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DR. B. C. DAS GUPTA, B.SC., M.B., M.R.C.P. D.P.H. D.T.M. & H.

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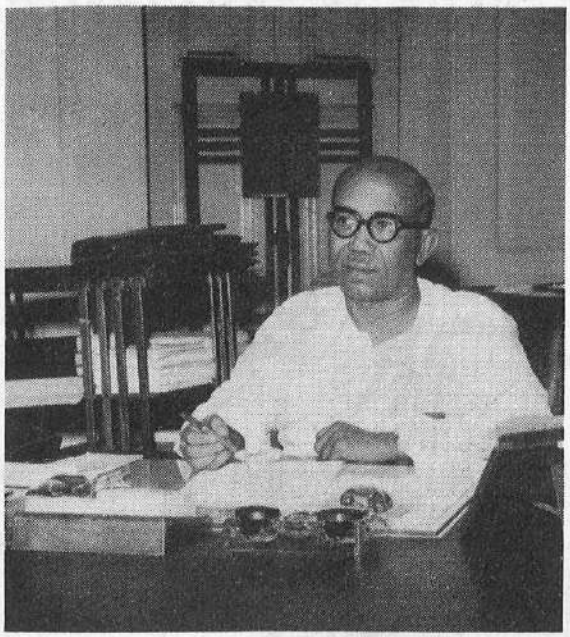

MINISTER,
DEPARTMENT OF HEALTH,
Government of West Bengal,
Calcutta, August 9, 1956.

I am glad to learn that the Indian Public Health Association is going to publish a periodical of its own by the name of "Indian Journal of Public Health."

Public health in the past did not receive the extent of interest needed to develop conditions of better health in our country for various reasons. Of late, keen interest is being evinced by not only public health workers but also those who are devoting themselves to evolve schemes to rouse up health consciousness of the vast mass of the Indian population.

During the First Five Year Plan period a very good beginning has been made and during the Second Plan period more stress has been laid to augment the resources of all the States in India in pushing through the activities in the public health sector more vigorously. In all progressive countries of the world, extensive researches have been undertaken not only to find remedies for the maladies but also effective measures have been evolved to prevent diseases without which a healthy and virile nation can hardly develop.

It is a very happy augury that the members of the Indian Public Health Association have taken upon themselves the task of focussing public attention on the very many problems which face us all over the country, urban and rural, in getting positive health conditions take firm root.

I am quite confident from the trend of events taking place all around us in the Government level and outside that a very bright future awaits us. In the realisation of this ideal contribution of all public health workers as well as the journal which is coming out will be immense. I have no doubt that the periodical will receive the unstained support of all the well-wishers of our country.

I pray for the success of the efforts of our public health workers of all denominations in ushering in a new era of solid positive health for our people. May the journal of Public Health serve its purpose fruitfully and prove to be a forum for discussion of public health problems and their solution on realistic principles.

I wish the periodical an eventful career.

A. Mukherjee

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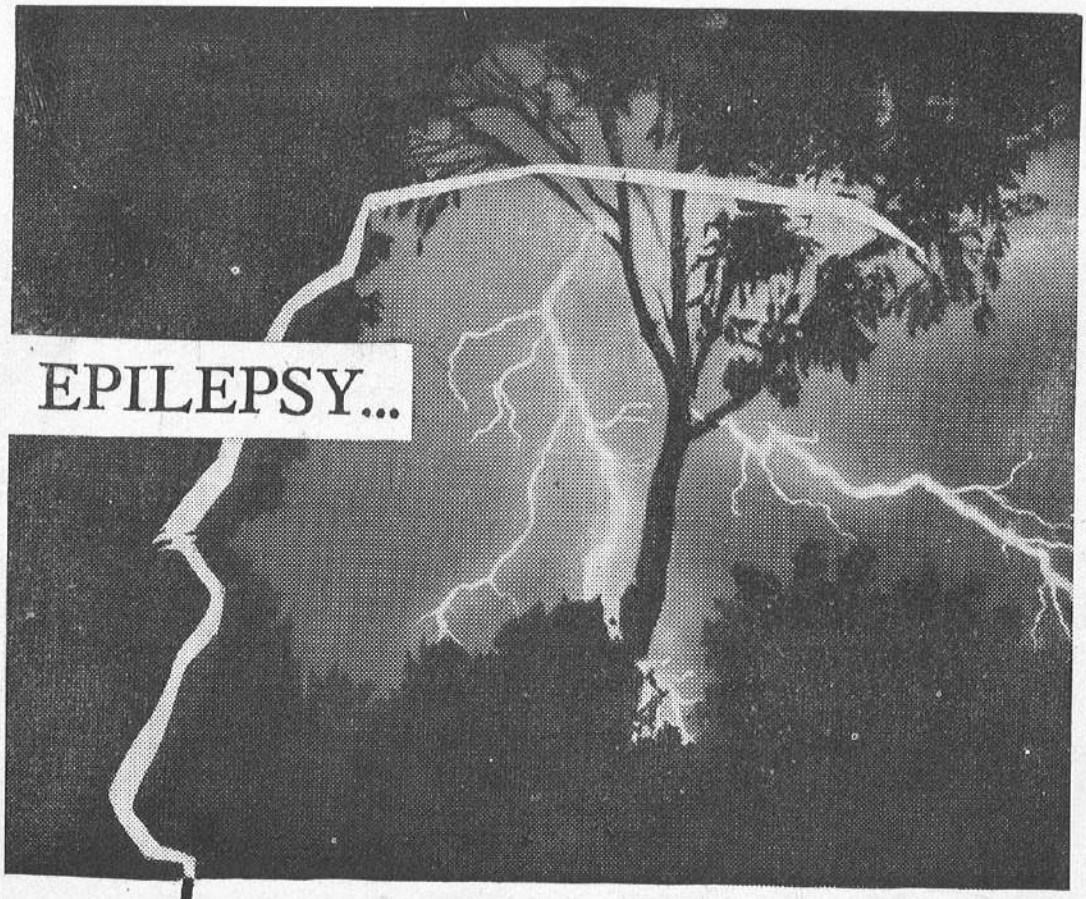

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INDIAN JOURNAL OF PUBLIC HEALTH

Official Quarterly Publication of the Indian Public Health Association

VOLUME 1 OCTOBER, 1956 NUMBER I

THE PROBLEM OF RURAL HEALTH IN INDIA

By

DR. K. C. K. E. RAJA, L.M.&S., L.R.C.P.&S., D.P.H., D.T.M.&H.

Officer on Special Duty, Ministry of Health, Government of India; Secretary, All-India Institute of Medical Science Committeee.

Of a total population of 356.7 million enumerated at the 1951 census about 82.7 per cent were were living in rural areas. The total number of villages in which they lived was 558,089 giving an average density of inhabitants in a village of about 529 persons. Some idea of the range of dispersal of the rural population may be obtained from the fact that 26.5 per cent of the total number of villages in India had less than 500 inhabitants, that 48.8 per cent had populations ranging between 500 and 2,000, and that all those with less than 5,000 together constituted 94.7 per cent of the number of villages in the country. The very high proportion of the population living in villages, namely 82.7 per cent, emphasises the importance and urgency of the rural health problem. While the need for rural health development is undoubtedly great, it is well for us to remember that any scheme for improvement that is put forward should take note of the difficulties that exist and that the formulation and execution of the necessary measures to deal with those difficulties constitute essential preliminary steps towards a successful programme of action. Some of these difficulties art, therefore, first referred to briefly.

