Send in your donations. Send reports of your efforts and accomplishment.**

#### Calcutta

The first meeting of the new Executive Committee was held on the 27th July, 1954 with Dr. S.L. Hora in chair.

It was the general opinion of the members that articles on topical interest, as are often published, should form a regular feature. One or two articles of this nature should be able to attract the attention of the readers.

The Branch proposed to arrange for talks, once in two months at the first instance, by eminent persons, the full report of which might be made available for the journal.

The members were reminded of the Vijnan-Karmee fund appeal. It was proposed to send a special appeal to members of the Branch to donate liberally to this fund.

Executive Committee authorised the Preparatory Committee on the proposed convention on unemployment to raise funds for the proposed convention and disburse the money the way in which it considered opportune and necessary. In this connection the Executive Committee also resolved to donate initially a sum of Rs. 25/- to the proposed fund.

In the Executive Committee meeting it was considered expedient to hold a meeting of the Branch at Jadavpur as early as possible to revive the unit.

#### Lucknow

The Lucknow Branch Executive met thrice during the period under report. A programme of lectures and seminars has been drawn up. An emergency meeting of the Executive reviewed the situation created by

the retrenchment in the staff of the Medical College consequent on the abolition of the B.M.B.S. course. A deputation consisting of Dr. Ram Dhar Misra, Dr. V.S. Mangalik, Shri S.L. Kumar, Dr. D.L. Shrivastava and Dr. Nityanand met the Vice Chancellor of the Lucknow University in this connection and presented a memorandum placing before the authorities concerned the views of the Association on this important issue. A copy of the Memorandum was subsequently submitted to the Hon'ble Shri C.B. Gupta, Minister for Health and Medical Education, U.P.

#### Kanpur

*Scientific Workers' Association  
(Affiliated to ASWI).*

The following have been elected as office bearers of the Association for the year April 1954 to March 1955:—

<i>President</i>	Shri V.V.S. Murty
<i>Vice President</i>	„ J.N. Misra
<i>General Secretary</i>	„ M.R. Raman
<i>Treasurer</i>	„ M.S. Gupte
<i>Chairman (Bombay Branch)</i>	„ S. Ramabhadran
<i>Secretary</i>	„ H. Balakrishnan
<i>Treasurer</i>	„ K.G. Varghese
<i>Chairman (Delhi Branch)</i>	„ S.K. Kapoor
<i>Secretary</i>	„ M.N. Mehta
<i>Treasurer</i>	„ B.N. Tewari

#### Poona

Under the auspices of the Association, a public meeting was held in the month of July 1954, when Dr. P.R. Pisharoty, Meteorologist, Meteorological Office, Poona, delivered a lecture on "Meteorology in U.S.A."

**Calcutta Convention**  
on  
**“ Unemployment of Scientific Personnel ”**

**I**N view of the growing unemployment, under-employment and malemployment of scientific, engineering, medical and technical personnel in the country, the Calcutta Branch of the Association has decided to hold the convention in December 1954 to explore the magnitude of the problem and to find immediate and effective measures to check it.

In connection with the convention, the preparatory committee held a conference of the representatives of different learned societies in Calcutta on 3rd July 1954 with Dr. H.L. Roy, Professor of Chemical Engineering in the Chair.

Reputed scientists representing various learned societies were present in the meeting and they agreed to help in every possible way.

The meeting was unanimously of the opinion that every possible attempt should be

made to get a correct picture of the employment position. The meeting decided that in order to get correct information of the employment position of members of different learned scientific societies and their opinions regarding the problem, the following questionnaire should be issued.

The questionnaire, duly filled in, should be sent to Dr. D. Lahiri, Secretary, Preparatory Committee, Convention on “unemployment of Scientific Personnel”, 92, Upper Circular Road, Calcutta-9.

**Questionnaire**

1. Name.....
2. Address.....
3. Qualifications and Experience.....
4. (a) Whether you are employed.....  
 (b) If so, (i) in what capacity?.....  
 (ii) Whether as a scientific or technical hand?.....
5. Name of the Firm or Institution with which you are attached (with nature of its business).....
6. Total number of Scientific and Technical Personnel engaged as against that of non-technical personnel.....
7. Number of hands working under you (technical/non-technical).....

- 
8. Whether any technical or scientific appointment is held by a person without having the specialised professional training otherwise required for such appointment? If so, state the number of cases (including respective designations).....  
.....
9. Cases of supercession in scientific or technical postings, if any (state number).....  
.....
10. Number of foreign scientific or technical personnel employed in the establishment.....  
.....
11. If Indian understudies are attached to foreign technical or scientific personnel engaged in the planning, design or fabrication work .....  
.....
12. What are your suggestions as to the ways and means of solving the problem of unemployment among scientific workers, engineers and trained technicians in the country.....  
.....
13. What steps, in your opinion, the Government should take to solve the problem of unemployment among the scientific and engineering personnel in the country.....  
.....
14. Any other relevant information not covered by the above questions.....  
.....  
.....
15. Names of learned societies of which you are a Member.....  
.....  
.....

## Round the States

### Our Lucknow Diary

#### *Seven Institutes*

WITH the opening of Planning Research and Action Institute, Lucknow has now seven research Institutes controlled either by the Centre or by the State. They are: The Central Drug Research Institute, the Railway Research and Testing Centre, the National Botanical Garden, the P.W.D. Research Institute, the Indian Institute of Sugar Cane Research and the Public Analysts Laboratory. These, together with the Lucknow Medical College and associated hospitals form the nerve centre of research activities and development at Lucknow. The number of scientific staff on the rolls of these institutions may run up to 500. Housing shortage in the city continues to be acute and the majority of scientific workers find it difficult to secure even the barest accommodation unless they are prepared to pay exorbitant rentals quite out of proportion to their salaries. This is the urgent cry of the moment and scientific workers in the city have to get together to do something about it.

#### *Food Adulteration*

Food adulteration is on the increase in Uttar Pradesh. It is felt that although the existing provisions of Pure Food Act are not very satisfactory, the machinery that is entrusted with the job of enforcing these regulations is

not entirely fool-proof. The Public Analysts Laboratory needs strengthening in the form of modern apparatus, more staff and laboratory space. These will go a long way in examining the steadily increasing number of samples and their speedy disposal.

#### *More Hospitals*

According to a tentative Plan drawn up by the Health Department of Uttar Pradesh, the Government propose to open 150 general and women's hospitals in the next seven years. Besides these a number of specialised clinics, sanatoria and medical colleges will be opened. It is to be hoped that a tradition for research and original investigation and the proper academic atmosphere for these will be ensured in these new Institutions.

#### *New Curriculum*

Acharya Narendra Deva Committee has recommended English to be made optional at the High School and Intermediate level. Out of the six subjects taken, three are to be compulsory and three optional. Hindi and Sanskrit are to be made compulsory and Mathematics for Boys and Science for girls. The new curriculum is effective from 1956.

B.M.G.

### Our Nagpur Diary

Pt. Ravi Shankar Shukla, the Chief Minister of Madhya Pradesh, declared open the imposing Government Science College at Rajpur, on the 18th July. Speaking on the occasion, Pt. Shukla stressed the importance of scientific and technical education as being the precursor of all advancement and progress. The opening of a Polytechnic Institute in the backward Chhattisgarh area was also receiving the active consideration of the Government, said the Chief Minister.

A Homeopathic Mahavidyalaya, run by the Homeopathic Education Society, has been started at Akola. The Homeopathic and Biochemical College at Nagpur, with an attached dispensary, will start functioning

from September, 1.

#### *Health Scheme*

The Union Minister for Health, Rajkumari Amrit Kaur, performed the opening ceremony of the Madhya Pradesh Vaccine Institute Extension at Nagpur, on July, 11. The Rs. 4.5 lakh Extension is a part of the Rs. 8.71 lakh scheme under the Five Year Plan. The Extension has a fully equipped laboratory and will manufacture, beside the small pox vaccine, sufficient cholera vaccine (30 lakh doses) to cover the entire requirements of the state, resulting in a saving of c. 2 lakhs for its import.

Rajkumari Amrit Kaur also declared

## News and Notes

### Our duty as scientists

THERE is no escape from the present dilemma apart from the international control of atomic energy. It is our duty as scientists repeatedly to emphasise that such control is technically feasible; that all nations are agreed on its necessity; that both the U.S.A. and the U.S.S.R. have accepted the principle of permanent inspection, and of a system of control, not subject to veto, whereby suspected violations may be investigated.

In short, that no fundamental issue now stands in the way of agreement. Without such an international control the whole world will continue to live in this shadow of a frightful catastrophe.

But it is not sufficient for us to point out the dangers of our present situation and to suggest ways of avoiding them. The great destructive powers which have even conjured up sometimes lead honest people to look askance at science and scientists.

Conscious of this tendency, the British A.Sc.W. in a recent statement on the hydrogen bomb, has rightly pointed out that whilst scientists have certain public responsibilities in view of their specialised knowledge, the final responsibility for the use of weapons must always rest with those who exercise political power.

But in addition, we should do more to stress the great benefits which can flow

from the peaceful applications of science to human welfare. In the temper of the present times, there has been a tendency for scientists in some countries to take a cynical attitude to such questions, to regard them as pious expressions of good will with no serious bearing on practical affairs.

Such a view is profoundly mistaken. In science, as in other human affairs, to lose moral prestige is to begin to lack creative power. Our great scientific traditions were established by men who were profoundly confident in their capacity to solve problems by an application of the scientific method to every aspect of human affairs, and who believed that the proper end of the sciences was to endow human life with new inventions and wishes.

Our scientific tradition has been sustained because of the high public esteem in which such philosophy is bound to be held. In a situation in which the health and vigour of the sciences are of profound importance for the future of the whole world, we should do everything to foster a public regard for science.

We shall, as scientists, be worthy of our traditions and shall strengthen them only if we contribute to relieving the present misery in the world and to producing the abundance that is now technically possible.

(C. F. Powell, *W.F.S.W. Bulletin*, July, '54)

open the 50-bedded T.B. Sanatorium at Buldana on July, 9.

It is heartening to note that the State Government has decided to launch soon a five year plan for the eradication of leprosy. More beds would be provided in the Raipur Leprosy Hospital and a colony would be found at Gunga Nala near Champa in Bilaspur District. Leprosy has been on the increase in the state at an alarming rate.

### *Development of Cottage Industries*

The State Government has sanctioned a scheme for the development of village Leather and Pottery Industries, at a total cost of Rs. 189,240. The main object of the scheme is to improve the technique of the hereditary workers by training them in the use of improved tools and labour-saving con-

trivances and processes.

The Industrial Institute, Department of Industries, Nagpur will shortly start conducting training classes in various cottage industries. No fees will be charged but the trainees will bear the actual expenses on raw materials required. A separate section for ladies has also been organised in the Institute for imparting training in vocations suitable for ladies.

### *Rich Manganese dioxide Deposits*

It is reported that rich manganese dioxide deposits have been located in Sausar Tehsil. The ore contains 90% Mn O<sub>2</sub>; iron content is less than 1%. Manganese mine of Madhya Pradesh, though richest in the world, had not given such high quality ore uptill now.

Y.R.C.

