SCIENTIFIC WORKERS IN THE UK, USA AND USSR

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(In May 1960 *issue of* SCIENCE & CULTURE, *we had the occasion to refer to the conditions of employment of scientific workers in India, in our leading article* (**25**, *p.* 607). *In that context, we reproduce below the text of appendices* (1) *and* (2) *of 'A Note on Scientific Personnel' which was released recently by the Scientific Personnel Committee of the Government of India, for wider circulation.* —Ed. Sci. & Cult.)

RECRUITMENT, PROMOTION AND STRUCTURE OF EMPLOYMENT

United Kingdom

THE general outlook or philosophy underlying the structure of scientific employment is characteristically different in UK and the Western European countries, USA, and USSR. In UK (and also in many Western Europ countries) the basic concept is of a 'service a 'cadre' consisting of a group of individ who have entered the service for life car The 'service' system offers great security tenure and prospects of promotion usually the basis of seniority. Time scales of pay also characteristic features of the service sys in UK and in most of the Western Europ countries. Every service officer has cer rights regarding his pay, and other ben and higher posts. Promotions are norm from within each service and, at higher le depend on vacancies. Transfers from service to another are rare, and very resign or are discharged from the ser The 'service' concept logically leads to recr ment at comparatively young ages throug Civil Service Commission. In UK, in princi

this Commission is completely centralized. The Civil Service Commission also acts as a referee in various questions relating to the services. Posts are publicly advertized and candidates either sit for special examinations or are selected usually after interviews by selection boards or committees. There have been some significant developments in the case of scientific posts. The need of making special arrangements for scientific posts began to be appreciated during the war; and a new organization, the Scientific Civil Service, was established in 1945 which led to an improvement of the status and prospects of scientists working in Government agencies. A scientific committee was set up with the responsibility of making a continuing review of the efficiency of the Scientific Civil Service. (This service consists only of scientists and engineers engaged in research, development and design activities. Operating scientists including engineers engaged in production, maintenance etc., structural and other work serve in other branches of the civil service). There is a scientist member of the Civil Service Commission who has special responsibility for scientific appointments; and a scientific section of the commission works exclusively on recruitment to such posts.

The scientific officer class is recruited mainly from first and second class honours graduates from the universities; the experimental officer class mostly from junior technical institutions with about 20 or 25 per cent of graduates from the universities. The scientific assistant class correspond to laboratory mechanics and technicians in the universities and are recruited from among persons with high school education who have had some training in scientific or technical work. Candidates for permanent appointment are selected on the basis of academic records and experience and usually after a personal interview by a selection board with scientists as members. The scientific officer class has six grades; and promotion in the three upper grades depends not only on the ability of the individual but also on the existence of specific vacancies. Promotion usually implies larger supervisory duties. Some special provisions have been made for merit promotion in the British Civil Services; and additional posts can be created in the higher grades to provide from the promotion of individual research scientists of outstanding ability without necessarily expecting them to carry additional administrative responsibilities. Merit promotions are made on the recommendation of an inter-departmental scientific panel which works through sub-committees of which all the members are scientists of established reputation. The stratification into three classes is quite rigid and reflects the social structure and stratification of the educational system. Promotion from one class to another is extremely rare. The maximum age of entry is 31 years for the grade of senior scientific officer (with certain exemptions for officers from Defence Service). In UK, in addition to the Scientific Civil Service, there are also some Defence Science Services.

The salary scales for top Government posts in science are, however, still lower compared to top posts in the administrative class. There is a good deal of feeling within the Scientific Civil Service against the lower status of scientists compared to the administrative class in the Civil Service. The Atomic Energy Authority, however, has a large scientific organization which has been separated from the Civil Service in order to secure greater flexibility and greater opportunities for promotion for outstanding scientists. There is also provision for offering higher pay in special cases. The most significant change in the British system has been the recognition of the principle that the accomplishments of scientists can be properly evaluated only by their peers. Panels of scientists are therefore used for recruitment and also for normal and special promotion. In the British Scientific Civil Service opportunities are being provided for advanced training at Government expense at universities and non-government laboratories by the award of fellowships; and there is a system of sabbatical leave on full pay. Attendance at professional meetings is encouraged. There is occasional inter-change of scientists with other parts of the British Commonwealth.