As already pointed out 75 per cent of the villages in India contain less than 2,000 inhabitants and this fact adds considerably to the difficulty of organising and maintaining adequate health services for the people. In all countries where the provision of services for an improvement of the health and welfare of the people has reached a high level of development, a substantial part of the cost involved is borne by the local community. In India, with its low per capita income the small-sized community is obviously at a great disadvantage in providing funds to promote the growth of proper services for health, education and other essential needs of the people. Another important feature in this connection is the diversity of distribution of the rural population in different parts of the country. Taking an area of 25 square miles the Registrar General set out, in his 1951 Census Report, the average number of villages and the average number of inhabitants in the six zones into which he divided the country. His figures are quoted below:—

Zone	An average village group covering 25 square miles	
	Number of villages (In round figures)	Number of inhabitants (In round figures)
North India ...	25	12,200
East India ...	18	7,800
South India ...	9	9,000
West India ...	7	5,000
Central India ...	9	3,900
North-West India ...	8	3,600

It is clear that the concentration of villages in an area of 25 square miles and the average

* Read at a Symposium on the subject at Agra on 4th January, 1956, at the Session of the Indian Science Congress.

number of inhabitants in individual villages vary considerably in different zones. A sparse distribution of villages and a relatively small number of inhabitants in each of them would add naturally to the problem of providing adequate services to the people. This statement is true both in respect of personal health services for preventive and remedial care and of impersonal services such as the provision of safe water supply, proper disposal of human wastes and maintenance of the sanitation of the inhabited area at a reasonably satisfactory level. It is much easier to introduce modern sanitation and protected water supplies in large towns and cities with their concentrated populations than in rural areas with their sparse distribution of inhabitants. Further, while in most parts of the country the houses cluster together in the villages, in Malabar and Travancore-Cochin the homesteads stand on widely separated sites and the village, as it is generally understood elsewhere in India, does not exist. The introduction of community services for safe water-supply and for dealing with human wastes would, therefore, present even grtater difficulties in the south-western region of the country than in other parts of rural India.

Another important obstacle to the devtlopment of proper services in rural areas is the unwillingness of all types of health workers to live and work in the villages for prolonged periods. This is largely due to the lack of the amenities to which these workers, who were trained in urban centres and have lived in them for many years, have become accusomed. Inadequacy of amenities in rural areas include unsatisfactory housing conditions, difficulty of transport, insufficient facilities for the education of children, and lack of opporunities for recreational and cultural pursuits. A removal of all these disabilities associated with rural life will undoubtedly take time, but ways and means must be found to lessen the hardships to which these workers are subjected if they are to be attracted to rural service in adequate numbers. Certain measures in this connection will be mentioned later in this address.

To the young doctor, who had been trained under reasonably satisfactory conditions in the hospital attached to his medical college, the state of affairs under which he has to function in a medical institution in the rural areas may appear to be wholly disheartening. Lack of essential aids such as laboratory and X-ray services, of a trained anæsthetist and of opportunities for consultation with specialists, all militate against the practice of modern medicine in a satisfactory manner. He, therefore, finds himself faced with a difficult situation, especially in the absence of any specific training during his medical course to stimulate in him sufficient initiative, imagination and adaptiveness to cope with new and unfamiliar conditions in the rural areas, at least with a partial measure of success. The eventual solution of the problem should be to provide our village population with medical centres at which proper treatment on sound lines can be made available. This may take time but, in the meanwhile, something must be done to improve the present state of affairs. Otherwise the young medical man tends gradually to forget most of what he had been taught and to content himself with a low level of professional work as the easiest method of adjustment to the situation in which he is placed. I shall refer to this subject again.

Other difficulties in the way of developing a programme of effective action for the improvement of rural health can also be mentioned, but I hope I have said enough to indicate that a lasting and satisfactory solution of the problem can be expected only as the result of planning and execution of the necessary measures on a long-term basis. It should also be remembered that the health of the individual and of the community is influenced by a variety of factors, of which the provision of adequate medical care in its curative and preventive aspects, although it is of undoubted importance, forms only one among the many measures that are necessary. A healthy environment to live in, sound nutrition, elimination of the hazards to health associated with employment, facilities for recreational and cultural pursuits and, above all, practice of the hygienic mode of life based on an adequate knowledge of the principles underlying such life—these are all necessary to promote both physical and mental well-being. Therefore, the proper setting for improved health can be created only by an all-round advance in the standard of life of the community and almost every activity directed towards national development has its bearing on the problem of health. I do not, of course, propose to deal with the problem of rural health on this broad basis. I shall confine myself to a brief consideration of some of the major matters relating to the organization of services for preventive and remedial medical care to be provided

for the rural population and to the steps necessary for promoting an improvement of the environment in which that population lives. These two different types of services are appropriately named personal and impersonal health services.

At this point it seems appropriate to refer briefly to the lines on which the national health programme has been promoted under the First Five Year Plan and is likely to take shape under the second Plan. As a joint effort by the Centre and the States steps have been taken, during the First Plan period, to carry out national campaigns against malaria, tuberculosis, filariasis and leprosy; a general plan of rural medical care is being promoted by the provision of health units and maternal and child care centres; and a simultaneous approach to the problem of environmental hygiene has been made through a programme for the provision of water supplies and improvement of sanitation.

As regards malaria the estimated population exposed to the disease is 200 millions. The scheme envisages the establishment of 200 control units, each dealing with approximately a million people through the spraying of houses with DDT and treatment of malaria cases with anti-malarial drugs. The population covered by this service is already more than half of those exposed to risk and it is anticipated that the Second Plan will complete malaria control over the entire 200 millions. Against tuberculosis a campaign of BCG vaccination has been in progress on a mass scale for the past few years. About 60 million persons were tested and 20 millions who were found to be negative and therefore liable to take up the disease have already been vaccinated with BCG. The population, which provides most negative reactors, consists of persons under 20 years of age and it is expected that the BCG campaign will complete the whole of this population by 1961. The number of beds for tuberculosis patients has increased from about 5,000 at the time of the partition of the country to 20,000. As a number of new drugs for the treatment of the disease hold out the prospect of an early and effective sterilization of the patient, it has been proposed that an experimental study should be carried out to assess the practicability and value of a programme of domiciliary treatment of tuberculosis patients. If this method of approach is found successful, extension of medical care to those suffering from the disease and a consequent control of the spread of infection will become much more easy than through the costly process of isolation and treatment in hospitals.

For filariasis 13 control units and 22 survey units have been established during the First Plan period and it is anticipated that the total estimated number of 78 control units will be provided during the Second Plan. As regards leprosy the programme consists of the setting up of field control units to survey and determine the extent of incidence of the disease and to provide domiciliary treatment to cases and contacts. This programme is only at its initial stge, but it is expected that the Second Plan would provide control units in 135 districts in which the incidence of leprosy is known to be high. In addition to these programmes the Second Plan will make provision to the extent of a crore of rupees for starting a national campaign against venereal diseases.

As regards water supply several thousand villages have already been helped to improve their supplies through local development works, national extension and community projects. It is anticipated that the Second Plan will provide a sum of about Rs. 35 crores for extending the provision of safe water to rural areas. Simultaneously sanitation programmes are also being developed.