## Science in Ancient India

ACCORDING to an article by Mr. Jean Fillozat, Professor of the College of France, published in the *Journal of World History*, research in ancient India led very early to the development of theories which, although ahead of their time, were nevertheless logical systems of thought about the structure of reality, that is to say, of science. He deals chiefly with astronomy and physiology discussed in the oldest Indian texts between 1500 and 500 B.C.

The most important astronomical work revealed in the Vedic texts is the list of 27 or 28 constellations marking the path of the moon. This sort of lunar zodiac evidently contributed to Brahmin religious rites, which were based upon the position of stars; it permitted simultaneous determination of the position of the full moon and the sun in relation to the stars. Such astronomical knowledge was widely diffused in other countries. Later, when India became acquainted with Grecian astronomy, through cultural and commercial exchanges with the Roman Empire, these earlier methods were combined with the new ones dividing the zodiac into 12 "houses"; the most widely used mechanism for astrological divination.

Two other discoveries in the field of astronomy were noteworthy, that of the trigonometric sine and of the "cosmic cycle". The former of these is described in a treatise dating from the middle of the 4th century

B. C. The Arabic astronomer, Al Battani, who introduced it to the West, gave full credit to its Indian origin. This was the basis for the development of trigonometry.

Calculation of the cosmic cycles of the universe were related to speculations in Greece and Western Asia about the "Great Year"—the period required for the stars to return to exactly the same apparent position which they occupied at the beginning of the interval. There is a close resemblance between the Grecian and Babylonian computations and those made in India much earlier.

In the fields of physiology and medicine, conceptions current in India between 1500 and 1000 B.C. are encountered later in Hellenic and Mesopotamian records. Some of these had an important place in the medical theories of Hippocrates.

Considering that it was India which first adopted the system of numbers, probably of Mesopotamian origin, which is the basis for our arithmetic, and spread it throughout the world, one is disposed to agree with Professor Fillozat that ancient India was indeed an energetic and influential source of scientific thought. It seems also reasonable enough to claim that she spread it throughout a region far greater than that reached by Greek science, which so generously welcomed and also diffused, along with her own teaching.

*Curr. Sci.*, 23 (6): 179, 1954)

(Continued from page 19)

number of footnotes which may be vexing to an easy reading of the book.

Every scientific worker who is pledged to the Charter of Association of Scientific Workers of India is sure to be benefitted by the study of this fascinating book. He will be able to understand the current forces of society which are directing the life of the millions of Indian people. He can think

over many of the formidable problems that are threatening with poverty and distress of our masses. A correct analysis of science alone can redeem the misery of the people. This book will certainly function as a guide to further action.

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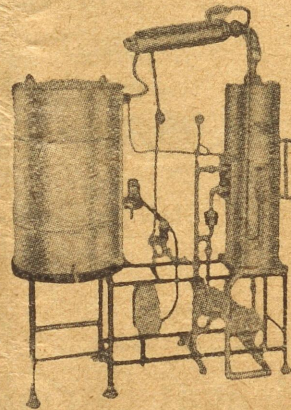
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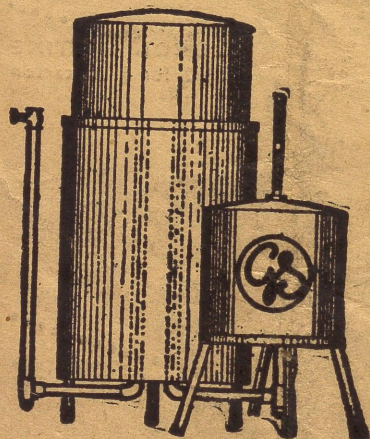
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# VIJNAN-KARMEE

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SEPTEMBER 1954

[ No. 8

Editorial : The Flood Problem

Logical Positivism and Dialectical Materialism

at work in Mathematics.....*Jagjit Singh*

The Spectroscope in Science and Industry.....*K. S. Korgaonkar*

Meteorology in U.S.A.....*P. S. Pisharoty*

Facilities for Technical and Industrial Training in U.S.S.R.....*S. S. Sokhey*

*and other regular features*

*Editor*

**Narendra Singh**



**I had  
three hours  
to produce  
a miracle!**



**W**HEN the office peon called with the chit I was looking forward to an easy afternoon. When he left I had three hours to produce a miracle. My husband was bringing his boss home to dinner! It was too late to order anything special—yet I knew how important this dinner was to my husband. Just then the postman brought a big envelope. In it was a shining new Dalda Cook Book I had ordered.



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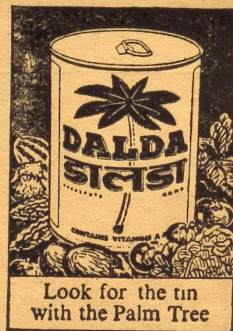


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## Charter for Scientific Workers

"I consider it a privilege to be associated with the Indian Association of Scientific Workers. Such an Association was urgently needed in India and the Indian Science Congress has given shape to it at the right moment. It is meant to protect these workers and to help them. It is meant also for the advancement of science and the service of the community. I hope that scientific workers all over the country will join this Association and make it an active and vital organisation."

—Jawaharlal Nehru

# विज्ञानकर्मी

## VIJNAN-KARMI

Vol. VI ]

SEPTEMBER, 1954

[ No. 8

### The Flood Problem

A total area of 132.20 lacs of acres of land flooded, Rs. 38.50 crores worth crops damaged, Rs 11.74 crores worth damage to houses, 7202 cattle lost, all contributing to an aggregate loss estimated at Rs. 50.24 crores in the states of U. P., West Bengal, Bihar and Assam—such is the grim tragedy caused by the floods in 1954 in these states. The aerial and field inspections of affected areas by as many as three Union Ministers, including the Prime Minister himself, further underline the gravity of the situation and governmental awareness to the need for urgent action to set afoot relief, short term and long term remedial measures. Shri Katju outlined the extent of damage done and the nature of relief operations undertaken in the several states. Shri Kidwai has assured us that the food situation will not be aggravated by this unexpected natural calamity. Shri Nanda has given considerable thought to the remedial measures to be undertaken for short term and long term solutions, on a “war footing”, as he himself chose to describe it in the course of the debate in the Lok Sabha on 11th September.

Although the intensity of the problem varies from year to year, the problem itself is nothing new. Occurrence of floods and consequent damage have become regular features in U. P., Bihar, West Bengal and Assam. While relief operations must be undertaken on an adequate scale, it is time that permanent remedial measures were given higher priority and greater attention than hitherto to prevent extensive flood damage. It is unfortunate that flood control measures did not figure prominently in the first Five Year Plan. As Shri Nanda himself admitted, “in the past years, there was lack of sustained and systematic effort to deal with the problem on a comprehensive basis.”

The measures now outlined by the Government have to be viewed in the light of their effectiveness to remedy past neglect and to launch immediate action.

Although Shri Nanda outlined on 3-9-54 a three phase programme

comprising the first phase of collection of data for the first two years, the second phase of short term measures starting with the second year extending to the sixth or seventh year, and the third phase of long term measures for three or five years following thereafter; it is heartening to see that he has relaxed the neat rigidity of this time table when he announced in the Lok Sabha on 11-9-54 that the Government "might provide some kind of protection to towns being eroded by floods and where valuable property was threatened.....to be done quickly within a year or so."

Moreover, it is difficult to comprehend the low priority given in the time table to the construction of "storage reservoirs on tributaries of certain rivers", especially in the face of the official admission that "construction of storage reservoirs and diversion channels, wherever feasible, is obviously amongst the most effective measures for the control of floods". If this be so, "the most effective measures" are naturally entitled to a higher priority in the time table. They should be initiated, "wherever feasible", even in the second phase itself, after the collection of necessary data, along with "embankments and channel improvements", but not relegated to a distant future.

We, therefore, urge that the time table laid down should be suitably altered, or, at any rate, should not be rigidly enforced; but the most effective plan drawn up for each affected area and implemented according to priorities warranted by conditions peculiar to each area.

We congratulate the Government for the speed with which they have set up a Central Flood Control Board. Similar Boards are envisaged in all the affected states; to begin with, in U.P., Bihar, West Bengal and Assam. The State Boards will be represented on the Central Board. After a three day visit to the flood affected areas in the above states, the Prime Minister has announced that "it is intended to set up two major river valley commissions : one for the Ganga and the other for the Brahmaputra. In addition, it is proposed to have a Central Board supervising and coordinating the work of these Commissions". The relation between these Commissions and the State Boards needs to be defined. We urge that clarity of the organisational structure, right from the beginning is absolutely essential for effective action on the part of all these Boards and Commissions.

Frequent mention has been made of the magnificent success which our great neighbour, China, has achieved in this field by enlisting popular participation in governmental schemes to an extent which has not so far been possible in our country. The delegation of top ranking Indian engineers which recently toured China has testified to the speed of construction in that country, rendered possible by millions participating in flood control schemes with unbounded enthusiasm. Our Prime Minister, Shri Nanda and several other speakers who participated in the Parliament debate have also alluded to this.

There is no reason why the Chinese success can not be emulated with advantage by us. Common people all over the world have the same fervour of patriotism. The affected masses of U.P., Bihar, West Bengal and Assam are

only awaiting the touch of the spark for lighting their potential energy, which, if once aroused, can accomplish the seemingly impossible. To argue that the socio-political conditions in our country are different from those in China and hence we can not copy the Chinese example, as some are arguing today, is to lull ourselves into a false sense of complacency. There is no room for harping on such differences on such an important question as mass mobilisation for flood control. To think that socio-political conditions existing in our country today are a great impediment to mass mobilisation is to cast a slur on democracy, as it were. The all-round support extended to the Government by the Parliament on this issue augurs well for the future and demonstrates that the Chinese pattern of work is possible right today in our country. As Shri Nanda pointed out, "This is not a Party affair. In fact, if a National platform could be formed, irrespective of party differences and other distinctions, I am sure something great can be done. It is then possible to enthuse the people." Active participation of the people is the best guarantee for the success of any scheme. And yet, it is disappointing that while a complicated network of official Boards and Commissions is being set up, there is no evidence so far of any concrete scheme by which the people of the affected areas are associated not only with the execution of these schemes but even their formulation.

This question has a vital bearing on the formulation of the schemes themselves. The need of the hour is not the preparation of long drawn out schemes running in their costs to hundreds of crores of rupees spread over decades and so complicated that people can not understand, let alone participate in them. Success lies in evolving schemes—may be less impressive and spectacular, but—effective and simple, so that large masses of affected people understand the nature of the proposed remedial measures and become their planners, besides builders. Control of floods is to be done by millions of hands of our countrymen and not by the hands of a select few. The role of the Government lies in enabling the people to do the job by providing the technical know-how. This is the lesson which China gives us and this lesson must be heeded. There is no other alternative.

Apart from questions of undertaking control measures and enlisting public cooperation in their execution, we, as a body of scientific workers, wish to draw attention to one important factor, which has not figured as prominently as it should, in a consideration of the flood problem. It is often not realised that the causes and nature of floods are not yet completely known, especially in Northern India. In other words, their scientific genesis needs to be better understood. This and other related questions are matters of research, which is still in a very incipient stage. Research on flood control problems should be immediately improved according to a planned programme.

The scientific and technological workers of India pledge their full cooperation to the Government in this matter of alleviating the sufferings of our people.