In UK the universities and non-Government agencies have separate structures of recruitments, promotion, pay and prospect etc. The system is broadly similar in the different universities; and there is some movement of scientists from one university to another. Leave and retirement benefits are usually transferable without difficulty and medical care is practically free as in USSR. Scientists working in Government agencies or in industrial concerns get somewhat higher pay. Scientific traditions, however, are very strong in the British universities; and many scientists of ability prefer to work in the universities because of the academic freedom and other social and cultural amenities. In the Western European countries the normal system is that of career services to which recruitments are made at a comparatively young age. The class structure is absent or is much less rigid compared to UK. Recruitment is more decentralized and in some countries there are arrangements for

contract posts. The status of scientists is generally high and the social prestige of university professors 'who are usually members of the Civil Service' is in most Western European countries as high as members of the higher Civil Service. In Switzerland the pay and status of scientists in universities and higher educational institutions is higher than the pay and status of administrative officers of comparable ability and qualifications serving under Government.

USA

In USA the system is entirely different and there is nothing which is really comparable to the service system in UK and other Western European countries. In USA the emphasis is on the 'post', and in principle it is possible to select for any post the best available candidate from within or outside Government agencies. In UK if any post falls vacant in a Government agency, normally it must be filled by promotion from within the service itself. In the Western European countries also the position is broadly the same but there is greater freedom of movement because the service system is more universal and covers the universities and scientific institutions.

In UK recruitment to Government service is completely centralized. In USA, although there is a Federal Civil Service Commission, recruitment is decentralized to a very large extent. In UK the appointing authority is in fact the Civil Service Commission but in USA the authority for making appointments is vested in the department or agency concerned and not in the Federal Civil Service Commission. In USA the Civil Service Commission prepares standard job classifications and lays down the required qualifications for appointment to particular posts and prescribes rules and procedures for selection. The actual recruitment is delegated to selection boards of a department or an agency or to a board representing a number of such departments in the same fields of activities. In USA the selection boards for scientists consist entirely of scientific members; and the evaluation of candidate's qualifications for appointment or promotion is made by scientists. In USA, Government employees can apply for any post in any Government agency on his own initiative. In UK and Europe the movement of Government employees is kept strictly under official control; and individual employees cannot take the initiative in looking for more attractive posts. Because of the greater initiative in seeking other posts in USA, there is much greater mobility compared to UK and Europe not only between different Government agencies but also between Government agencies and non-Government educational and scientific institutions as well as private enterprises.

Because of the service concept, promotion in UK and Western European countries is normally possible only when there is a specific vacancy in a higher grade. In UK some flexibility has been introduced through the provision for special merit promotions, but these are very few in number, only about 10 or 12 per year on an average. In USA promotion depends on an individual being selected for a higher post. There is great emphasis on evaluation of posts with a system of classification and specification of requirements. In the American system which is oriented to the concept of the 'post', the ability or achievement of any individual scientist is not relevant except when he is seeking a new post. That is, there is no explicit concept of normal promotion. In USA, however, there is an increasing tendency to create additional posts in order to attract or retain scientists of ability. One very important feature in USA is the financial provision for a larger number of posts than are filled at any given time. Government agencies are continually on the look out for man of ability and usually have sanctioned but unfilled vacancies at their disposal to enable the appointments being made very quickly. The American system is highly decentralized and promotes greater mobility depending on individual aptitudes and also on mutual adjustments between the superior and subordinate workers. For persons of comparable ability, promotions are normally much more rapid in USA compared to UK and Western European countries. The universities and non-Government scientific institutions in USA have their own individual systems for recruitment and promotion of scientists. There are also wide variations in scales of pay and prospects from one institution to another. In the larger universities and institutions, however, the tendency is towards a great deal of uniformity in the pay structure. Retirement benefits are generally similar and transferable; and a person serving in a Government agency can take out his benefits when he accepts a post outside Government and also, if after an interval, he comes back to a Government agency he can usually bring back his benefits and deposit the same with Government. Leave rules are also basically similar.