The national campaign for improved health can be promoted only by the creation of the necessary trained personnel of different types. The following figures supplied to me by Dr. T. Lakshminarayana, Health Adviser to the Planning Commission, indicate the rate of progress that is expected: —

	1950-51	1955-56	1960-61	Number needed at the rate of 1 for 5,000 population
Doctors	59,000	70,000	80,000	90,000
Nurses	17,000	22,000	32,000	80,000
Midwives	18,000	26,000	32,000	80,000
Health Visitors	600	800	3,000	20,000
Nurse Dais and Dais	4,000	6,000	35,000	80,000
Inspectors	3,500	4,000	8,000	40,000
Health Assistants and Sanitary Inspectors				

There are, at present, 36 medical colleges in the country. Six more are to be added during the Second Plan period and four new dental colleges are also to be established, which, along with the six that already exist, will provide 10 dental training centres in India. Provision is to be made at medical colleges and at the large hospitals for the training of nurses, midwives, pharmacists,

sanitary inspectors and technicians of various types.

This brief description of what is being attempted indicates that we are proceeding on satisfactory lines. What is required at the same time is to raise the rate of progress. Some of the difficulties in promoting a rapid advance in rural medical care, to which I referred earlier, should be tackled early and with the determination to see that they are solved. For instance, the grant of a special pay for service in the rural areas, provision of free transport and the granting of a subsidy towards the education of children are all measures which should be brought into operation without delay. The Second Five Year Plan has an ambitious scheme to establish some 3,800 health units in rural areas; the flow of doctors, nurses, health visitors and other personnel into these rural centres can be promoted satisfactorily only if these amenities are provided. The money thus spent will make an abundant return in the way of improved service by a contented staff.

The Bhore Committee, after an exhaustive study of the question, came to the conclusion that a satisfactory medical service for the rural areas can be created by making it a cadre of full-time officers, who are paid a reasonably good scale of emoluments and are prevented from taking up private practice of every kind. It is a combination of curative and preventive medical care which should be promoted in the rural areas. Those who are engaged on preventive health work are, by the established practice of all countries, prohibited private practice. This adds additional justification for the proposed elimination of private practce. Medical education is perhaps the longest and the most costly among the different forms of professional training and the type of service which the doctor renders to the community is undoubtedly as good as, or even superior to those performed by other types of public servants, including officers of the Indian Administrative Service. To demand, therefore, that the scale of emoluments granted to medical men should be the same as the scale for Indian Administrative Service Officers is no unjust claim.

An essential need is to ensure that technical workers of all types, who are produced at considerable expense to the State and to their parents, are suitably employed after training. To-day, it is estimated that we have some 70,000 doctors in the country and the number is expected to rise to 80,000 by the end of the Second Five Year Plan. A vast majority of them are in private practice and they crowd together in urban centres, where an appreciable proportion among them have to earn an insufficient income under conditions of fierce competiton. Simultaneously with this state of affairs there is difficulty in recruiting doctors for rural work. Is the continuance of such a situation satisfactory from the point of view of the public or of the doctors who have undergone a long and arduous process of training? An early improvement of the conditions of service in rural areas is, therefore, essential. It is also necessary that this rural service should be based on a cadre of full-time officers. Such a cadre will facilitate a rotation of officers to serve in the rural areas. It is when a man is condemned to serve in a village for an indefinite period that he becomes discontented Moreover, an opportunity for him to serve in a large medical centre after isolation in a rural institution for some time is necessary from the professional point of view. Short refresher courses and more prolonged periods of study at intervals are all useful to promote professional fitness and arrangements to meet these requirements become relatively easy when there is provision for rotation of service between rural and urban centres.

Our objective should be to provide, eventually, for our rural population a proper medical service. The practice of modern medicine does not become satisfactory unless provision can be made for X-ray and pathological services and for the utilization of the talent which specialists in different branches of Medicine can provide. Even our rural medical institutions should therefore develop into hospitals, which, although of limited size, will be manned at least by a Physician, a Surgeon, an Obstetrician and Gynæcologist as well as by staff competent to provide X-ray and pathological services of a reasonable good order. Such development will, no doubt, take time. In the meanwhile there is urgent need for a type of doctor who has been helped, during his training period, to meet the needs of the rural situation, at least in part, by a flexibility of outlook and by the development of adaptiveness to primitive conditions through the improvisation of cheap and, at the same time, reasonably effective methods of dealing with such conditions. For instance, side by side with the training given to the medical students under the conditions provided by his present teaching hospital, can provision be made for similar training for a

short period in wards where less elaborate forms of service are purposely developed and demonstrated to him and where his powers of initiative and of resourcefulness can be given an opportunity to find expression? This is a matter which may well be given serious consideration by our medcal educationalists. To-day, there is a growing dependence on the part of the doctor on laboratory tests and other aids to diagnosis. The importanc of these is not denied, but such dependence in an undue measure may tend to retard, to some extent, his own powers of observation and the effective use of the senses for a fuller understanding of the patient's condition. A greater emphasis on the development of such powers by the prospective medical practitioner is undoubtedly of value to him, wherever he practices, but it is eves more so in the case of a physician labouring under the disabilities associated with a rural medical institution.

In a recent book entitled "Rural health and medical care" Lt. Col. P. C. Dutta made an excellent study of the problem we are discussing today. In that book he sketched in brief outline a health organisation for a population of 50,000 living in about 60 villages. This health organisation consists of two doctors, a man and a woman, two sanitary inspectors, 3 health visitors, six auxiliary medical workers, 12 village level workers and 20 trained *dais*. He has calculated that a levy of one per cent of per capita income, which he has estimated Rs. 225 per year, will finance the scheme in full, including a building programme spread over a period of two to three years. He has pointed out that a survey in Singur Health Centre, West Bengal, by Lal & Seal demonstrated that, on a per capita income of 165 a year in 1944, the people were spending Rs. 2/8/- per head per year for medical expenses, or 1.52 per cent of their average income. He, therefore, assumes that one per cent of the income should not prove to be an unduly heavy burden on the people, especially if, as suggested by him the contributions from individual families are graded upwards from Rs. 10/- per year for families with annual incomes between Rs. 500 and Rs. 1,000 to Rs. 25 per year in the case of families with annual incomes of Rs. 2,000 and above. He also suggests that this levy from families should be supplemented by contributions by the District Board at the annual rate of Rs. 2/8 per family with its income below Rs. 500/- a year and by the State Government of a similar amount for such families and of an additional contribution of Rs. 2/- per year for each family within the annual income group of Rs. 500/- to Rs. 900./-.

The principle of a contributory health scheme is excellent. To make even a small contribution adds to the self-respect of the beneficiary under the scheme and it raises the service above the level of charity. There is indeed need for experimentation in the field of organising rural medical care in order to work out the cost and efficiency of the service that is made available. Eventually, however, I feel that it is important to organise the service not in scattered units promoted on the initiative of individuals or of organisations but on the comprehensive basis of a State-wide scheme, so that personnel of adequate quality will become available for recruitment in view of the wider opportunities for promotion and for varied experience which such a service would provide. Rotation of work in urban and rural areas, provision of facilities for refresher courses and for higher professional studies and the stimulus to better performance which contact with a variety of institutions and with workers of high standing will provide—these are advantages which such a comprehensive scheme will make available. Further, it should be remembered that a rural medical care programme should not remain isolated from the general health service for the community as a whole. Higher and better forms of service can be made available to the rural population only when rural hospitals and dispensaries are linked to the more elaborately staffed and equipped institutions in urban centres and when patients from rural areas requiring specialised diagnostic and curative services can be moved up to these urban institutions for appropriate treatment. From this point of view also the objective should be to organise the service on a State-wide basis. The various health developments that are taking place under the successive Five Year Plans, to which a brief reference was made earlier in this address, will obviously tend to reach this goal. In the meantime I agree that there is also room for experimentation in the field of organisation of community health services. Well planned experiments of this nature can be handled with a greater measure of flexibility if they are started in limited areas by individuals or organisations than if they form part of the governmental programmes. Financial support and technical guidance should, at the

same time, be made available by Governments, whenever necessary.