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## Logical Positivism and Dialectical Materialism at Work in Mathematics \*

Jagjit Singh

THE subject of this evening's talk is Logical Positivism and Dialectical Materialism. These are no doubt somewhat recondite, even high-sounding phrases. But I claim no credit for choosing them. They were chosen for me by your council. However, I should like to plead on their behalf that they had a very good reason for their choice. The reason is that positivism and dialectical materialism are the only two alternative philosophical outlooks open to us, twentieth century men and women, if we wish to adopt a standpoint based on modern empirical science. For one consequence of the success of empirical scientific method introduced by Galileo and Newton some three centuries ago has been the complete devaluation of the older metaphysical method of speculation. As this method reached its maturity during the second half of the nineteenth century, two distinct critiques of speculative metaphysics were developed—one by logical positivists and the other by dialectical materialists. Both agree that metaphysical speculation is idle pastime and leads nowhere, for instance, Comte, the author of the term "positivism" proclaimed that the "epoch" in which men tried to arrive at a comprehensive view of the world by metaphysical speculation was over and that henceforth we must cultivate the method of empirical science which alone provides "positive" knowledge. In a somewhat similar *key* Engels, who in collaboration with Marx laid the foundations of dialectical materialism, wrote that the advance of scientific knowledge led to a comprehensive view of the inter-communication of nature by means of the facts provided by empirical natural science itself and that this finally disposed of all need for philosophic system building.

### Radical Differences

But despite this debunking of metaphysics which both the systems advocate there is a world of difference between the positivist and dialectical materialist philosophies. The philosophies, (for they are nothing else) differ radically as to how the results of empirical science are to be used in understanding and changing the material universe around us. Now it would give you too schematic, bare, and abstract an idea of the two philosophies, if I tried to summarise their fundamental principles in a sort of vacuum divorced from the concrete scientific setting in which they have been developed. Such a treatment may even be grossly misleading. Since both philosophies claim to be rooted in empirical science, a better procedure would be to observe them at work in modern science. But science includes within its range all manner of diverse human activities,—from star-gazing to plant-breeding and I could not, even I wished, show you the two philosophic systems in action in relation

to the entire field of scientific activity. I shall therefore, attempt to show you how the two philosophies work in one particular science, Mathematics.

### Two Aspects

When we wish to study any scientific subject we may study it from two different aspects. First, we may study its history and evolution, that is, the historical aspect. Secondly, we may study its inner content, that is the material aspect. Taking first the historical aspect, dialectical materialism sheds a flood of light on the development of mathematics. Read, for instance, Hessen's **Social and Economic Roots of Newton's Principia** and you will understand why Newton was led to study the problem of gravitation. It was not to satisfy mere idle curiosity but because of its importance in navigation in an age of growing overseas trade. A systematic account of the development of mathematics from the dialectical materialist point of view has yet to be written but Hogben's **Mathematics for the Millions** deals with the development of mathematics up to the early eighteenth century. In this great classic, Hogben consciously adopts the dialectical materialist view of history. He relates each great mathematical development to its proper source, the productive relations of the period. He is thereby able to show with admirable clarity how mathematics is the mirror of civilisation.

The work that Hogben did in this book needs to be continued and in my projected book "Mathematics and You" I have tried to cover the ground up to the present day. For want of time I will quote just one instance from my book to illustrate how the development of productive relations in a society leaves its inevitable mark on the growth of mathematics. The instance in question is the rise of a rigorous school which introduced new canons of mathematical reasoning during the early years of the nineteenth century. It is not that mathematicians of the early nineteenth century such as Cauchy, Galois, Abel, Weirstrass, etc. began all of a sudden to argue less loosely than their predecessors. No they were virtually driven to it and if you will permit me a short digression I will show you how it happened.

### Need of Trade

Lewis Mumford has divided the history of the Western machine civilisation during the past millennium into three successive but over-lapping and inter-penetrating phases. During the first phase, the eotechnic phase, trade, which at the beginning was no more than irregular trickle grew into a veritable flood. This left in its wake a rich sediment of pros-

\* Paper read in Lucknow University under the auspices of the Lucknow Branch of ASWI, reproduced from National Herald of August 21, 1954.

perity which transformed the whole life of Western Europe. It is true that the development of trade led to a steady growth of manufacture as well, but on the whole, throughout the period, which lasted till about the middle of the eighteenth century, trade dominated manufacture. Thus it was that the minds of men were occupied more with specifically trade problems such as the evolution of safe and reliable methods of navigation rather than with those of manufacture. Consequently, while the two ancient sources of power, the wind and water, were no doubt developed at a steadily accelerating pace to increase manufacture, the attention of most leading scientists, particularly during the last three centuries of this phase was directed towards the solution of navigational problems.

The chief and most difficult of these problems was that of finding the longitude of a ship while at sea. It was imperative that a solution be found as the inability to determine longitude led to very heavy shipping losses. Newton had tackled it although without providing a satisfactory practical answer. In fact, as Hessen has shown, Newton's masterpiece, the Principia, was largely an endeavour to deal with the problems of gravity, planetary motions and the shape and size of the earth to meet the demand for better navigation. It was shown that the most promising method of determining longitude from observation of heavenly bodies was provided by the moon. The theory of lunar motion, therefore, began to absorb the attention of an increasing number of distinguished mathematicians of England, France, Germany and America. Although more arithmetic and algebra were devoted to the Lunar Theory than to any other question of astronomy or mathematical physics, a solution was not found till the middle of the eighteenth century, when successful chronometers that could keep time on a ship in spite of pitching and rolling in rough weather, were constructed. Once the problem of longitude was solved, it led to a further growth of trade, which in turn induced a corresponding increase in manufacture. A stage was now reached when the old sources of power, namely wind and water, proved too "weak, fickle, and irregular" to meet the needs of trade that had burst all previous bounds. Men began to look for new sources of power rather than new trade routes.

#### Paleotechnic Phase

The change marks the beginning of Mumford's second phase, the paleotechnic phase, which ushered in an era of the "dark Satanic mills". As manufacture began to dominate trade the problem of discovering new prime movers became the dominant social problem of the time. It was eventually solved by the invention of steam engine. The discovery of the power of steam, the chief paleolithic source of power, was not the work of "pure" scientists. It was made possible by the combined efforts of a long succession of technicians, craftsmen and engineers from Porta, Rivault, Caus, Branca, Savery and Newcomen to Watt and Boulton. Although the power of steam to do useful work had been known since the time of Hero of Alexandria (50 A.D.) the social impetus to make it the chief prime mover was lacking before the eighteenth

century. However, in spite of the great social need for a source of power as a result of the phenomenal growth of trade during the eighteenth century a successful steam engine could not have been invented, had it not been for the introduction by craftsmen of more precise methods of measurement in engineering design. Thus the success of the first two engines that Watt erected at Bloomfield colliery in Strassfordshire and John Wilkinson's new foundry at Broseley depended, in a great measure, on the accurate cylinders made by Wilkinson's new machine tools with a limit of error not exceeding "the thickness of a thin six pence" in a diameter of seventy two inches. The importance of the introduction of new precision tools producing parts with increasingly narrower "tolerances in revolutionising production has never been fully recognised, and the entire credit for inaugurating the Industrial Revolution is usually assigned to the steam engine. And yet the transformation of the steam engine itself from a wasteful burner of fuel that it was at the time of Newcomen, into an economical source of power that it became in the hands of Watt and his successors seventy years later, was achieved as much by the introduction of precision methods of increasing fineness in technology as by Brake's discovery of the latent heat of steam.

#### The New Look

A natural consequence of the introduction of higher standards of refinement in industry and technology was that mathematical language itself became increasingly exact, subtle, delicate, fine, intricate and complex. The greatest change in this direction occurred in the language of the infinitesimal calculus, as the reasoning on which its technique had been based was shockingly illogical. The methods of calculus were accepted not because its reasoning was logically impeccable but because they "worked" that is, led to useful results. But now that industry was setting new standards of precision, mathematicians rose to the occasion and began to purge the calculus of all its illogicalities, loose methods of reasoning, and premises of doubtful validity. They thus virtually introduced a new look in mathematical reasoning that has come to stay.

#### No Explanation

While dialectics illuminates whole epochs of mathematical history, logical positivism either refuses to treat the question or treats it mystically. Officially it does not even attempt to offer any explanation as to why a certain development took place in a certain social or economic milieu. If pressed, it would say that the question whether there are any basic casual factors determining the general direction of the evolution of human societies and its component institutions is an empirical question and therefore cannot be decided a priori on logical grounds. That is fair enough. But when empirical evidence is presented to show that such factors are the changes in the mode of sustaining life and the system of economic production, the logical positivists reply that economic motivation is not the sole motive and is only one among the many. That is setting up an Aunt Sally merely for the fun of knocking her down for no dialectical materialist ever says that economic

motivation is the sole motive force of history. Life is complex and its manifestation even in any one sphere whether politics, art, science, music or mathematics reflects in some way or another an infinity of aspects of the real world. But this is not to say that the development of human societies is the result of a fortuitous play of an infinity of factors. For if so, how is it that the various expression forms of a society such as, its architecture, sculpture, painting music, drama, religion, ethics, science, mathematics have an underlying congruity? Even some of the logical positivists themselves have noticed this underlying congruity. But they try to account for it by adopting the fideist view borrowed from Oswald Spengler, namely, that the culture of a people is quite literally a biological phenomenon. Like all living creatures it is born, it grows and after a long or short period of adolescence it declines and finally dies. Consequently, all its various manifestations must exhibit an inner unity, very much like the unity of the diverse activities of a single individual. Thus, for instance, the logical positivist Keyser wrote "taken together, not as a mere collection but as a spiritually organic ensemble of inter-related and cognate partial manifestations of one manifold life" these expression forms determine the character of the whole culture. Despite the great difference existing between the various expression-forms of any given culture each one of these forms mirrors the culture of which it is the product, in particular therefore, the mathematics of any major culture is an index of the type of the culture as a whole.

#### Close Tie-Up

Now the reason why art, religion, science, ethics, mathematics, etc. of every civilisation or culture show a family likeness is this: there is at all times a close tie-up between the diverse expression forms of a culture on the one hand and the current methods of production and distribution on the other. For as Marx and Engels were the first to remark, the way the men earn their living, the mode of production and exchange,—must form the basis of every society and in the last analysis determine the general character of the social, political and spiritual process of life. While man, no doubt, does not live by bread alone, it is the one thing that he cannot do without a fact that leaves its indelible mark on history. This thesis, known as the materialist conception of history, makes it possible to understand an otherwise incomprehensible unity underlying the entire gamut of expression-forms of any given epoch. Logical positivists, on the other hand even when they do manage to grasp a truth intuitively try to explain it away by invoking a mysterious spirit that drives a culture quota capriciously sometimes in one direction and sometimes in another. Verily, none are so blind as will not see!