There is practically no class stratification of the British type in USA, and there are good opportunities for scientists to work their way up from the bottom. Compared to UK and

Western European countries there is far greater horizontal and vertical mobility. In USA pay scales in Government agencies and in educational and scientific institutions used to be appreciably lower compared to private industries. This has received a great deal of attention in recent years and already there is a good deal of improvement in pay scales in the universities and scientific institutions. Pay scales in Government agencies have also been increased. There are also indirect methods of offering high pay for Government work. Large contract projects are given by Government to universities and private scientific organizations which enable very high pay being given to scientists of outstanding ability. I have heard that a big research institution (The Rand Corporation) is in legal form a non-Government non-profit incorporated agency which, however, in actual fact is practically an organization of the Defence Services. This enables the Rand Corporation to offer terms and conditions to scientists without any of the Civil Service restrictions.

USSR

The USSR has developed yet another system which resembles the American system but is even more flexible. There is no concept of a scientific service in either the British or Indian sense. There is a great deal of emphasis on classification and specification of posts somewhat resembling the practice in USA. But the real emphasis in the Soviet system is on the functional qualifications of individual scientists. The structure of scientific posts is broadly as follows:—(*a*) Technicians (which correspond broadly to the scientific assistants in the British Civil Service); (*b*) Junior Scientific Worker; (*c*) Senior Scientific Worker; (*d*) Professors and Directors, and (*e*) about 500 members of the USSR Academy of Sciences and 1,200 members of 20 other Academies of Republics, or of all-union academies in special fields: medicine, agriculture, buildings and construction, etc. There is no concept of any service system on time-scales. There is more or less a fixed pay (with a very small band to provide some flexibility) in each category. The pay is basically uniform for each category of posts with slightly higher pay, (10 or 15 per cent) in some institutions of national importance. A personal allowance of the order of 10 per cent or 15 per cent of the pay can also be given in special cases. There are certain personal allowances for additional qualifications, for example, for passing prescribed examinations in foreign languages or acquiring special qualifications in particular subjects.

Qualifications and eligibility for each category are carefully prescribed. Candidates who have completed their training in junior technical schools are eligible for appointments as technicians in category (1). Graduates from universities and higher educational institutions are eligible for appointment as junior scientific workers in category (2). Persons with the degree of '*Kandidat*' (the junior doctorate) are eligible for appointment as senior scientific officers; and persons with senior doctorate degree for appointment as professors. Exceptions can be made on the basis of actual accomplishments and record of work but are subject to confirmation by a higher authority. The system of recruitment is completely decentralized and the authority for making appointments vests in each agency or institution. There is, however, a well organized system and procedure for this purpose. Each scientific institute and institution has a scientific committee which is appointed by a higher authority and which consists of the director and some members of the staff with some outsiders. In the case of the research institutes of the USSR Academy of Sciences, to be referred to as *Akad. Nauk* the scientific committees are appointed by the presidium (governing body) of the academy. Posts are normally advertized. There are prescribed qualifications for each post with possibility of giving preference to candidates with recognized additional qualifications. Applications are scrutinized by a small committee on which there is a representative of the USSR Trade Union of Scientific and Educational Workers. The task of this scrutiny committee is to examine the qualifications of each candidate and check whether these satisfy the prescribed requirements. This committee simply prepares a report on the eligibility of the candidates without giving any opinion on their merit. This scrutiny prevents any candidate without prescribed qualifications being considered for the post. The applications then go to the director and the scientific committee. The director can appoint technicians with the concurrence of the scientific committee. For any appointment in any higher category the selection is made by the scientific committee on the recommendations of selection boards. Evaluation of the candidates including personal interviews are entirely by scientists and the concurrence of the director is necessary. The scientific committee has the powers of selecting an eligible candidate for any post in the category of junior scientific workers; but appointments which are proposed to be made on grounds of exceptional individual merit require confirmation by a higher authority. Promotion to a

post in the category of senior scientific worker is subject to scrutiny and examination by a higher appointments committee, nominated by the presidium of the academy. Such examination, I understand, is real, and cases occur in which the recommendation of the scientific committee is not accepted. Appointment to posts of directors and professors are made by the presidium on the recommendation of scientific committees or selection boards. It is also worth mentioning that no candidate can be appointed to a post, even by the presidium of the academy, except on the recommendation of the scientific committee concerned. The system is basically similar in universities and Government agencies. The initiative comes from the agency concerned but there are higher committees to examine recommendations for promotion to a higher category. In the universities, for example, the appointment of a professor is subject to approval by a special committee of the Ministry of Education. There are similar committees consisting of scientists in other ministries with similar functions.