There are many other aspects of the rural health problem which require consideration besides the ones I have already dealt with here. For instance, what is the place of the indigenous system of medicine in a national health programme for the rural population? The Chopra Committee suggested that a selection should be made from among the few hundreds of thousands of local practitioners of these systems in India, so as to secure the more intelligent and efficient among them, that these selected persons should be given a course of training for six months and should then be utilised as doctors in the rural areas in order to spread medical care rapidly through the coustryside. The proposal is, in my opinion, not only unsound but also harmful if a long term view of medical developments in our country is taken. These indigenous systems represent a stage of development of Medicine which, in their own day, presented a high level of excellence. But the world has moved a long way from that time. Modern medicine has become an attempt to utilise all the available resources of the physical and biological sciences to interpret health and disease and to promote measures to prevent sickness, to cure it wherever possible or at least afford relief to the patient and to contribute to the advancement of man's general sense of well-being. The extent to which success has been achieved in reducing morbidity and mortality, in prolonging life and in increasing working capacity is phenomenal. Therefore there can be no going back on the process of India's participation with the rest of the world in the fight against disease by the utilisation of all the knowledge which modern medicine provides. The rural population has as much right to ask for the best form of medical care as the inhabitants of towns and cities. When it is remembered that the preponderant section of the community lives in rural areas and that it is the preservation of the health of these people and an enhancement of their working capacity which will eventually determine the level to which national prosperity attains, the importance of choosing wisely the form of medical care to be made available to the rural population becomes all the more emphasised. The fruits of an efficient use of the resources of modern medicine are already becoming known to a growing section of our village people. Anti-malaria measures, mass campaigns against venereal diseases, the use of the newer drugs for the treatment of tuberculosis are all demonstrating what can be achieved by the adoption of measures which advancing knowledge in the field of medicine is increasingly making available to us.

The plea that, by the adoption of the method advocated by the Chopra Committee or of some other form of using practitioners of the indigenous systems, it is possible to spread medical care rapidly through the rural areas need not also be taken seriously. It is doubtful whether a heterogenous crowd with varying levels of general education and of training in indigenous systems selected from existing practitioners of these systems can be made into useful workers by a course of training for six months as advocated by the Chopra Committee, especially as that course has to provide at least the elements of all the major subjects including preventive medicine and obstetrics. On the other hand, it seems to me that the proposal that has been put forward to create, as a temporary measure, a group of auxiliary health personnel, who starting with Matriculation as the standard of general education are to be put through a course of two years and are then to be utilised for work in rural areas under the supervision and guidance of fully qualified doctors, is a much sounder method of securing the same result.

I do not want to convey the impression that my attitude is one of total condemnation of the indigenous systems of medicine. They no doubt contain principles and practices and, above all, certain drugs of great value. These must be secured for the benefit of mankind. But whatever is of value has been thickly overlaid with much material that has to be discarded and it is essential that a careful process of selection through scientific methods of investigation should be carried out in order to secure the valuable elements in these systems. This is a process which has already been started by the Government of India by the establishment of the Ayurvedic Research Centre at Jamnagar.

I would advocate that India should lay down a five point programme in regard to indigenous systems, an enunciation of Pancha Shila in this particular field.

(a) Firstly, there should be adequate provision for research into these systems so as to ensure that whatever is of value in them is not lost. The incorporation of such useful material in modern medicine will constitute a process of synthesis which is of definite

value to all. Already a certain number of Ayurvedic drugs have been admitted into the Indian Pharmacopœia and some of them have received a wide range of acceptance in other countries also.

(b) Secondly, in regard to medical education India must produce doctors who are in no way inferior to the medicial men of other countries. Therefore, qualification in modern medicine should be made a prerequisite for training in the indigenous systems of medicine. A precedent to this procedure is available from the legal restriction in the United Kingdom that training in Homœopathy can be undertaken only by qualified practitioners of modern medicine. When such a background is provided, the medical man may be expected to use his discretion even when he takes to the practice of other systems of medicine.

(c) Thirdly, the Central and State Governments should declare that modern medicine will be the basis for the development of national health services.

(d) Fourthly, practitioners of all indigenous systems of medicine should be registered throughout the country, and, after a particular date, no others should be permitted to get themselves admitted to these registers except those who fulfil the second condition mentioned earlier.

Indeed, a complete registration of all practitioners of modern medicine is equally necessary, the required qualifications for registration being those recognised under the laws prevailing in the country.

After this process of registration is complete for all systems, no one should be permitted to practise medicine, who has not been admitted to any of these different registers. Even with this restriction there will be, in the country, a considerable number of practitioners of the indigenous systems for about 25 to 30 years, so that those, who desire to benefit by these systems, will be able to avail themselves of their services.

(e) Lastly, implementation of these principles should be carried out on an all-India basis, the necessary Parliamentary legislation being undertaken at an early date.

This five-point programme will give the correct lead to the country and promote the emergence of a common policy which will help to secure for the benefit of the people whatever is useful in the indigenous systems of medicine and will, at the same time, ensure that the limited funds that are available for health development are not diverted to channels which are not in the best interests of the country. It is pertinent to point out in this connection that, a few years ago when I was the Director General of Health Services, I put forward this programme of action, that it received full support of the Central Cabinet but that, at a Conference of Health Ministers which took place later, this proposal although sponsored as a recommendation from the Centre was not accepted by the States. The position is that, today, a number of States are maintaining Ayurvedic Colleges and hospitals and dispensaries. Those who seek admission into Ayurvedic Colleges are people who fail to get into the institutions giving training in modern medicine and, even in these Ayurvedic colleges, the students are more keen on that part of their course which deals with modern medicine than that for the exposition of Ayurvedic principles and practices. As already pointed out the general public too are beginning to recognise that modern medicine brings to them a range of preventive and remedial medical care which far exceeds in quality the benefits conferred by the indigenous systems. With a growing expansion of modern health services this conviction on the part of the people is bound to become stronger and more pronounced. The increasing demand that will consequently follow for the provision of health services based on modern medicine will gather such strength as to make it obligatory on the States to revise their present policy and to agree to the adoption of the five principles enunciated earlier. It is only a question of time before this change, which is inevitable, comes over the country.

It is worthwhile to look across our borders and see what our neighbouring country, China, is doing in regard to a similar problem which exists there. They are making use of the practitioners of their indigenous systems of medicine to povide medical aid for those who prefer to be treated by such practitioners. China is, at the same time, pushing forward her active programme of training in modern medicine. It is understood that she recently decided that the full-five year course will alone meet her requirements and so she has planned to produce only doctors of reasonable competence. What is even more important is that she has decided to stop the training of practitioners of indigenous systems. Those who practise these systems are all registered and practice by unregistered persons is prohibited.

It is to the advantage of India if similar

decisions can be taken and implemented by our governments. There are in the country several thousands of persons trained in modern Ayurvedic colleges. They are better trained than the group recommenedd by the Chopra Committee for incorporation into rural health services. If they can be given sufficient training in preventive health work, obstetrics and in other branches of medical practice in which they are deficient, they can and should be used for expanding health work in rural areas. They have been produced in relatively large numbers mainly by the efforts of State Governments and their services should be utilised in full. But, in my opinion, it would be wrong to maintain the Ayurvedic colleges and to continue the production of these types of doctors.