#### A Fundamental Problem

I shall now examine the content of mathematics in the light of logical positivism and dialectical materialism. One of the fundamental problems of mathematics is the reform of mathematical reasoning so as to avoid paradox or contradiction. Mathematical reasoning has been haunted by the fear of paradox since the days of Pythagoras and Zeno. Pythagoras

found to his dismay that the diagonal of a unit square cannot be expressed as a ratio of two integers and Zeno astounded Athens by apparently proving that the fleet-foot Achilles could never overtake the crawling tortoise. Paradoxes in many ways similar to these have been discovered from time to time and as recently as the close of the nineteenth century a whole series of them were uncovered by Burali Forti, Russell, Richard, König, Berry and others. The logical positivists claim that if mathematical reasoning is to avoid paradox and contradiction not only here and now but "for ever", then it must be reduced to logic which is nothing but language or rather the syntax of a language. But what is a language? Language, of course, is the agency whereby men communicate to one another their ideas. In the extended sense used by logical positivists it includes any system of signs or symbols used for the purpose of inter-communication. These signs may be sounds (spoken words), marks on paper (printed words), or any other signalling device such as flash light, etc. Now it is well known that everyday language such as we all use in our daily affairs is by no means perfect. Excellent though it be for the purpose for which it was evolved by the total social effort of the community, it does not always enable us to say exactly what we intend to convey. This is very often the cause of misunderstandings, especially when we study the message of prophets, thinkers, leaders and important personages who have something particularly significant to say to the world. Indeed, a single line in their work may sometime require a Talmud of commentary to elucidate what it really means, while to others it may still remain meaningless. Logical positivists claim that all such confusions arise from inadequate understanding of the nature of a logically perfect language. Not that they have constructed such an ideal language for universal use. Far from it. But they consider that an understanding of the conditions of a logically perfect language will dissipate all confusions.

#### The Perfect Language

Now what are the conditions of logically perfect language? First, the rules of its grammar must explicitly exclude nonsensical combinations of signs (or words). What this means is that every language such as English has to have a grammar or rather syntax which lays down rules for combining different signs or words. But these grammatical rules are not as 'precise as an ideally perfect language would require. For instance, the laws of English syntax explicitly exclude such a word-combination as "heavy is spectrum this" but not "this spectrum is heavy", although both are nonsensical combinations of words. The reason why the syntax of English language often permits such nonsensical word-combinations as the latter is that its syntax is not as complete as that of a perfect language. The syntactical rules of a logically perfect language must exclude all nonsensical word-combinations. In such a language, its grammar or syntactical rules would not allow us to form any meaningless word-combination like the one cited above. Secondly a symbol or a sign must not be ambiguous it must have a definite and unique meaning. Ordinary language such as English, of course, abounds in words with multiple meanings. For instance 'rubber' may

mean in one context an eraser for rubbing off pencil marks, and in another winning of two games in a round of two or three games of bridge. Thus, on both counts, the language of everyday use such as English falls far short of the ideal and is in need of a theory of Symbolism for carrying out a comprehensive programme of what the logical positivist Morris has called "debabilization".

#### Russell's Aphorism

The first to point out the need for such a theory was Wittgenstein but as he was led head-on to solipsism, the doctrine that nothing is real except my sense—data and you and everything else around are nothing but my dream, most logical positivists now consider this consequence of Wittgenstein reasoning to be a great defect. Carnap, another famous logical positivist, undertook to remedy this defect. He took his cue from the celebrated remark of Bertrand Russell that Mathematics is the only science where, one never knows what one is talking about and whether what is said is true. At first sight Russell's aphorism might appear to degrade mathematics to the triviality of a meaningless gibberish. But what he meant to say was that in mathematics one deals with various entities without knowing or even caring to know their exact 'meaning'. Take, for instance, the branch of mathematics usually called geometry wherein one deals with entities like points, lines, planes, circles, etc. Now if we attempt to define what we 'mean' by these terms we often encounter pretty serious difficulties. Thus the text-book definitions of geometrical terms, e.g. of a point as "that" which has a "position but no magnitude" or of a straight line as the "shortest distance between two points", etc. are not quite satisfactory even though they may be good enough for a beginner. Since the attempt to define the meaning of mathematical terms leads sometimes to confusion or contradiction, Russell and his followers propose that "pure" mathematics should have nothing to do with the meaning of the terms of its discourse. All that is necessary for the development of mathematics is to start from certain arbitrary definitions and axioms or "formal" rules according to which the terms of its discourse are to be used in the sequel and to stick to them consistently throughout. Thus, in "pure" geometry, the geometer should not concern himself whether a 'point' means an infinitely small dot and a 'line' an infinitely thin scratch on a piece of paper but should merely specify the axioms or "formal" rules according to which he proposes to use them in developing his subject. For instance, he may proceed by postulating that there are certain things called points, lines, planes, etc. such that two points determine a line, two lines determine a point, and so on. From these and other similar axioms explicitly set up at outset, he should derive all the conclusions that follow logically. In this way, he would never know what he means by the terms of his discourse and whether what is said of them is true. He would thereby avoid having to answer certain awkward questions regarding the nature of mathematical entities or concepts although his theorems would be denuded of all 'content' or 'meaning' as a result and would possess a purely for-

mal structure—a sort of internal relatedness among themselves.

Now this method of formalised discourse has been in the main self frustratory and sterile even though it may have been partially useful in elucidating the formal relations existing between the various kinds of mathematical symbols. But pushed to absurd extremes by the logical positivists it has only led to fantastic absurdities unparalleled since the time of the scholastics of the thirteenth and fourteenth centuries. Here is one classic instance from the work of two celebrated Polish logicians, Chistwek and Hepter, who in their *New Foundations of Formal Mathematics* make the statement "the sign C is the fundamental element of our expressions. It has no meaning at all". Obviously, the authors have in mind their own meaning of 'meaning' into which I need not go at present.

#### Carnaps View

In spite of the failure of Russell's method of formalised discourse in mathematics, it has recently been imported in logic and philosophy by the logical positivists of the Vienna School. Carnap, the leader of this philosophical movement, says in effect that just as the attempt to define the 'meaning' of mathematical terms leads to confusion and contradiction, so also the attempt to read 'meaning' in the propositions of logic and philosophy gives rise to philosophic difficulties and pseudo-propositions. He, therefore, proposes that in logic and philosophy we must deal only with the relations between different propositions but never with the relation between a proposition and the fact it represents. In other words we may never inquire into the 'meaning of philosophic propositions'. But how, one may ask are we to deal with propositions which are not allowed to have any 'meaning' or whose meaning we are forbidden to investigate. In order to do this, Carnap distinguishes two modes of speech. In the one he calls the "material" mode of speech, statements concerning objects 'facts', or 'states' of affairs have 'sense' 'content', or meaning. In the second, he labels the "formal" mode of speech, propositions have no 'meaning' or 'content'. They say nothing at all about the world at large and are merely conventions covering usage of certain words or terms in subsequent discourse. Thus, for instance take the proposition which in the 'material' mode says that 'time has neither a beginning nor an end'. According to Carnap, a discussion of this thesis in the 'material' mode, that is, as a proposition referring to the flow of time in the real objective world could give rise to "insoluble difficulties and contradictions". This is, indeed, true. Kant showed in what he called the First Antinomy of Pure Reason when he demonstrated that it could be proved equally conclusively that time has a beginning and that it has none. Carnap therefore suggests that we should translate this thesis in the "formal" mode. Every positive and negative real number expression can be used as a 'time co-ordinate'.

(To be continued)

## The Spectroscope in Science and Industry

Dr. K. S. Korgaonkar \*

**T**HERE exist few scientific instruments which can outflank the Spectroscope in its range of application and analytical powers. At one time, this premier position was assigned to the microscope. The phenomenal progress in biological and medical sciences is no doubt due to the microscope. But in recent years Spectroscopy has found applications in such a wide variety of scientific and industrial fields that the Spectroscope is assuming a role of Master Key of Science.

How hot is the Sun? Is life not possible on Jupiter? Ask the Spectroscope. How much does the core of a uranium atom weigh? How many electrons are there in a carbon atom? How much vitamin A does this sample of cod liver oil contain? Is the illness of that worker in a paint factory, due to lead poisoning? What is that impurity which is producing those green spots on the clean white glaze of these porcelain ware? Is it the same tool which the burglar used in breaking open that kitchen door? Such innumerable questions of scientific, industrial or forensic nature are being asked from time to time, and answered correctly with the aid of the Spectroscope.

It was Sir Issac Newton who in 1666 A. D. introducing a glass prism in the path of sunlight, first split the white light into a spectrum of colours and thus laid the foundations of spectroscopy. This separation of light into its component colours was only partial with considerable overlapping. The first instrument which could separate light into its ultimate purity of colours was made by a Munich optician Fraunhofer in 1814 A.D. and that was the first Spectroscope built.

Despite its tremendous analytical powers a Spectroscope is very simple and almost a fool-proof instrument. It has a few parts and no moving part to wear out. Light to be analysed is sent into the Spectroscope through a narrow slit. Then it passes to a prism or similar device which separates the different waves of light in accordance with their lengths. Waves of a particular length are sent in a particular direction and a telescope which receives them makes them appear as a line of coloured light, an image of the Spectroscope slit in colours of utmost purity. Thus light waves of different lengths appear as lines of different colours at different places. Since the Spectroscope arranges the spectrum lines in order of wavelength, it is not necessary that they be seen in colour. They can be photographed and later identified from their positions only. In fact it is more advantageous to photograph the spectrum than to see it

through a telescope. For our eye is sensitive to visible light only, while a photographic plate is sensitive in the ultraviolet and near infrared regions also. Moreover, a photographic record can be retained and examined in detail at leisure. Hence in most of the instruments a telescope is replaced by a camera and the instrument is then called a Spectrograph.

There are two types of Spectrographs, a prism type and a grating type. In each type instrument is again available in different sizes viz., small, medium and large size and in several "mountings" or arrangements of the parts. Different mountings have different advantages. In a small size prism instrument the spectrum length is about 3 inches; in medium size it is about 8 inches and in large size it is about 2 feet long. For a given wavelength range, larger the length of the spectrum, better is the separation between the different component wave length and the instrument is said to possess better "dispersion".

When very large dispersions are needed, instead of a prism-instrument a grating-instrument is used. A grating is highly polished mirror on which as many as 200,000 sharp parallel scratches have been accurately ruled 15 to 20 thousand to an inch with the point of a diamond. The grating instrument eliminates the use of lenses necessary for prism instruments and can be used for any region

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ultraviolet, visible or infrared within reason. Large grating instruments throw light into a spectrum hundreds of feet long, around a huge circle and allow the wavelength measurement within an accuracy of 1 part in 3 millions.

Until the recent progress in the technique of time measurement by the high frequency crystal oscillators, there was no measurement known in science which could equal the precision attained in the measurement of wavelengths. Since the light waves themselves are of length, only of the orders of  $\frac{1}{50,000}$  of an inch, distances even smaller than billionth of an inch could be measured by reference to the spectrum lines.

### Light from Atoms

The great analytical power of the Spectroscope is of course not totally due to the instrument but also depends upon the fact that the phenomena of light emission or absorption is a discrete atomic or a molecular phenomena and the light which the atoms or molecules emit or absorb, carries in itself many secret messages concerning these atoms and molecules.