The Soviet educational system is closely related to the methods of recruitment and promotion of scientific and technical manpower. There is a comprehensive system of education covering the whole country which is free up to the highest level. The 10-year school education up to the normal age of 16 plus, is free, compulsory and universal. A radical change has been, however, recently announced and would be soon introduced by which all school students would start earning their living two years before completing the school course and would finish the last two years of the present school programme by taking evening courses extending over 3 years. After the 10-year school education, admission to all educational institutions, both at the junior technical and university level, is strictly through entrance examinations. The subjects differ for different types of institutions, university, engineering, or medical, agricultural, etc., but for the same type of institution the syllabus and standards of examination are more or less the same for the whole country. A candidate passing the entrance examination for universities becomes eligible, in principle, for admission to any university in USSR. The most important feature is the high degree of uniformity of standards. As a general rule, stipends are given to practically all students who are admitted to technical and higher educational institution which are sufficient to meet their living expenses during the whole period of study. This has ensured the maximum flow of students of ability into science and technology.

In addition to day courses, there is a highly organized system of education through evening and correspondence courses. Evening courses are given not only in educational institutions but also in industrial enterprises. Big enterprises individually, or groups of small and medium enterprises in a locality, would give training in evening courses not only in general education but also at different levels, in subjects related to their respective type of production. In 1954, during a visit to Erevan (in Armenia, which used to be a very backward area before the Russian revolution) we saw a big enterprise with about 3,000 workers engaged in the production of heavy electrical goods. We found that four types of evening courses were being given in this enterprise. There was a 3-year upper school course for workers who had completed only 7 years of school work but did not have the opportunity of receiving the full 10-year education. There was a junior technical school which admitted workers who had completed 7-year of school education. There were also higher (or university level) courses leading to the degree of electrical engineering with specialization in heavy electricals. Finally, post-graduate courses had also been started a year ago which would enable workers who had completed the higher (university-level) degree course to study for the '*Kandidat*' or junior doctorate degree, and later for the senior doctorate degree. Most of the teaching is done by the engineering and scientific staff of the enterprise itself; a number of teachers also come from the local university and higher technical institutions. Teachers participating in the evening courses received additional remuneration which, depending on the amount of work, can go up to 50 per cent of the pay for the regular day time occupation. The enterprise had a good research section and possessed a great deal of scientific equipment which was used for purposes of training in the evening. We learnt that a program for expansion had been sanctioned which would double the capacity of this factory, and saw that some construction work had already started. It was the responsibility of the enterprise to recruit the additional technical staff; and the manager of the factory told us that they expected to do this mostly by giving training in their own evening courses. This made the training completely suited to the task.

The normal period of study in an evening course is usually one year longer compared to the corresponding day course leading to the same degree or diploma. In addition to courses leading to regular degrees or diplomas a very large number of special courses are provided.

These are usually qualifying tests or examinations for admission to their courses. Usually there is also an examination at the end of the course which is not necessarily a written one, but may be a practical exercise or an oral examination. Passing these examinations is considered as obligatory or additional qualifications for appointments to particular types of posts. This acts as a great incentive for undertaking such courses.

Every Soviet employee has an absolute right to resignation, except in a limited number of cases where a trainee has accepted an incentive scholarship for training in a specialized field on condition that he would serve for a limited number of years in assigned posts. This right of resignation together with complete decentralization of recruitment enables young scientists to find opportunities to work to suit their own aptitudes. For changes within the same strata, he would not get any higher pay (or only to a very small extent in the case of a small number of designated institutions of national importance). An important feature of the Soviet system is that the responsibility is thrown on the directors and the supervisory staff to attract and retain promising candidates, *not* by offering higher pay, but by providing better facilities and a congenial atmosphere for work. During my visit to Moscow two months ago I asked a distinguished Academician, who is setting up a new Institute of which he would be the director, how he would select the professional staff. He answered: "Well, it is mostly with the help of a smiling face and sweet words to point out to the candidates how he would feel happy with us, how he would get a little more space for work or some special equipment. We cannot offer higher pay except in the case of a promotion from one category to another. This is, however, a more difficult procedure and usually appointments are made within the same category."