As already stated the rural health programme should be considered as a part of the total scheme of improvement of the life of our village population. A considerable increase in the standard of life resulting from improved agriculture and diversified employment to meet the growing demand for consumable articles by the people, better housing, a higher standard of education and promotion of cultural activities on a wide scale, more abundant food of better quality—these and many other developments are necessary as contributory factors for a rise in the standard of public health, as apart from the provision of adequate health services for the people. These objectives will be reached through the achievements of progressive Five Year Plans and, in the process of execution of these plans, the scattered population of today is bound to be brought together into rural townships, in which the amenities of modern civilized life will become increasingly easier to develop and maintain. As and when these changes come into being, the disadvantages which rural life presents today and which keep back health workers and others whose active participation in rural reconstruction is necessary, will steadily disappear and the tempo of progress in the promotion of the health and welfare of the people living in rural areas will be accelerated to a corresponding extent.

Human effort in all forms is motivated partly by utilitarian considerations and partly by the urge for an outward expression of the creative spirit that animates man. Both these types of forces have their influence on the health worker. The attainment of professional success and approbation of fellow workers, of government and of the general public are rewards mainly of a utilitarian character. Side by side there are also satisfactions of a deeper and fuller nature. Conquest of disease, amelioration of suffering and enlargement of man's capacity to enjoy life are all positive achievements, participation in which possesses something of that quality which is associated with creative effort in science, art and literature. The abiding joy which creative self-expression promotes can well be earned as a fitting reward by workers in the field of health.

A STUDY OF THE CONTRIBUTIONS OF SOCIAL FACTORS TO THE CONTINUED PREVALENCE OF CHOLERA IN THE CITY OF CALCUTTA

By
S. C. SEAL, M.B.B.S., D.P.H., Ph.D., F.A.P.H.A., F.N.I.
and
K. K. MATHEN, M.A., M.P.H. (Johns Hops.)
With the Technical Assistants of
A. GHOSH-HAZRA, M.B.B.S.,
K. DAS GUPTA, B.Ccm.
and
M. V. RAMAN, M.A., DIP.PUB.ADM.,
All-India Institute of Hygiene and Public Health, Calcutta.

The successful control or natural recession of many of the so-called 'tropical' diseases which were once widely prevalent in the temperate regions of Europe and other western countries is believed to be rather due to the improvement of social and economical conditions in those countries than to the knowledge of their causative germs. This knowledge was acquired much later than the time of commencement of their decline. In spite of the advanced knowledge, now available, of the causative germs and the methods of control, some of these diseases like cholera, smallpox, leprosy, enteric fevers, etc., are persisting in the various rural and urban areas of this country. It now appears that it is not the lack of application of the preventive measures that is always responsible for this continued prevalence, but certain social factors, the importance of which is being increasingly realized by the medical world, are in its background. In fact, the three groups of factors which have been found to operate, to a greater or lesser extent, to bring about the existence and continued prevalence of a disease in a locality are (1) Biogens (pathogens), (2) Sociogens and (3) Geogens (Seal, 1954). The relative influence of these factors vary more or less in different places with corresponding variations in the disease prevalence. The results of general health survey in a rural area of West Bengal by Lal and Seal (1949) also pointed towards the influence of social, clutural and economic factors upon the prevalence of the so-called 'tropical' diseases there. The main purpose of the present investigation was to acquire and widen our knowledge through the collection and interpretation of more precise information about the contributory factors in disease prevalence in order that more effective attack could be made for the solution of the problems. It was also intended to demonstrate methods by which information obtained by field survey would tie together morbidity data from hospitals and information from routine sources on the general population.

Selection of place and procedures of study.

The city of Calcutta which is the home of many tropical diseases and which has a numbe of well-equipped hospitals was considered as the suitable field for carrying out this work.

It was decided to begin the studies on Cholera in the first instance, as an epidemic was actually in progress in the city at the time and this was one of the diseases which has been persisting there since long past. Records of deaths from cholera in the city are available for the last one hundred years or more as given in Appendix I. The quinquennial averages of these deaths are shown in Fig. 1. The present study was designed to make inference on the relationship of social factors with certain diseases by comparing the socio-economic and environmental background of patients with similar information obtained from the general population. The general investigative procedures consisted of collection of the names and addresses of cholera patients from the Nilratan Sarkar Hospital where the majority of such cases were admitted, as well as from the City Health Department where the records of all cases of cholera in the city, removed by the ambulance, were available. The data were collected in properly designed schedules by visiting the patients' houses. A

list of 1,243 proved cholera cases was prepared, out of which 662 cases including 112 from the neighbouring town Howrah, was available for study. The period of investigation extended between April 1953 to September 1954 and covered two epidemic seasons. The results of analysis of the data are given below:

Results

1. *Distribution of cholera in the city.*

Out of 32 wards of the city the principal affected ones during the two consecutive cholera seasons arranged according to the number of cholera deaths and densities of population (1951 census) are given in Table I (see also Map I).

TABLE 1

Number of cholera deaths in the principal affected wards of the city of Calcutta in 1953 and 1954 with their corresponding densities of population per acre.

Serial No.	Most affected areas	Ward No.	Number of recorded cholera death	Density of population per acre (1951 census)
1	Tollygunj	27	241	142
2	Entally	19	235	170
3	Maniktala	29	154	90
4	Jorabagan	5	138	491
5	Bartola	3	105	309
7	Shampukur	1	86	300
8	Jorasanko	6	86	458
9	Tangra	18	84	46
10	Beliaghata	28	82	104
11	Kumartuli	2	76	342
12	Colootola	8	69	399

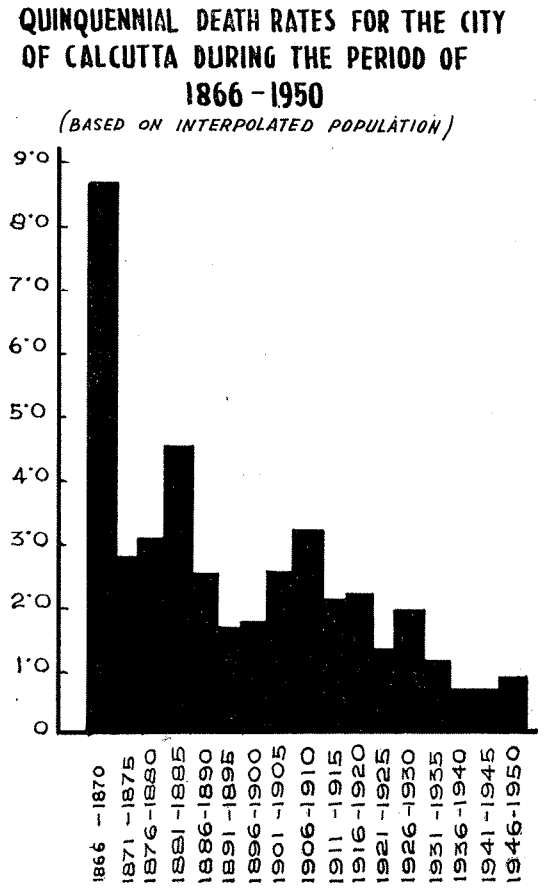


Fig. 1.