Each kind of atom from hydrogen to americium emits light of certain wave lengths and those only. Hence just as an experienced radio listener knows when his radio tunes on 294 meters that he is hearing Lucknow station, Similarly a Spectroscopist knows that he is getting light from sodium atoms when he sees a doublet line in the spectrum at 5893 angstroms (1 angstrom=hundred millionth centimeter) or there are calcium atoms if 4226.73 angstroms line is seen. A Spectroscopist is even surer of his identification than a radio listener, firstly because Lucknow station might shift its meter band to some other wave length to suit the weather vagaries without the particular listener knowing about it and secondly because an atom broadcasts not on a single wavelength but on a group of wavelengths. Iron atom, for instance, gives more than 20,000 lines when excited in an electric arc or a spark. Moreover, it is practically true, and perhaps theoretically too, that no line is produced by more than one element. Hence it is not necessary to measure all the 20,000 lines to identify iron atoms. One or two lines, carefully measured, serve to identify any single

atom which emitted them. It is thus almost impossible for an atom to mask its identity if its light can be sent through a Spectrograph. The method is so sensitive that only minute quantities of materials are needed for spectroscopic analysis and even in such small quantities any element which is present in an amount as much as one millionth part of the whole does not escape its detection. It is no surprise therefore that spectroscopes should prove useful in a variety of problems where the usual macrochemical methods prove to be inadequate. More than ten rare elements were first discovered through the spectroscope.

### Biological interest

Amounts of metal so small as to detect chemically are often of great biological interest. Almost every kind of atom may be traced in the human body, But many of these are present in extremely small amounts, some essential to life others merely incidental. Even among those that are essential in small traces some when present in relatively large amount act as poisons. Chiefly among these are lead and arsenic. Very small amounts of any of these metals in the blood, can do a great damage to human body. Lead poisoning is one of the great hazards of industry. Lead fumes are found in some mines and storage batteries and paint factories. Workers in these industries are in the danger of accumulating lead in their bodies to danger point and succumb to diseases which are difficult to cure. It is, therefore, important to keep a regular check on the lead contents of the blood of such workers. By the aid of a Spectroscope this is possible. For, even when the lead contents in the body are as low as one atom of lead per a million molecules of blood, these could be detected by Spectroscope.

### Industry

No metal has been made so pure that spectroscopy could not find impurities in it. Even the 1000-proof gold which is the basis of the currencies of many countries reveals some atomic dirt to the searching eye of the spectroscopist. In industry very often some manufacturers, especially of drugs, want to keep a rigid control over their products, or at times they want to test the composition of some material of a rival firm, showing

superior qualities, say of Steel, used for the hair-spring by a rival watch-making firm and showing better temper and elastic properties. It is the spectroscope that can do the complete analysis of such materials.

### Crime detection

If a police officer wants to check whether a certain tool was used by the burglar in breaking open a certain door, he has simply to scrape a small amount of invisible dirt sticking to the tool and put it in an arc in front of the spectroscope and compare its spectrum with that of a sample of paint scraped from the door. If the two spectra are found identical it is a trustworthy evidence which could be produced before the court.

### Physics

To the physicist the apparent irregular distribution of spectrum lines means more than the mere presence of the atomic species. He has found the spectrum lines to fit into certain series and groups and he is able to deduce many facts regarding the structure of the atom and its innermost core, the nucleus. He can find how much the nucleus weighs, how many protons and neutrons are within the nucleus, how much is its "spin" how many electrons reside outside the nucleus and what are their motions and so on.

### Astronomy

Atoms which are studied with the spectroscope need not be even near the instrument. The light which they emit can travel billions of miles across space and still deliver their message when passed through the spectroscope. The instrument, therefore, is also an aid to an astronomer. With its help he can know the temperature of the stellar bodies and their motions in space. It is the spectroscope which has revealed that even the most distant nebula are made from the same elements we know on earth. More than three-fourths of the discoveries in astronomy are through the combined use of a telescope and spectroscope.

### Combustion

So far the applications of atomic spectra are only discussed. When a material under test is put in an arc or a spark usually it vapourises and its molecules are split up

into its atoms which give rise to the atomic spectra. Using milder methods of excitation such as a flame or a gaseous discharge or even arc in some cases it is possible to make simpler types of molecules, like one of nitrogen, or of aluminium oxide, to emit their characteristic light and pass it through the spectroscope. The molecular spectra normally gives a fluted or banded appearance. It has found important applications in combustion problems and in astronomy. In the process of combustion there occur certain reactions in which the intermediate products have only transient existence. These quasi-molecules are difficult to be dealt with by the usual chemical methods. It is, however, possible to catch them by the watchful eye of the spectroscope and study the combustion as it is occurring. This study has in fact opened a separate branch in spectroscopy known as Combustion Spectroscopy. By observations on the molecular spectra from the stellar bodies, astrophysicists are able to note the molecular abundance in different stars and determine their temperatures.

### Chemical research

In many biological and chemical researches, very often very complex molecules are of interest. It is not possible to excite such molecules without destroying their structure splitting them into simpler molecules or atoms. Proteins or vitamins for example would be burnt in an arc or spark. Fortunately, however, these substances can be studied by an entirely different technique where these molecules are not damaged. The principle used is that if a molecule can emit light of a particular wave length, it can absorb light also of the same wavelength. In this method, instead of exciting the molecules to emit light, these are allowed to absorb the light of selected wavelengths of their choice, when lights of different wavelengths is passed through the material. The spectrograph is used, in this case, to analyse not the light it receives but which it is missing being absorbed by the molecules before it enters the spectrograph. The absorption curve obtained from such data acts as a spectroscopic label or like a "finger-print" for that compound. This technique is also so sensitive that cases have been found when a layer of material

## Meteorology in U. S. A. \*

Dr. P. R. Pisharoty

### Incredibly efficient

A large part of the progress in the Meteorological Services of U.S.A. is directly attributable to the incredibly efficient system of tele-communications in that country. Observations taken throughout the country at any fixed hour reach the Central Office within ten or fifteen minutes, because almost every observatory is connected to the Central Office by a teleprinter circuit. In India, the time of transmission is about 2 hours. During the course of the day, fresh forecasts are issued 4 times to the public over the radio, and in many cases, the radio station concerned has the microphone installed in the Forecast Office, into which the Duty Forecaster speaks directly. Consequently, the forecasts heard by the American public are based on synoptic observations only two or three hours old, and such forecasts are issued afresh every 6 hours. In India, on normal days, the forecasts based on 0830 hrs. IST is heard over the All India Radio at about 6 P.M., nearly 10 hours after the observations, and with a period of future validity for another 24 hours, i.e. till the time of the next broadcast on the next evening. In other words, the state of telecommunica-

tions in India gives the Indian Forecaster the task of forecasting 34 hours ahead, while in the U.S.A., the task is virtually reduced to forecasting only about 10 hours ahead. As far as the performances 34 hours ahead are concerned, the advancement in U.S.A. over that in India, is somewhat like the improvement in the time taken by a sportsman of U.S.A. or of India for a 100 yards dash.

### Hurricane Forecast

In the case of the Hurricane Warning Service also, the considerable advances in U.S.A. are again in the matters of observation their collection and dissemination. They send, at the instance of the Forecasting Officer, their heavy aircraft over sea areas, where disturbed weather is suspected. And once the disturbed weather is noticed to be a cyclone, there is always an aircraft hovering around the area, giving hourly information about the position and intensity of the cyclone. Such an arrangement costs about half a lakh of rupees for every day of such reconnaissance flights. The information from such planes and weather charts are co-ordinated at one Hurricane Forecast Centre and broadcast

only five atoms thick can be detected by the light it absorbs. Thus the identification of complex compounds even when these are available in limited quantities has become possible with the aid of the spectroscope.

Besides mere identification of compounds, the spectroscope can also disclose the presence of certain molecular groups and the structural features of the compound and this has made possible the study of action of certain enzymes and hormones not accessible to usual chemical methods.

By noting the amount of light absorbed at the proper wavelengths it is also possible to measure the quantities of the compound pre-

sent in a given sample. Vitamin A for instance, absorbs strongly at 3280 angstroms. Hence by passing light at 3280 angstroms through the sample, either by a proper choice of a source and a filter or with the help of a monochromator device, and measuring the amount of light absorbed by it, it is possible to state the amount of vitamin A in the sample of oil, in a few minutes. Otherwise one has to feed the oil to rats for weeks to get the potency of the sample oil.

**The Spectroscope is, thus, a super-microscope, a super-telescope, a super-thermometer, a super-speedometer, a super-vitamer all in one.**

\* Talk delivered under the auspices of Poona Branch of the A.S.W.I.

every two hours over the Radio from a short-wave Broadcasting Station, whose studio room is located at the Forecast Centre.

### Research

The main bulk of research in Meteorology is done at the Universities, mainly from funds provided by the Defence Services, for specific items of research called 'Projects'. There are nearly 29 Universities who get such grants. The grant for Meteorological Research at one such University, the University of California, Los Angeles—amounts to about a hundred thousand dollars per annum. The research is carried out under the direction of the Professors, by the students and teachers. Such an arrangement provides ample assistance for students of science, who do part-time work for the various projects. They earn while they learn, and a team spirit in Research work is also inculcated.

### Employment

The scope for employment for Meteorologically trained personnel in America is very large. The Air Force, the Navy, and the Civilian Weather Bureau, employ among themselves about 10,000 professionals; Air line companies and Industrial concerns also employ professional Meteorologists. In recent years, private practice of Meteorology is also coming to vogue. Most of such 'Practitioners' are consultants. They give meteorological advice on specific problems to private in-

dividuals, small business firms, farmers and the like.

### Application

The country as a whole makes considerable use of available meteorological information in day to day life. For example, the ice cream manufacturer will send large quantities of ice cream to areas where high temperatures are expected. The restaurants will make foods appealing to ladies on sunny days, for on such days the shopping is generally done by them; while on rainy days the restaurants will cater to masculine tastes as on such days the shopping is done by men. For defoliation, cotton crop has to be sprayed with chemicals, when dew is likely; consequently hiring of labour and of equipment need meteorological advice. Such a wide use of meteorology, a considerable part of which is based on climatology and probability forecasts, is mainly due to lack of such knowledge by the average man in America, who has not been at any one place for any length of time. Here in India, there are families, who have been in one place for centuries and there is so much "folklore" in Meteorology that every one thinks that he knows enough of climatology. As he belongs to a comparatively young nation, the average American is free from such a half-knowledge, and gets an expert opinion on every issue. Such a procedure becomes economical in the long run and even in the short run; it also provides employment for scientifically trained meteorologists.

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Have you paid up the subscription for the year 1954?  
 If not, remit it to your Branch, Unit or to the Central  
 Office at 39, Massey Hall, Y. M. C. A., New Delhi, at  
 the earliest.

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## Facilities for Technical and Industrial Training in U.S.S.R.

Major General S. S. Sokhey.

**T**HE question of industrial training is of very great importance to us. If we are to increase our productive resources to give our people higher living and cultural standards, we must industrialise the country rapidly. To do so we must have adequate cadres of highly technical trained personnel, not only because foreign personnel could not be had in numbers needed for development, but, even if available, would be prohibitively expensive.

### Technical Training in the West

We are indeed thankful to U.S.A., U.K. and other Western European countries which have accepted our scholars in their technical institutions for training but unfortunately in those countries industry is privately owned, with the result that though our people get good fundamental training, they invariably fail to get facilities for doing practical work in factories of their speciality. In these countries the situation is as if a student went to study medicine and he was trained in a medical college, but was not allowed to work in a hospital. He would not be adequately trained to work as a doctor. In these countries the industry itself gives practical training after engaging the partially trained personnel. Therefore, while it may suit the students of those countries our students cannot avail of this facility.