Comparison between the different systems

The American and the Soviet systems are a good deal similar. The American system is naturally restricted to posts in the Federal Government while the Soviet system is universal and covers all posts in the country. In the Soviet system there is much greater emphasis on scientific and technical training and on the acquisition by each candidate of general and academic and specialized training qualifications. There is a high degree of decentralization of recruitment in both USA and USSR. In USSR it is not possible to offer higher pay for posts of the same category which leads to a great deal of emphasis on creating a congenial atmosphere for work for the scientists. There is, however, one important difference between the American and the Soviet system. In USA posts have to be created in terms of duties and responsibilities without any reference to the qualifications of individual candidates. In USSR there is much greater emphasis on individual qualifications and ability; and normally additional posts would be created to promote suitable candidates. For example, when a scientist working in any institute under the *Akad. Nauk* receives the *Kandidat's* degree or the doctor's degree, a new post in the category of senior scientific worker or in the category of professor would almost automatically be created to give him promotion. This acts as a great incentive for a continuing improvement of individual qualifications. In USA also, in actual fact, government agencies usually have unfilled vacancies in reserve so that appointments can be made very quickly as soon as suitable candidates become available.

In contrast the service system in UK or in the Western European countries is far more rigid. In UK, but not generally in the Western European countries, the scientific service is still in a somewhat lower position than the administrative class. The service system also has a sharply defined class structure in UK; but this is not so in Western European countries. For historical reasons the service system with a very rigid class structure was established in India on the British model and has continued and has become possibly even more rigid after independence. The basic issue in India is whether it would be wise to continue indefinitely the present system on the British model or whether, at least in the case of scientists, attempts should be made to evolve a more flexible system on the lines of USA and USSR.

Pay Scales in Advanced Countries

United Kingdom

In the British Civil Service, the standard pay scales (before taxation) are in pound sterling per year: (1) Scientific Officer* (£ 506 to £ 1,055), (2) Senior Scientific Officer (£ 1,135 to £ 1,345), (3) Principal Scientific Officer (£ 1,375 to £ 1,950), (4) Senior Principal Scientific Officer (£ 2,000 to £ 2,300), (5) Deputy Chief Scientific Officer (£ 2,400 to £ 2,700), and (6) Chief Scientific Officer (£ 3,000 to £ 3,250). It is interesting to note that a 'broad band' has also been recently established from £ 3,500 to £ 6,000 for scientists

*One pound is equal to Rs. 13.33 (app.)

of exceptional ability who may be given any suitable pay within the band. This entirely new and unorthodox provision had to be introduced in order to attract and hold outstanding men. There have been also considerable improvements in pay scales in educational institutions in UK. In grammar school the pay range until recently was from £ 425 to £ 900 per year for an assistant teacher, £ 1,250 to £ 1,525 for a deputy headmaster, and up to £ 2,200 for a headmaster. Very recently further improvements have been made. A teacher with an honours degree may now go up to £ 1,700 in London and a little less elsewhere. If he is a scientist he is likely to reach this stage in late thirties; most science graduates would reach £ 1,400 to £ 1,500 per year, and the least successful will earn £ 1,200 by the age of forty. The maximum for headmasters in bigger schools has been increased to £ 3,000.*

In British universities the standard pay scales are £ 550 to £ 650 for an Assistant Lecturer, who is, in fact, on probation and would go elsewhere unless he is promoted to the post of a Lecturer on £ 650 to £ 1,350. A Senior Lecturer or Reader would get from £ 1,400 to £ 1,850 and a Professor from £ 1,900 to £ 2,850. The pay in educational institutions (both schools and universities) is somewhat lower than that in the regular civil service posts but the difference is not very great (except for the 'broad band' of £ 3,500 to £ 6,000 mentioned above). It is also possible for a scientist in universities and higher educational institutions to undertake outside work on a part-time basis either through his own institution or on his own for which he may receive additional remuneration up to a certain proportion of his regular pay.