The data in Table I apparently show no correlationship between the densities of population and intensity of cholera. Some of the affected wards are distributed along the River Hooghly or the canal system in the city connected with the river. Thus a suggestion was put forward by some workers that the existence of the River and the canals is responsible for the persistence of infection but this hypothesis does not apply to all the affected wards. The four wards which generally escape infection and were practically free during the two seasons under consideration are Nos. 12, 15, 16 and 17. The ward No. 12 consists mainly of the office quarters and the business centre of the city and wards 15, 16 and 17 are inhabited predominantly by the Europeans and the richer strata of the Indians.

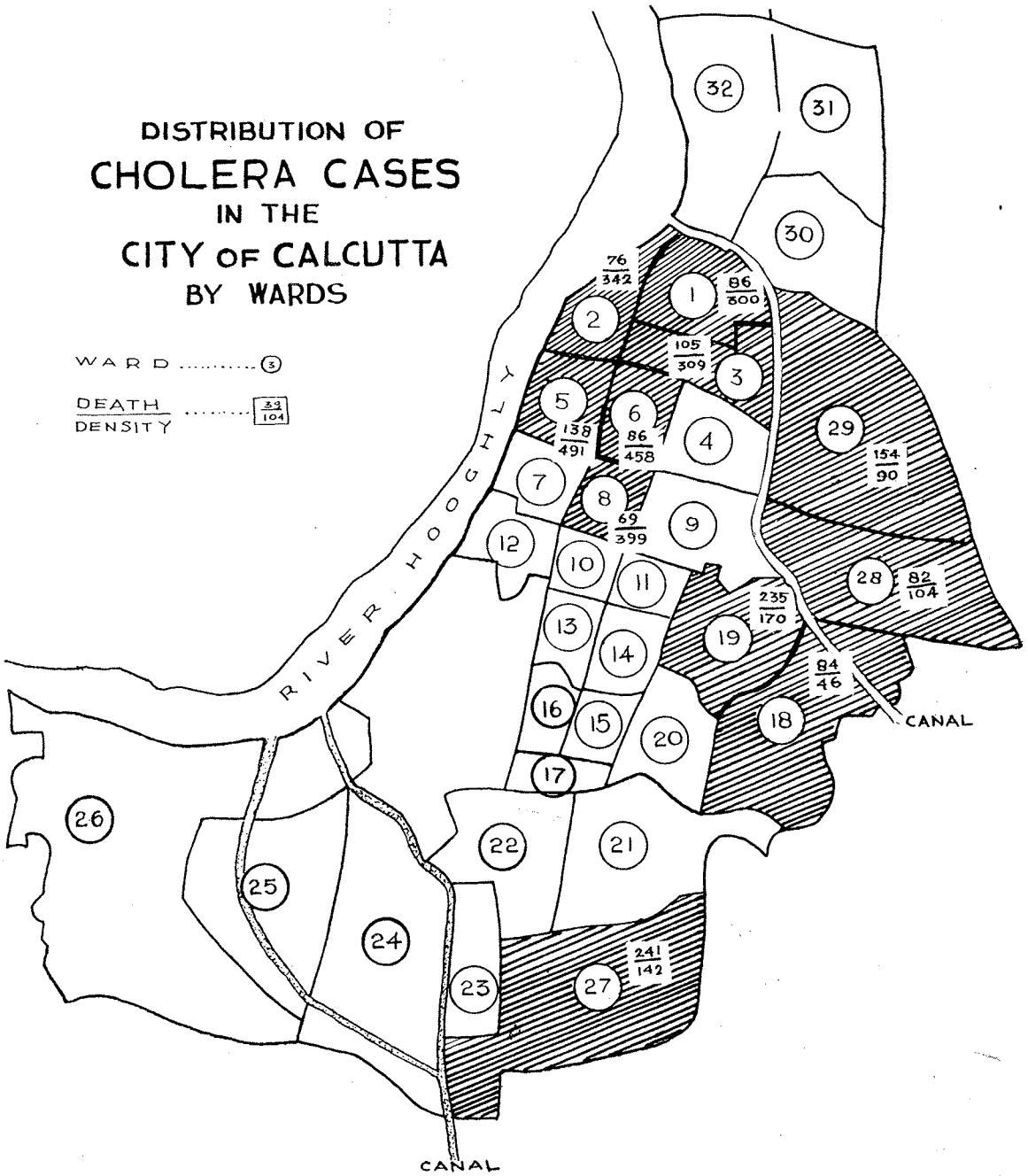
2. *Residential Status of the Cholera cases:*

Of the 662 patients contacted 28.4 per cent were temporary or occasional visitors and the remaining 71.6 per cent had been resident in the city for more than 2 years. Including 245 Hindi speaking patients who could not be contacted due to either death or their leaving the city immediately following convalescence, the percentage of temporary residents was about 35.0 among the total cases of 1243 in the list. Since the proportion of temporary residents in the city at any one time would not exceed 5 per cent, a propor-

tion of 35 per cent in the incindence of cholera cases in the city is indeed very high. It shows that the new comers contribute largely to the endemic incidence of cholera in the city.

3. *Age incidence :*

The percentage distribution of cases among different age groups is shown in Table II (see also Fig. 2). The records show that the majority of the age groups were more or less affected almost in the same proportion as their relative distribution in the city population (1951 census) but the proportion of cases in the age groups 1-4.9 years was nearly



double and the same in the age group 55 years and above slightly higher than that in the city population. Cases also occurred in certain number of breast-fed and milk-fed babies. The latter possibly picked up the infection from water, contaminated milk or utensils.

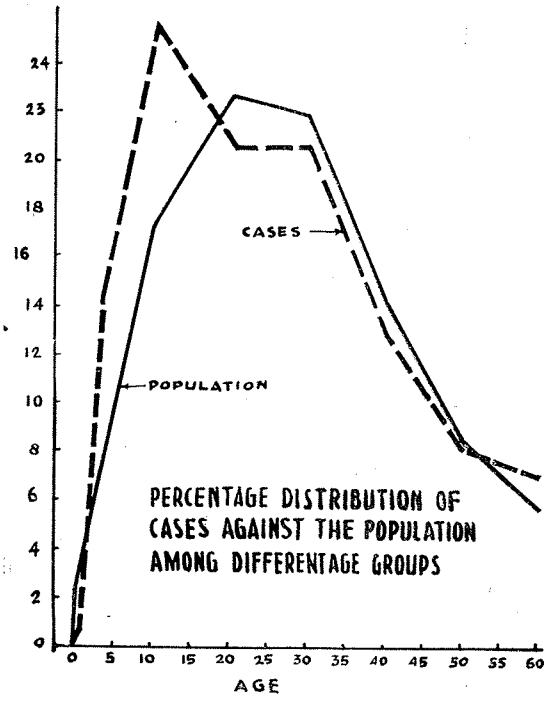


Fig. 2.

TABLE II.

Percentage distribution of cases among different age groups as against the percentage distribution of population in the city in the same age groups.

Percentage distribution of	AGE GROUPS 0-1	1-4.9	5-14.9	15-24.9	25-54.9	45-54.9	55 and above
Cases	0.6	13.7	15.7	20.8	20.8	13.0	7.1
Population in the city ...	2.25	7.0	17.3	22.8	22.0	14.4	5.7

4. *Sex, Marital status and Religion :*

Among the cases 52 per cent were males and 48 per cent females (Fig. 3). The population of male to female in the city population being 65.1 : 34.9 cholera obviously affected greater proportion of females than males. This happened in the two consecutive outbreaks investigated. Among the cases 56 per cent were married including the widowed.