Since there is no private industry in U.S.S.R. and other Peoples Democracies of Eastern Europe it could be expected that practical technical training would be available for all scholars admitted to technical institutes. Two trips were accordingly undertaken to the Soviet Union, Czechoslovakia, Hungary and Poland to see what sort of facilities for technical training were actually available and whether we could make use of them.

### Training in U.S.S.R.

In the Soviet Union, technical, industrial and vocational training is given in special institutes which are not parts of universities. Universities limit themselves to broad scientific training. There are over 830 technical

institutes which give elementary vocational training, secondary vocational training and higher technical and industrial vocational training. The elementary and the secondary institutes give two and four year courses of training respectively and produce skilled workers and higher grade technicians. Seven years school work is necessary for admission to the elementary and secondary institutes. It is the higher technical training institutes that are of interest to us, and there are about 200 of them. Students are taken into these institutes after ten years of schooling at the age of 18. They have to pass an entrance examination for admission. The courses of training last for five years. First two years are devoted to general scientific education and the last three years to the speciality of the student. During the third year the student spends a month or so in a plant of his speciality and in the fourth year he spends about three months and in the final year as much as six months. Thus he gets a very thorough practical training besides getting good theoretical grounding.

There are 24 Polytechnical institutes of the usual type in different parts of the country, and in addition there are about 180 specialised institutes divided into 23 groups, situated in the very heart of the industries and not in towns, such as Power, Electrical Engineering, Radio Engineering, Physical Engineering, Machine Building, Ship Building, Aviation, Cinema Engineering, Auto-mechanics, Geological Mining, Oil, and Metallurgy, etc. etc.

As there are no private enterprises, there are no private consulting engineers. The

teachers of the institutes in different regions act as consultants for the development of the industry. Thus there is a very close relationship between the industry, the teachers and the students. They form one integrated whole. Further, because of planned economy under which the country functions, every student knows a year in advance the particular job he or she is going to hold after graduation. As a matter of fact, during the last year of training the projects that are sent to the institute by the region are distributed among the final year students who devote that year to preparing projects, blue prints, specifications of plants, and economics of the processes involved. When the thesis is approved, he is deputed to execute the project. Thus during the final year a student is really preparing for a particular job and not for an academic degree.

### Facilities for Indian Students

Enquiries made elicited the information that the Soviet Union would be agreeable to take Indian students in their technical institutes on the request of the Government of India. The training facilities available in the Soviet Union would be best employed if the Government of India took definite decision about the industries that it wanted to start under its own control during the Second Five Year Plan. Government should get its experts to collect teams of suitable technical personnel for each industry to be dealt with under the plan of development. These selected teams should be trained in such a manner that the work of a particular industry would be divided among them, and they on return would remain integrated teams and develop that particular industry. It is obvious that extensive and rich facilities for training can be made use of only on a government to government basis.

Furthermore, since the Soviet Union has adhered to the United Nations Extended Programme for Technical Aid to Under-developed countries and has contributed about two millions of dollars for the purpose,

money is available for the upkeep and training of Indian students which the Government of India chooses to send to the Soviet Union, and also to obtain the services of Soviet experts which the Government may need for industrial development of the country.

I have said enough to show that excellent facilities exist in the Soviet Union for industrial training and they are available to the Government of India for getting technical cadres trained for industrial development. There is no doubt that industrial development of Soviet Union is as high as that of any other country in the world. What is more these 830 technical institutes of various grades have actually 20 million students under training. The significance of this should be clearly understood. In a few years, there will be no unskilled worker in that country. All the work will then be done by skilled trained workers.

### Language Difficulty

Then there is the question of language. Indian student will have to learn the Russian language. Some Indian students I met in Moscow told me that they had learnt enough of the language in six months to follow lectures well. Russian is now a very important scientific language and it would be an advantage to our country if a sufficient number of our scientists know the language

It is also to be noted Soviet Students in the higher technical institutes are entitled to a stipend if they make a certain mark in the entrance and term examinations. The value of stipend varies from roubles 250 to roubles 750 depending on the grade of the student. 85% of the students get a stipend.

What I have said of the Soviet Union also applies to Czechoslovakia, Hungary and Poland. The training facilities in these countries are developed on exactly the same pattern as the U.S.S.R. Czechoslovakia and Poland also adhere to the United Nations Extended Programme for Technical Aid for Under-developed Countries.

## Association Activities

### V.K. Fund Progresses

IN the July and August issues of the journal we have appealed for collection for V.K. Fund with a target of Rs. 5,000 by the end of the year. We are glad to announce that the response to the appeal is encouraging and we are giving below the first list of donors.

Raniganj Branch	...	Rs. 25/-/-
Mr. S. K. Mohindra	...	Rs. 5/-/-
Maj. Gen. S.S. Sokhey	...	Rs. 120/-/-
Hyderabad Branch	...	Rs. 100/-/-
Dr. P.K. Kichlu	...	Rs. 10/-/-
Dr. J. J. Chinoy	...	Rs. 5/-/-
Mr. Jugal Kishore	...	Rs. 2/-/-
Mr. P. B. Rao	...	Rs. 5/-/-
Dr. I. S. Verma	...	Rs. 2/8/-
Mr. V. P. Singh	...	Rs. 1/-/-
Mrs. Shakti M. Gupta	...	Re. 1/-/-

Total Rs. 276/8/-

As will be seen from the figures we are very far from the target, the situation leaves much scope for improvement. An all out effort is needed on the part of the branches, units and the individual members. This collection drive should be made one of the most important tasks before every committee whether of the branch or region or unit and should be viewed upon as a lever in

### Bombay

The Annual General Meeting of the Tata Memorial Hospital Unit of the ASWI was held in July under the Presidentship of Dr. Khanolkar. Dr. K. S. Korgaonkar, a member of the Executive, read a paper on "Spectroscopy" (published elsewhere in this issue). After the presentation of the Annual Report by the out-going Secretary Miss S. Kelkar, Dr. Khanolkar gave his presidential address. He emphasised the need to strengthen the Association and appealed to the scientific workers to join. Proposing a vote of thanks to the chair Mr. N. K. Varma, the Joint Secretary of Bombay Branch, remarked that the Association was the only instrument for voicing the feelings of the scientific workers and it was a great hope for the future. He added it was the duty of every scientific worker to make it strong and successful. Mr. A.J. Baxi and Miss S. Kelkar were elected

building up the Association. The collections must enable us to reach the target by the end of the year.

Hyderabad branch has given the lead, on the branch level, by donating Rs. 100 and also promises to approach the individual members for collections for V. K. Fund. Raniganj Branch sent us Rs. 25. Calcutta and Poona branch executives discussed the matter in their meetings and have promised all support to the appeal and to make all out efforts for collections. Reports from other branches are awaited.

So far Delhi occupies the leading position for collections made from individual members.

**Send in your donations.**

**More than all, remember to send reports of your efforts and achievements**

Secretary and Joint Secretary respectively of the Unit for the next term.

### Delhi

It is encouraging news that the Unit in the Delhi University, which used to function a few years ago, has again been brought into existence, thanks to the enthusiasm of a few interested workers.

The Unit held its first meeting on 3rd August with Dr. P. K. Kichlu in the chair. Maj. Gen. S. S. Sokey, who has recently returned from a tour of Europe and the USSR addressed the members on "Science and scientists in the Soviet Union".

In the course of his address, Maj. Gen. Sokhey described the organisational structure of science in the Soviet Union and the important position which the scientists occupy in the national life of the country. He drew particular attention to the fact that science and

science teaching are closely related to the agricultural and industrial development projects in USSR. The free education in the primary and secondary stages and a large number of stipends in the University and higher stages of learning are matters of great asset. Higher technical training is extensive in the Soviet Union. In conclusion he referred to the possibilities of Indian students taking advantage of the available facilities in the Soviet Union for the betterment of India.

### Poona

#### *Fourth Meeting of the B.E.C.*

The executive Committee of the Poona Branch at its fourth meeting held on 20-6-54 discussed the convention proposed by the Calcutta branch on the "Problems of unemployment, malemployment and underemployment of scientific and technical personnel" and decided that every effort should be made to collect statistical data and other relevant information in this connection. A copy of the convention circular is being sent to every member of the branch for suggestions.

Dr. Ganapathy, the Branch President, informed the executive that in the near future a unit of the Association will be formed at the Penicillin Factory at Pimpri.

#### *Independence Day*

The branch celebrated the Independence Day on 15th August, 1954. Shri L. M. Nadkarni, I.C.S., Commissioner, Municipal Corporation, Poona addressed the members. Dr. K. Ganapathy presided.

Shri Nadkarni greatly appreciated the aims and objects of our Association and the working of the same. He dwelt on the industrial advancement of the country since the achievement of Independence and emphasised greatly that the role the scientists of country have to play is imperative and highly essential for the country's prosperity. He reiterated that the only approach to the problems of the day will be to view them objectively and scientifically and arrive at solutions with least prejudice or emotion.

Shri Nadkarni briefly referred to the Labour-Management relations and he was of

the opinion that a mutual agreement of Labour and Management will help to ease the conflicting tendencies in their relations and can enhance greatly the productive capacity of any industry which will also help to improve the country economically.

#### *Informal Meeting*

The active workers of the branch held informal discussion with Maj. Gen. S.S. Sokhey on 18th August, 1954 on matters connected with the strengthening of the Association.

#### *Public Meeting*

On 26th August, a public meeting was held under the auspices of the Association to honour Maj. Gen. S. S. Sokhey, with Dr. K. Ganapathy in the chair. Gen. Sokhey addressed the gathering on "Facilities for scientific and technological training in USSR" (published elsewhere in this issue).

#### *Fifth meeting of the B.E.C.*

At the fifth meeting of the B.E.C. held on 29th August, 1954, the committee considered the important question of granting training facilities for hundreds of science graduates working in various government departments, and scientific institutions to work in them, outside their office hours with a view to enable them to undertake advanced work in the fields of their choice. This would help remedy the existing unsatisfactory state in the matter of availability of suitable scientific and technical personnel in the higher levels.

While endorsing the suggestion offered by Dr. Pisharoty, the committee desired that a concrete scheme might be put forward by him for its implementation.

#### *Republic Day*

The committee decided to celebrate the republic day, 26th January, 1955 in a befitting manner. A special committee is being formed to organise the celebration.

### Hyderabad

The Branch Executive has taken a commendable step in constituting a sub-committee

for discussing each issue of the Vijnan Karmee with a view to suggesting improvements. The first meeting of this sub-committee discussed the July issue and offered a number of valuable suggestions, one of which relates to the need for having a standardised form for reporting the activities of the Branches and Units in these columns.

Further, the executive has appointed a correspondent for the journal to send reports regularly not only on activities of the branch but also on other general scientific activities in the region as a whole.

### Bangalore

The Bangalore branch also discussed, at a meeting of the B. E. C. held in July, 1954, the question of improving Vijnan Karmee. Several suggestions pertaining to the design of the front page have already been incorporated.

Like the Hyderabad B.E.C., Bangalore also decided to send periodical and regular reports on the general scientific activities of region for "Round the states" feature, recently introduced in the journal.