Western European Countries

In Western European countries pay scales are usually the same for men of comparable ability working in Government agencies and in universities, educational and scientific institutions. It is usual to have a number of overlapping grades with short time scales. Among scientific workers the dispersion, or the ratio of the maximum to the minimum pay, is usually quite small. In UK and practically all Western European countries there are dearness allowances and also some compensatory allowances in places with a high cost of living. The scientists can also accept part-time consultation or teaching work for which he can receive suitable remuneration.

In France, in universities and scientific institutes and laboratories, a Laboratory Assistant would get a monthly salary of about 60,000 francs (one rupee = 100 francs), a Junior Scientific Worker from 75,000 to 95,000 (in 15 years), a Senior Scientific Worker from 90,000 to 110,000 (in 10 years), a Reader from 100,000 to 125,000; and a Professor would start at 120,000 and go up to 150,000 or in exceptional cases to 200,000 per month. The top civil service pay would be 250,000. Engineers in France would get from 65,000 to 115,000 francs per month. In Germany, there is a large number of overlapping grades A(1) to A(16) with time-scales in each grade and higher posts on fixed pay in grades B(1) to B(11). A scientist or engineer would normally start at A(13) with a scale of from 735 to 1,155 (German) Deutsch Marks per month. (One DM = Rs. 1.14). Promotion to the next grade A(14) with a pay scale from 807 to 1,335 DM per month would be normal, but after this only a selected few would reach higher grades A(15) and A(16) rising to 1,490 and 1,735 DM. The director of a large research establishment may be promoted to B(3) with a monthly salary of 1,925 DM. There are family and other allowances and pensions which may be as high as 75 per cent of the pay, and a widow may receive pension up to 60 per cent of the husband's pay. In Switzerland there are 25 grades, each with a short time-scale. The lowest grade (25th) has a pay scale from about 6,000 to 7,100 Swiss francs per year (one Swiss franc = Rs. 1.11 approximately). Engineers would start at the 8th grade (11,000 to 15,500) and after a few years reach the 5th grade (13,100 to 17,700) and may stop there for the rest of his career. The top or the first grade in civil service has a scale from about 21,000 to 25,700 Swiss francs per year. Professors in universities would often get higher pay, up to about 30,000 Sf. The range is small, and the ratio of maximum to minimum for scientific workers would be less than 3. In Sweden also, there are 30 grades ranging from the bottom (1st grade) with a monthly salary of about 700 Swedish Kroner to the top (30th grade) with 3,000 Skr. per month (One Skr = Rs. 0.90). A graduate would start in grade 13 on 1,257 Skr., and persons with a higher degree in grade 15 on 1,400 Skr. and may normally go up to grade 27 or 28 on 2,500 or 2,600 Skr. per month. In universities and higher educational institutions a junior part-time teacher may start on 1,000 Skr. per month, and fully qualified research workers

*The *New Scientist*, 18 June 1959. It is also noted that a newly graduated chemist would get more in a school up to the age of 25 but after that age he would get more in industry. In late thirties an industrial chemist could expect to earn on an average £ 1,750, and about £ 2,200 in his fifties.

on about 2,000 Skr. Professors get from 3,200 to 3,500 Skr. which may be compared with the pay of Cabinet Ministers of about 4,500 Skr. per month, which is the highest pay in Government. In Norway, in educational and scientific institutions, a Scientific Assistant has a salary of about 16,800 Norwegian Kroner per year, Research Fellow 17,600, Lecturer 24,900, Associate Professor 26,100, and Professor 33,000 Nor. Kr. per year (One Nor. Kr. = Rs. 0.67). In Denmark engineers start at about 13,400 Danish Kroner per year (inclusive of cost of living bonus) and rise in 15 years to about 27,000 Dkr. per year (One Danish Kr. = Rs. 0.71). The ratio of maximum to minimum pay for qualified professional personnel in the Scandinavian countries is about 2½ or 3. In Netherlands there are short time-scale in different grades. An Assistant Engineer has a scale of about 6,000 to 7,100 Dutch Guilders (One Dutch guilder = Rs. 1.24) per year (in 3 years), Engineer 7,100 to 9,900 (8 years), 1st Class Engineer 9,500 to 11,400 (5 years), Chief Engineer 11,000 to 13,200 (6 years) and 1st Class Chief Engineer 12,000 to 14,100 (6 years). Head Engineers may go up to 18,400 Dutch Guilders. The ratio of maximum to minimum pay is again about 2. Salaries for research scientists have three rates of promotion for 'average', 'above average', and 'outstanding' persons; these rates and promotions are reviewed every year.