Among religions the Hindus and the Muslims were the main vistims, the propor-

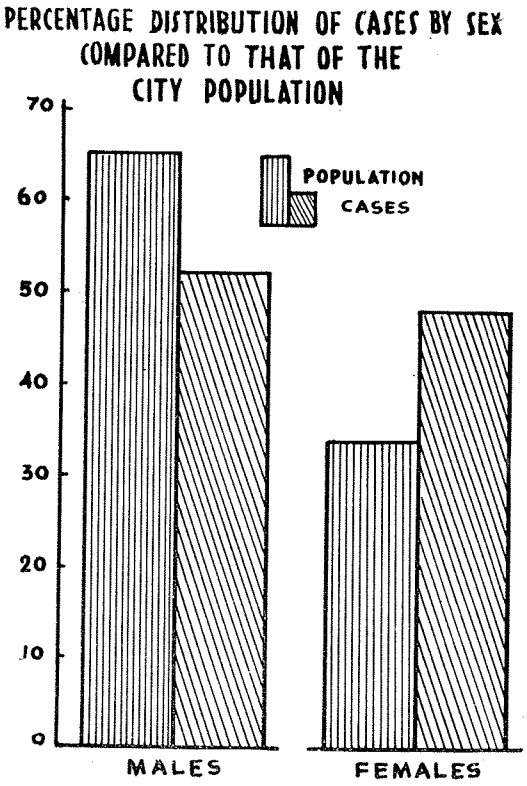
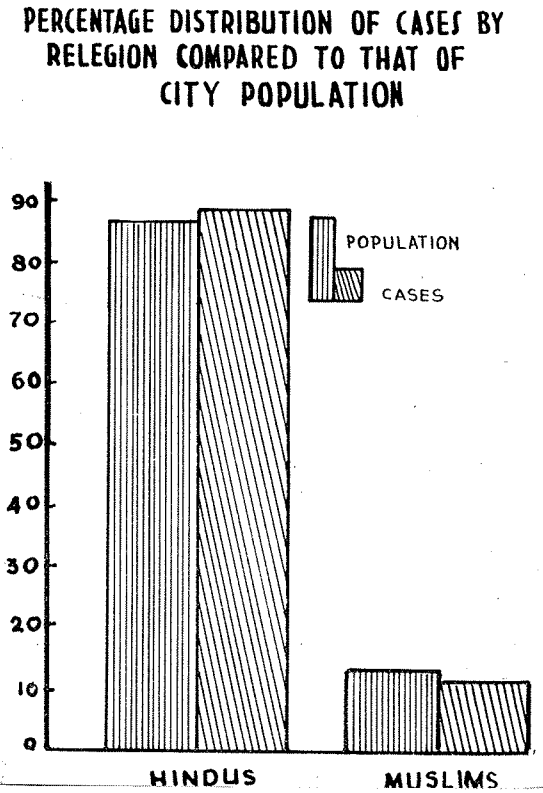


Fig. 3.



tion being 88.6 : 11.4 (Fig. 4) almost the same proportion as in the city population namely 87.4 : 12.6. Persons belonging to other religions either rarely suffered or did not come to the hospital.

5. *Occupation :*

The majority of cases, 93 per cent, belonged to the following occupations: At home—40.0, house-wife—24.0, servants and labourers including artisans—18.2, shopkeepers including hawkers and vendors—7.2 and students —3.6 others—7.0 (See Fig. 5). Thus as high as 64 per cent of cases occurred among those who stayed at home and 25 per cent among the low income groups such as daily labourers, vendors, hawkers and coolies; only three milkmen were included among the food-handlers.

About 72 per cent of the 547 patients whose place of employment was known were employed indoor, 13 per cent both indoor

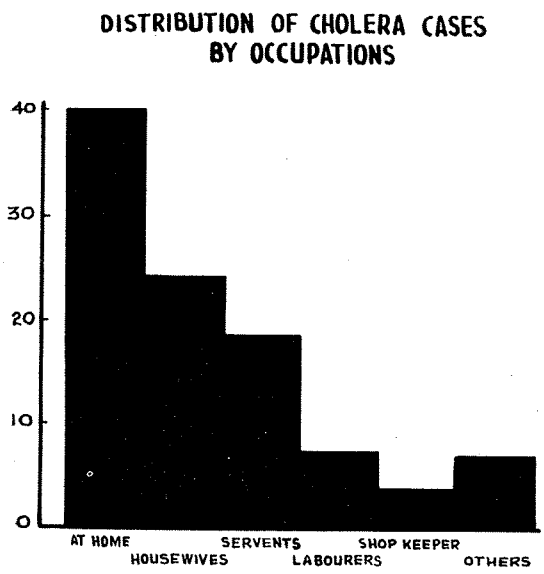


Fig. 5.

and outdoor and only 15 per cent outdoor. As high as 96.5 per cent had their attacks at home and only 3.5 per cent while at office or outdoor or during travel.

6. *Province of origin of cases :*

The statewise distribution of cases were as follows: West Bengal—66.9%, Bihar—18.9%, East Pakistan—4.1%, Orissa—3.9%, U.P.—4.4% and the rest—1.8%. Thus the proportional distribution of the Bengali, Hindi and Oriya speaking patients was 66.9, 24.5 and 3.9 per cent as against 65.6, 21.3 and 2.3 per cent respectively in the city population (Fig. 6). It is therefore obvious that the proportion of cases among the non-Bengalis

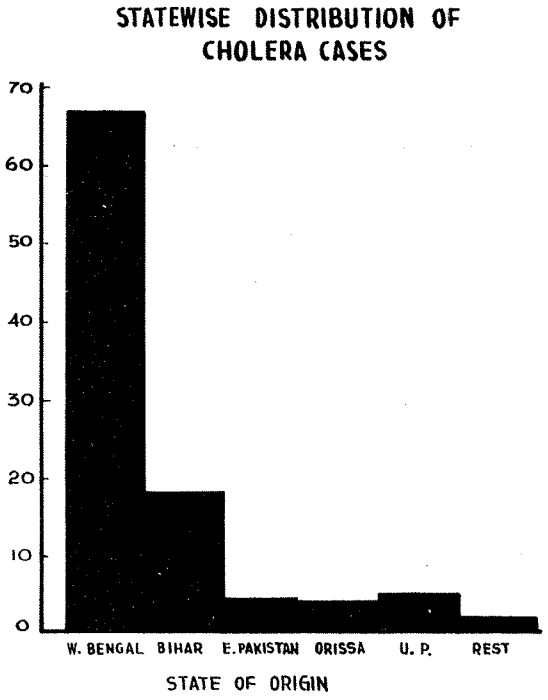


Fig. 6.

(majority Biharis) was higher than their corresponding proportion in the city population. It may be mentioned here that the Biharis and the Oriyas formed the major bulk of the more vulnerable temporary residents of the city. Actually the proportion was even higher than what has been stated above, for out of 1243 cases including those of the absentees (Bengali speaking—245, non-Bengalis—336). 370 or 30 per cent suffered from cholera against 21 percent in the city population. Taken only the 1954 outbreak this proportion was 28.4 per cent.