The Executive has discussed the Calcutta convention and urged upon the members to forward their comments and suggestions to Calcutta.

### *Changes in Executive*

As Dr. A. Ramchandran is going abroad very shortly, he has resigned from the branch Presidentship. In his place Dr. B.V. Raghavendra Rao has been elected as the branch President. There have been changes in the composition in the BEC also. A revised list of BEC members is given below.

<i>President</i>	Dr. B.V. Raghavendra Rao.
<i>Vice-Presidents</i>	Dr. V. Ramakrishna. Mr. M.V. Bhatt.
<i>Secretary</i>	Dr. A. Bhati.
<i>Joint Secretary</i>	Mr. P. Narasimhamurthy.
<i>Members</i>	Prof. K.R. Krishnaswamy. Dr. S. Dhawan. Dr. S. Ramaseshan.

Dr. (Miss) R.V. Phadke.  
Mr. A.V. Sreenath.  
Dr. B.S. Ramakrishna.  
Mr. S.D. Mahulikar.  
Mr. Gopinathachar.  
Mr. A. Das.  
Mr. K.S. Prabhu.  
Mr. Y.V. Nagabhushana Rao.  
Mr. Jawaharlal Vaid.  
Mr. T. Rama Sarma.  
Mr. P.D. Dasappa.

### Calcutta

Five more members have been coopted to the Preparatory Committee for organising the convention on "Unemployment, mal-employment and underemployment of scientific and technical personnel." Shri Amalendu Kar Gupta has been elected as the joint convenor and Treasurer. The Preparatory Committee took one more step forward towards the convention, when the convention details were discussed at a meeting held on August 14 with representatives of different Alumni Associations/Reunion Committees.

The Preparatory Committee is highly encouraged by the interest taken by other branches of ASWI such as Poona, Hyderabad and Bangalore in the matter. Similar response and cooperation is requested from other branches and units as well.

The committee further requests financial help from all the members of the Association in making the convention a success. The Calcutta B.E.C has already donated 25/- towards the Convention Fund. Intending members may kindly send their donation to Shri Amalendu Kar Gupta, Joint Convenor and Treasurer, Preparatory Committee, Department of Applied Physics, 92, Upper Circular Road, Calcutta-9.

### Kanpur

Under the auspices of the Unit at the Institute of Sugar Technology, a Professional Language class is being conducted for the last two months. To start with, the German language classes are being taken by one of distinguished members, Dr. B.K. Jha, M.Sc, Ph.D. (Birmingham), Alcohol Technologist

to the Government of U.P. and Head of the Alcohol Technology Department of the Harcourt Butler Technological Institute, Kanpur.

### Lucknow

A sub-committee appointed by the Lucknow Executive to report on the questionnaire on the Living Conditions of Scientific Workers has suggested certain concrete proposals for the implementation of the social survey programme. It is proposed to undertake this survey in the coming few weeks.

Under the auspices of the Association, Mr. Jagjit Singh of the Eastern Railways, read an interesting paper on "Dialectical Materialism and Logical Positivism" on Monday, the 9th August, 1954 at the Philosophy Lecture Theatre of the Lucknow University. Shri S.L. Kumar, Director, Railway Research and Testing Centre and the Vice-President of the Local Branch presided. Dr. Kali Prasad, Head of the Department of Philosophy introduced the subject. In a brilliant analysis of the teleology of the two systems of philosophy and detailing their application in evolving a philosophy of mathematics, Shri Singh expounded the superiority of the dialectical approach. An interesting

discussion followed in which Drs. Kali Prasad and D.P. Mukerji participated.

### New Bases

Earnest efforts are being made to form a Branch of the ASWI at Baroda. Response has been very encouraging and it is hoped that by the time our Annual Meetings take place, a strong Branch would come into existence at Baroda.

Encouraging news has been received that vigorous efforts are being made to form a Branch of the ASWI in Andhra with the nucleus at the Andhra University at Waltair.

We welcome the new members from Kalka, numbering seven so far. We hope that very soon a Unit will be formed.

### Dr. B. C. Guha

Dr. B. C. Guha left for the Soviet Union as a member of the Teachers and Students Delegation. He is expected to stay in U.S.S.R. for about a month.

Dr. Guha is attending the WFSW Executive Committee meeting in Vienna on 10-12th September, 1954 as the delegate from ASWI.

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We have to fulfil our targets for the Vijnan-Karmee Fund of Rs. 5000 and the Enrolment Drive for a membership of 3000 before the Baroda Session of the Council and General Body Meetings.

Contribute your mite to strengthen the cause of the Scientific Workers in India by introducing the Association and Vijnan-Karmee to coworkers and friends—and help fulfil the targets.

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## News and Notes

### Independence Day Honours

**T**HE Independence Day Honours list, the first of its kind in the post-independence era, includes among others some of the more eminent workers in the fields of science and technology. It is gratifying to note this appreciation of the role of science and technology in our advance towards a better India.

#### Raman

It was twenty six years ago that the Raman effect, which has brought in its wake immediate recognition and a Nobel Prize to its discoverer, was first announced. When a beam of incident light is scattered by a substance, the wavelength of scattered radiation is different from the original, incident beam—this is Raman effect. The Raman effect has furnished spectroscopy with a new and very powerful weapon for investigating the Infra-red spectra of determined Molecules.

Much water has flown since that time. Raman, still as active as ever, has kept himself to his Research, carefully avoiding the lure of public life, to which a good number of our eminent scientists have succumbed at great cost to science. The award of "Bharat Ratna", the highest of the Honours that our motherland could bestow on its great sons, is a fitting recognition of the great services rendered to Science and humanity by Raman.

The list for "Padmavibhushan" has an array of eminent Scientists and Engineers and includes Shanti Swarup Bhatnagar, H. J. Bhabha, K.S. Krishnan, A.N. Khosla, R.R. Handa and Satyen Bose.

#### Bhatnagar

Shanti Swarup Bhatnagar is a controversial figure in science. His admirers go into ecstasies over his administrative acumen and his critics take him to task for having left his research for administration. Every one, however, concedes the importance of Bhatnagar to the sciences in India. As the inceptor and architect of the 11 national laboratories, he has successfully debunked the theory that scientists cannot make good administrators.

#### Bhabha

Homi Bhabha, the youngest of our "scientific greats", has still a long way to go. Fellow of the Royal Society at the very young age of 32, Bhabha has an impressive record of brilliant service to Theoretical Physics. His work on Meson Theory and cosmic radiation has brought India into the arena of Theoretical Physics. As Chairman of the Atomic Energy Commission, the great responsibility of giving a good start to our Atomic Energy programme rests with him and those who know him have no misgivings about his capacity to do it.

#### Krishnan

What strikes us most about K.S. Krishnan is his ability to explain the complex concepts to the lay reader. Krishnan is probably the most prolific writer among the scientists of our generation. As a socially conscious scientist, he has been actively associated with the various organisations of scientific workers, and is the Vice-President of the ASWI. He has been the Director of National Physical Laboratory ever since its inception and a Member of the Atomic energy Commission.

#### A. N. Khosla

A.N. Khosla is one of the most eminent engineers of this generation. As the first chairman of CWINC, he has put in a lot of work for the River Valley Development in India. His contribution to the Engineering science is mainly in the field of irrigation. His theory of weirs on permeable foundations has been widely acclaimed. He has conducted the case for India in the Indo-Pakistan Canal Waters dispute.

#### R. R. Handa

R.R. Handa has been responsible for the construction of Bhakra Canals. At a time, when the actual costs are addicted to the habit of shooting up beyond the estimates, Handa had the unique distinction of bringing them down, effecting a saving of about Rs. 3 crores in the estimate.

#### Satyen Bose

As the propounder of the Bose-Einstein theory of statistics, Satyen Bose has earned

for himself the recognition of the scientific world. His work in quantum physics has been acclaimed all over the world. As a nominated member, he represents the sciences in the Council of States,

### Atomic Energy Conference

A conference on atomic energy is to be held in New Delhi in November. It is expected that the officials of the A.E.C. and Scientists in the field will participate in the conference.

Subjects for discussion include (i) plans for research work in Atomic Energy (ii) possibilities of production of atomic energy for industrial use in India, (iii) question of exchange of experience with other countries.

A notable omission is the necessity for the amendment of the Atomic Energy Act which was touched upon by Mr. Nehru in his speech to the Parliament. It will be interesting to see whether any comprehensive scheme for training of personnel, which has assumed greater importance—in view of the possibilities of peaceful uses of atomic energy in the near future, will be evolved.

### I.S.I. Function

In the presence of an impressive gathering of Ministers of Central Cabinet, Members of Parliament, high official dignitaries, members of the diplomatic corps and other distinguished gentry, the Prime Minister, Pandit Jawaharlal Nehru, laid the Foundation Stone of the ISI Building on 21 August 1954. The function was held on the site newly acquired by the ISI for its building on Delhi-Mathura Road, adjacent to the site reserved for the offices of the Comptroller and Auditor General of India. The building project of the ISI visualizes an expenditure of about Rs. 12 lakhs on the proposed building including essential services and equipment. The ISI has transferred Rs. 2 lakhs from its reserve to serve as nucleus of the building fund, and contributions from industry, trade and State Governments are expected to provide the balance.

A Building Fund Committee consisting of leading industrialists in the country has been formed with Shri Tulsidas Kilachand, M.P., as its Chairman.

### Prime Minister's Address

Speaking on the occasion, the Prime Minister urged the Indian manufacturers, big and small, to produce goods of lasting value. Warning the producers not to exploit the sentiments for Swadeshi movement while attempting to sell second rate stuff to the people, he said, "Our Indian people may, out of sentiment, buy stuff of inferior quality. But no foreign country is going to touch anything that is below the general standard. So whatever we produce should be of good standard quality", he said.

### Other Speeches

Shri T. T. Krishnamachari, Central Minister for Commerce and Industry and President ISI, Dr. Verma, Director of the Institution and Lala Shri Ram, a well-known industrialist and Vice-President ISI, emphasized that both government and private enterprise had to play their part in the expansion of the activities of the Institution.

Lala Shri Ram appealed to industrial and commercial houses to raise a sum of Rs. 10 lakhs for the building. Dr. Verma said that "India is now committed to a mixed economy envisaging a public and private sector. The ISI, in line with the co-operative industrial policy of the country, must necessarily look both to Government and private industry for financial sustenance and nurture." Shri Krishnamachari said, "We have been improving the standard and quality of the goods we produce in this country but still there is a long way to go. In this process of improvement, the ISI helps considerably".

### Facts about ISI

The ISI was established in 1947. During the last seven years, it has published nearly 500 Indian Standards and today its membership runs into 800 as against the initial 100 in the year of its birth. The ISI has 420 Standardization Committees, consisting of experts drawing from industry, technology, Government Departments and consumers, and functioning under four Division Councils, the Engineering Division Council, the Building Division Council, the Textile Division Council and the Chemical Division Council. The membership of

these Committees, which began with a modest 600, is now well over 4,500.

The Standards laid down by ISI are playing an important role in the manufacturing and trade practices in the country. Recently the Government of India issued an official directive to various departments not to buy goods except to specifications contained in Indian Standards wherever approved standards exist. This, together with the decision that each department should let the Indian Standards Institution know within a reasonable time why a particular standard could not be acceptable, will go a long way, in diverting a bulk of Indian production to standardized channels.