United States of America

In USA, there are great variations in pay scales in different universities and institutions. In the bigger institutions, the pay scales are broadly similar for men of comparable ability in Government agencies. In universities and scientific institutions the teaching staff can undertake part-time consultation work in industry or Government. In M.I.T. and similar institutions such part-time work is encouraged as a mark of competence. Men of comparable ability would get higher pay in private industry. Many scientists, however, prefer to work in universities and educational and scientific institutions because of greater academic freedom. In USA it is usual for scientists working in universities and educational institutions to accept additional paid work during vacations. Because of wide variations it is somewhat difficult to quote figures for USA. The scale in Government increases from $8,400 to about $12,000 or $14,000 per year. But sometimes very high pay is offered to scientists in an indirect way through 'contract projects' for Government work. In the larger universities and higher technical institutions the pay would increase from perhaps $4,000 or $5,000 for junior instructors to $10,000 or $12,000 (and $15,000 in exceptional cases) for full professors. There are also earnings for part-time consultation work or for lectures given (usually in other institutions) during vacations. In industry, men of comparable ability may get from 25 per cent to 50 per cent more but conditions of service are sometimes considered less congenial. There are also outstanding prizes, beyond the reach of scientists in government or educational institutions, but greater risks in industry. There has been a great deal of complaint that industry has been taking a large number of men from the universities and higher educational institutions: and it has been also stated that about ten per cent of science posts have remained permanently vacant at university level in recent years. Serious attention is being given to this problem at the national level; and pay scales in universities are being steadily increased.

Union of Soviet Socialist Republics

Scientists have the highest pay scales and other incentives in USSR. This policy was initiated long ago with the object of attracting persons of ability to a scientific career. It is now agreed that this policy has achieved its purpose in the spectacular development of science and technology in USSR in recent years. During the last two or three years there has been, however, a general reduction in salaries at higher levels, as an egalitarian measure, but even now scientists receive the highest salaries. There are no time-scales and all appointments are for five years, subject to review at the end of each five year period. For persons working in the same post for five years there may be a slight increase in pay, of the order of 10 per cent, and another similar increase after 10 years of service but such increase is not given in every case. There may also be special allowances on the basis of additional qualifications, for example, for having passed an examination in a foreign language or having attended a post-graduate course in medicine. On the research side, the institutes are now placed in two categories, namely, (*a*) 'leading' institutions and (*b*) ordinary institutions. The Trade Union authorities have an effective hand in this classification. Pay scales in 'leading' institutions would be from 10 per cent to 15 per cent higher. Pay scales in natural sciences are also generally somewhat higher. Most of the institutes in the USSR Academy of Sciences (*Akad. Nauk*) belong to the 'leading' class. Typical pay scales in natural sciences in *Akad. Nauk* are given below. The Laboratory Assistant in the

lowest category of scientific worker would start at about 900 roubles* per month if with training from junior technical schools, and at about 1,000 roubles, which in special cases may go up to 1,200 roubles, if with a university level degree. The next higher category is the Junior Scientific Worker, for which the minimum qualification is the university level degree, who would get about 1,200 roubles (fixed pay) which would be increased to 1,800 or 2,000 roubles if he gets the '*Kandidats*' degree. The next category is the Senior Scientific Worker, for which the minimum qualification is now a *Kandidats*' degree, who would get from 2,500 to 3,000 roubles, which would be increased to 4,000 roubles, when he gets a senior doctorate degree, which is also the pay of a Professor. Thus a Senior Research Worker with a doctor's degree and a Professor have practically the same status. An Associate Professor would get about 3,500 roubles and would be normally a Senior Research Worker of experience with a *Kandidats*' degree. The head of a 'chair', which would imply some supervisory responsibilities, such as the guidance of some research workers, would get about 5,000 roubles. A Director of a laboratory or institute may get 5,000 or 6,000 roubles per month, depending on the importance of the institute. The ratio of maximum to minimum salary is thus about 6.