### Freedom of Scientific Workers

The following resolution adopted by the American Physiological Society, and other American societies, concerning threat to the freedom of certain American scientific workers, has been received from the W.F.S.W.

"The undersigned members of the American Physiological Society hold that the support of open scientific research, by government or private agencies should be based on the competence and integrity of the investigator and the merits of the problem studied. We fully recognize the paramount need of maintaining national security by careful investigation of all workers engaged in classified research. We hold, however, that when research is open and unclassified, the imposition of political or other extraneous requirements on the investigator as a condition of awarding a research grant threatens the freedom of science and the principles on which the American social order is founded.

Members of the society have received reports, from reliable sources, indicating that certain government agencies have recently violated these fundamental principles by revoking or withholding unclassified research grants, for reasons unconnected with the competence or integrity of the investigators. Further, it is reported that these actions are being taken not casually or incidentally, but as a matter of settled policy.

Therefore, we request the National Academy of Sciences to investigate these reports and, if they prove well-founded, to

take strong and appropriate action to maintain the freedom of fundamental scientific investigation in the United States."

### Meteorological effects of Atomic Explosion

Full text of the appeal issued by the Japanese Meteorological Society for the immediate suspension of Hydrogen Bomb Experiments and the banning of nuclear weapons, received by us through World Federation of Scientific Workers, is reproduced below.

"We, Japanese who were the first among nations to experience the terrors of the explosion of the two atomic bombs thrown on the towns of Hiroshima and Nagasaki and who lost in a single moment hundreds of thousands of lives, see again, that similar catastrophe caused by the tests of the hydrogen bomb on Bikini island afflicted our fishermen who were occupied with their daily work. We were profoundly shocked and our conscience gave birth to a doubt whether it is lawful to employ atomic energy, which is a product of contemporaneous science, for such destructive purposes.

This being the case, we invite the attention of mankind, from the standpoint of meteorological science and meteorological service, to the following two circumstances:

1. A tremendously large amount of radioactive dust which dispersed in the stratosphere as a result of the explosion of the hydrogen bomb is spreading all over the world in consequence of air circulation.
2. This extensive contamination of the atmosphere will last a long time and can influence solar radiation and other meteorological phenomena. It is likely to cause a cooling down of weather during summer and provoke other meteorological calamities which are impossible to foresee. In addition to that, a chain of experiments with hydrogen bombs can influence fishing and production of agriculture by the fact that sea water will be contaminated and consequently the rain, and thus a permanent peril for mankind may arise. We are convinced that it is our duty as scientists to march hand in hand with those who are striving for peace and demand emphatically and categorically, in the name of the salvation of mankind, cessation of further experimenting

## Readers' Forum

### Science Graduates and Employment

AS early as 1947, the Government of India appointed a 18 member scientific Man Power Committee to ascertain the requirements of scientific Man Power for the development of the country. The committee submitted its report in August 1949. The requirement of scientific and other technical personnel in the next five to ten years was put at about 50,000 persons excluding the number of qualified persons in the medical and teaching professions as also the junior grade staff required in all categories. Either the requirements are exaggerated or the report is lost sight of.

Whatever that may be, it is seen that the actual employment falls far below that and the position after seven years is rather disconcerting. Not only a large number of science graduates remain without employment, there is also retrenchment in a mild form, that is unfortunate.

It will pay the nation to be aware of the danger of wasting the most precious resource of young men with scientific training. It will also be useful to be aware that the work of one scientifically qualified man may provide employment and work for others and that the country may reap and continue to reap the benefits from a flourishing and expanding science and technology. That is the best guarantee of the means for our economic survival. As it is, the volume of investment in the shape of scientific personnel in agriculture and industry is low and an increase would greatly assist better and more rapid development.

In a lecture a few months ago, the Health Minister of the Union, speaking on her visit to U.S.S.R. stated that all medical graduates in that country are absorbed immediately after taking their degrees. In that country there is an official agency to coordinate the number of men to be trained in accordance with the need and also to expand or contract the need according to circumstances. A similar plan and system must be apparently

with hydrogen bombs, as well as the banning of all kinds of atomic weapons. This year's annual conference of the Japanese Meteorological Society, in connection with the above-

operating in the other departments of their national activity which requires scientifically trained men.

Our plans and programmes must be re-examined and revised and broken down to the level of the smallest operating unit and in doing so consideration must be paid to equating volume of employment and what is likely to be achieved. Otherwise, the expenditure of more of public money in combating unemployment is not likely to prove a good investment. The existing organisations may have to be suitably reorientated, if and where the new outlook and needs are incompatible with current systems and methods of planning and administration.

B. Viswanath

### The Scientific Worker as a Trade Unionist

Seven years ago the Association of Scientific Workers was born in the tent of the Indian Science Congress. The intention was that the Association should be recognised by the central and State governments as a trade union, so that interests of the body of scientific workers may be protected and advanced. In the intervening years between then and now, in spite of the best efforts of the Central Executive Committee, the Association has not yet received recognition as a trade union. However, the authorities concerned viewed sympathetically the representations made to them and redressed grievances found to be genuine.

This, however, has not satisfied the members, and in recent months there have been critical discussions on the situation and the general opinion has been expressed that there is no use for the Association if it is not to realise the objective with which the union was founded. There has been the other view that whether a professional body of scientists should or could insist on becoming a trade union organisation.

The report of the Press Enquiry Commission, a preliminary review of which was

mentioned facts, fervently supports the declaration of the Japanese Scientific Council on the 23rd April, 1954, calling for the banning of the hydrogen bomb."

## Round the States

### Our Lucknow Diary

*Railway Research:* In a brief note issued to the Press recently the main objectives of the Railway Research and Testing Centre, Lucknow, were set out as investigating the immediate possibilities of reaching self-sufficiency of equipment, safety of rail travel combined with comfort and simplicity and reliability of design leading to economy in construction, maintenance and operation of locomotives. Investigations now in progress in the Institute are geared to these objectives.

*Holiday Resorts:* Paid holidays to be spent comfortably in hill stations or sea side resorts is a desire cherished by all intellectual workers. The recent announcement that the Government of Uttar Pradesh has plans ready for developing the vast hill tracts for holiday purpose will be welcomed by all scientific workers.

*Education:* Uttar Pradesh which has already six universities will have one more in the near future if the recommendations made by a special committee on the formation of the Gorakhpur University are accepted by the Government.

Three community colleges are being opened in the State to train leaders who will undertake adult education and reconstruction works in the villages under the National Extension Programme. These are designed to supplement the 3200 junior high schools recently opened with the specific purpose of giving an agricultural bias to education. These schools are expected to disseminate information on agricultural practices and rural welfare on modern scientific lines.

*Industry:* Located in the picturesque

published last week has given both light and lead on the subject. The Commission carefully considered the dignity of journalists as a professional body and the need for the protection of the economic interests of journalists and expressed themselves in favour of journalists organising themselves into a trade union body. The press is generally called the fourth estate; science could reasonably be called the

surroundings of Kymore range is Uttar Pradesh's latest industrial undertaking, the modernised cement factory at Churk embodying features of great technical and scientific interest to engineers, chemists, geologists and production technologists. Built at a cost of Rs. 4.5 crores it was recently opened by the Prime Minister. A large part of the daily output (estimated as 1400 tons daily) will be diverted for the construction of the Rihand Dam.

### Our Nagpur Diary

*Unesco Scientific Exhibition:* Unesco's travelling scientific exhibition on "Our Senses and the knowledge of the world" was inaugurated at the College of Science, Nagpur, by the Governor of Madhya Pradesh, on the 5th August. It remained open till 19th August and attracted a good crowd. The Exhibition which was assembled at Paris in 1951, has been travelling in different parts of the world.

*Manganese Industry:* The manganese industry in the State had been undergoing serious depression in the past few months owing to the lack of external demand. It has resulted in the closure of many manganese mines and consequently a lot of unemployment. The recent decision of the Government of India to abolish the export duty is expected to enable the Indian manganese ore to compete favourably in the world market.

*Handloom Industry Development:* Madhya Pradesh has received so far during this year a loans totaling Rs. 4.5 lakhs and grants amounting to over Rs. 2 lakhs, from the centre for the development of handloom industry in the State.

fifth estate and can justifiably claim the privilege of demanding recognition as a trade union. All scientific workers should work in concert to establish an irresistible claim to the privilege and right of collective representation for a living wage and satisfying conditions of work.

B. Viswanath

## Notice

### Association of Scientific Workers of India

The Head Office of the Association (39, Massey Hall, Y.M.C.A., New Delhi) has sent the Following Circular Letter to the Branches/Units in connection with the forthcoming meetings of the Council and General Body.

"The next meeting of the Council of the Association will be held at Baroda in the last week of December 1954, or sometime during the 1st first week of January, 1955 at the time of the Science Congress Session. This letter is being sent to the Branches and Units of the General Branch for information and guidance on the various points connected with the Council meeting. The Branches/Units should take the appropriate action and try to send the material in time to the General Secretary at the above address.

1. According to Rule No. 45 each Branch has to the Council a number of delegates in the proportion of 1 to every 25 members. According to Rule No. 46 each Branch has to submit to the Head Office the list of members of the Branch and delegates elected to the Council not less than eight weeks before each Annual Council meeting. Substitute delegates may be elected and the list submitted to the Head Office.
2. According to Rule No. 52 any motion to alter the Rules of the Association cannot be placed on the agenda unless three Branches or 15 Units submit in writing not less than three weeks before the date of the Council Meeting that they support a motion for altering the rules.
3. Any motion, according to Rule No. 49, must be submitted in writing not later than eight weeks before the date of the Council Meeting. Members of the Association wishing to move resolutions at the Annual General Meeting shall ordinarily send them to the General Secretary with the opinion of the Branch concerned at least eight weeks before the Annual General Meeting (Rule No. 71). The provisional date for the General Meeting is 3rd January, 1954.
4. According to Rule No. 65 all Branches shall be invited to submit to the Head Office, eight weeks prior to the Annual Council Meeting, nominations to fill the vacancies in the Central Executive Committee. Such nominations shall reach the General Secretary not less than 6 weeks before the Council Meeting. The nominations should be duly proposed and seconded with the written consent of the person proposed.

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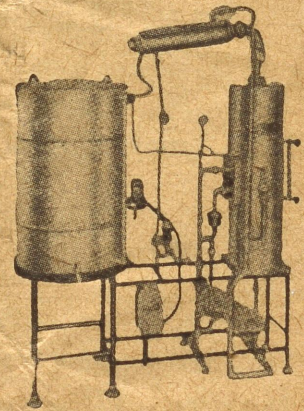
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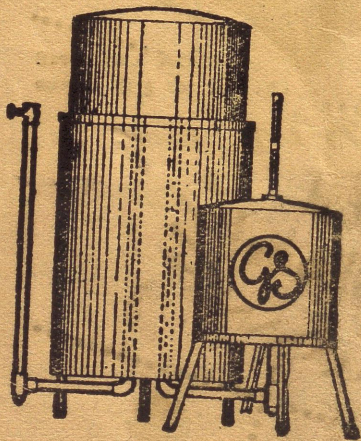
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