In *Akad. Nauk*, a 'Corresponding', or associate member gets 3,000 roubles as life pension; there are about 320 such members. An Academician, or full member, would get a life pension of 5,000 roubles (and a surviving widow would get a life pension of 2,500 roubles), a country house and a car. As he would be almost certainly a professor or a director, his income would be at least 10,000 or 11,000 roubles per month. There are about 170 Academicians or full members of *Akad. Nauk*. Members of the presidium (governing body) of *Akad. Nauk* get about 13,000, Vice-Presidents 15,000 and the President 19,000 roubles per month which is the highest salary received in USSR, and is higher than the salary of the Prime Minister and the President of USSR. Pay scales in other All-Union Academies (for Medicine, Agriculture, etc.), the Academies of Sciences of the different Republics, and in the universities and higher educational institutions are similar but somewhat lower than the pay scales in *Akad. Nauk*. It may be noted that pay scales for research scientists and teachers in university level institutions compare very favourably with pay scales in Government service. For example, in the Foreign Service, junior officers get 1,200 roubles, about the same as Junior Scientific Workers, Officers of the standing of Vice-Consuls and Second Secretaries about 1,800, Consul-Generals and First Secretaries, 2,000 to 2,200, Counsellors 2,200 to 2,500 and Ambassadors 2,500 to 3,000 per month as basic pay when working in USSR, that is, exclusive of special allowances when serving abroad.

Pay scales are lower in industry, but the staff may earn substantial bonuses on the fulfilment or over-fulfilment of the plan. The general view is that on the whole there is a good balance between industry, education, and research depending on individual aptitudes; and there is no appreciable drain from any particular sector.

There is wide-spread practice of scientific workers in research institutes giving lectures in the universities and educational institutions for which they get additional pay which may be of the order of 500 or 1,000 or 2,000 roubles per month depending on the number of lectures. A. N. Nesmeyanov, the President of *Akad. Nauk*, gives regularly two or three lectures in undergraduate classes in the Moscow University. Other Academicians also participate in university teaching; this, of course, is a cultural gesture. It is also usual for the teaching staff of universities and educational institutions to participate in the evening courses or to do some work in research institutes for which they would get additional allowances. Scientists in all institutions are encouraged to do part-time consultation work in industry; and scientists in industry participate in evening courses or sometimes in research work in institutes or universities for which they receive additional allowances. In fact additional part-time work is a strong feature of the Soviet system; the additional earnings may amount to half the salary of the regular full-time post. Many scientific workers have a good income from books and articles, as in USSR all scientific articles are paid for. It may also be noted that in USSR income-tax is very low and for top salaries would be of the order of about 12 or 13 per cent. There is a system of awards of medals and money prize for distinguished work in science and technology, the highest award being the Lenin Prize of 50,000 roubles. There is still a great shortage of housing in USSR and residential accommodation is very strictly rationed on the basis of the size of the family. Scientist with a *Kandidats*' or Doctor's degree are entitled by law to have an additional room, in principle, for use as his study; this

*One US dollar is 4 roubles at official rate and 10 roubles at the tourist rate; and one roubles is about Rs. 1.19 at official and Rs 0.48 at tourist rates.

privilege is highly prized. Great encouragement is given to attend special training courses for which there are prescribed requirements which may include passing a qualifying examination. Fellowships, which would not be less than the regular pay, are awarded for full-time study, also grants for books and equipment, travel expenses, and additional paid holiday of one month after completing the courses. Incentives are offered for part-time training in the way of supplementary paid holiday or special leave to prepare for examinations.

The pattern is broadly similar in all socialist countries. Scientists receive very high pay; professors are practically at the same level as the top administrators in government; and academicians enjoy still higher pay and have a higher status.