7. *Social conditions :*

(a) HOUSING: Out of 615 houses accommodating 662 patients who were contacted 66.3 per cent were bustee dwellings, 26.7 per cent family houses or blocks, 1.6 per cent mess buildings, 2.9 per cent office quarters or mill areas and 2.5 per cent miscellaneous types such as godowns, cooli lines, market place etc. Only 32 per cent of the houses including the office and mess buildings were brick built, the rest were huts, 33% being thatched, 13.1% huts with pucca plinths, 11.9% with tin or asbestos roof, 7.7% tiled

huts and 2% mud huts. Since the bustees constituted only 5-6% of the houses in Calcutta, Cholera affected chiefly the bustee dwellers i.e. the lower income groups.

(b) KITCHEN ARRANGEMENT: The cooking arrangement was satisfactory in 9.5% of households and insanitary in as high as 89%: 1.5 per cent had no kitchen or arrangement for cooking. As high as 66% of the families were cooking in the verandah and 16.6 per cent in the living room itself. The cooking was being done by patients themselves in 48.2 per cent instances, by the housewife in another 48.2 per cent and by the relatives or cooks in 3 per cent of houses.

There was no arrangement for storage of food in 45% of the affected families. It was unsatisfactory in 48.1% and satisfactory in only 7.1% families. Utensils were inadequate in 72.7% per cent families and practically nil in 1.1%. The habit of washing them was unsatisfactory and/or very unsatisfactory in 82.8 per cent families.

(c) OVERCROWDING: (i) The proportional distribution of houses according to the number of families is given in Table III. It will be seen that except for 7.7 per cent of the houses the rest (92.3%) had multiple families. One third of the houses had been accommodating 5-3 families per house and nearly another one third more than 8 families. One house accommodating refugees and kept very badly had 2,000 members belonging to more than 300 families with only one filtered water tap for drinking purpose. Thus the overcrowding was very high, the average number of families per house for all houses visited being 8.48 and for houses accommodating more than 8 families being 24.6. This is exclusive of the hotel and mess buildings and one refugee camp containing 103 families and 2910 members. This overcrowding is no doubt closely interrelated with the low economic status.

TABLE III.

Proportional distribution of cholera affected houses according to the number of families (Total houses 615).

Number of families in a house	Percentage of houses in each category**
Single family	7.7
2 families	6.8
3 ,, ...	12.8
4 ,, ...	10.1
5-8 ,, ...	33.0
More than 8 families	29.5*

** Remarks: Excluding hotels and mess buildings and one refugee camp of 103 families and 2,910 members.

* Average number of families per house was 24.6.

(ii) *Number of persons per family:* The number of persons per family varied from a single person to 25 with an average of 4.4. This was not high as a large number of temporary residents was either single person or two in a family.

(iii) *Number of persons per house and per room:* The seriousness of overcrowding was better realized when it was found that 30 per cent of the houses which were bustees, were accommodating 110 people each, the overall average of all houses being 38. Even excluding the 30 per cent houses where overcrowding was enormous, the average number of persons per house was 19.7 and per room 4.5. In fact, 75 per cent of the houses had 4-6 persons per room and there were 8 houses with more than 10 persons per room.

(iv) *Space per person:* The overcrowding was mainly due to the large number of families residing per house with very little available space per person. It was less than 25 sq. ft. in 88.2 per cent of families, less than 36 sq. ft. in 7.3 per cent families, less than 50 sq. ft. in 1.5 per cent families and 50 sq. ft. or more in 2.8 per cent families.

(d) *Lighting & ventilation:* Ventilation was very poor in 85.2 per cent houses, fair in 12.3 per cent and good only in 2.3 per cent houses. The condition of lighting was the same, being poor or very poor in 84.2 per cent houses, fair in 13.1 per cent and good only in 2.6 per cent houses.

(e) *Literacy:* As high as 86 per cent of the cholera patients were illiterate, including 12 per cent who could only sign their names. 12.8 per cent were attending schools and 1.1 per cent colleges. In other words, except for 1.1 per cent all the adult patients were illiterate. Since the cholera cases had almost the same proportion of age distribution as that of the city population the expected literacy rate was 44 per cent instead of 14 per cent found here (Fig. 7).

In regard to the knowledge of the causation and prevention of diseases, particularly of cholera, 70.6 per cent patients were completely ignorant of the causation of disease and 64.6 per cent had no knowledge about its prevention. The community sense was individualistic in 92.6 per cent of patients. Thus literacy and education proved to be an important social factor in cholera infection.

(f) *Diet and food habits:* Of the 662 cases 554 or 83.8 per cent were having rice diet, 10.7 per cent mixed rice and wheat and 3.9 epr cent wheat diet. Only 17 cases (2.5%) were having exclusively milk diet.

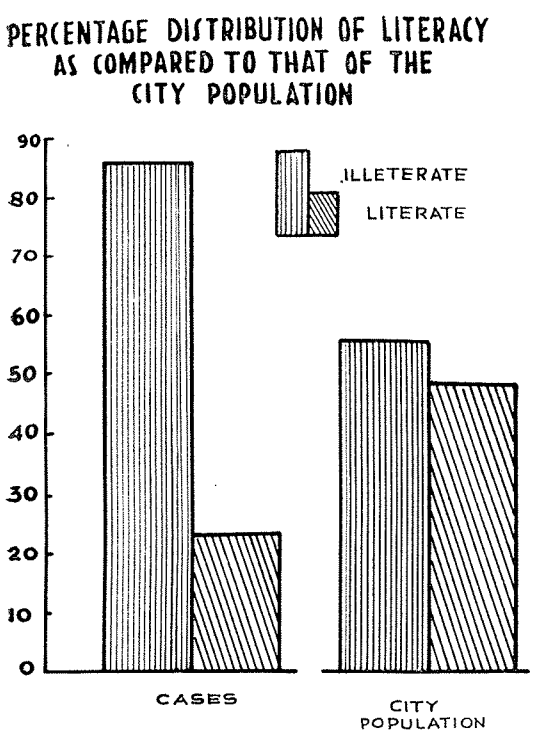


Fig. 7.

Thus 94.5 per cent of cases were indulging in rice diet wholly or partly, inspite of the fact that 30 per cent of them were Hindi speaking (non-resident of Bengal). It points towards the hypothesis that rice diet predisposes to cholera. The percentage of vegetarians among the cholera cases was only 5.4.

The outlook on food was traditional in 93.6 per cent of the cases including 1% prejudiced; 34.5 per cent of them were regularly eating food from common plates and another 5 per cent occasionally; 33 per cent were eating foods left by others either regularly or occasionally and 50.5 per cent eating foods prepared on the previous day either regularly (15.1%) or occasionally (35.4%), but as high as 93.8 per cent of the cases had the habits of washing their hands before taking their meals.

(g) *Other hygienic habits:* The usual evacuation habit was not so satisfactory in 87.5 per cent and unsatisfactory in 6.7 per cent cases, but the mouth hygiene was satisfactory in 83.5 per cent and unsatisfactory in 6.3 per cent of the cases. The cleansing of nails was unsatisfactory and spitting habit was indiscriminate in more than 90 per cent of them. Only 25.4 per cent were having regular baths. Addiction to country liquor was noted in 2.5 per cent of the cases, to smoking in 28.7 per cent, to tobacco chewing in 5 per cent and to pan chewing in 12.5 per cent.

8. *Economic Conditions:*

(a) PATIENTS' PERSONAL INCOME: Only 41 per cent of the patients were wage earners including 4.4 per cent not actually earning just prior to the present illness due to unemployment or other reasons. Of those who were earning 8.4 per cent had income less than Rs. 25/- per month, 56 per cent Rs. 50/- or less 18.4 per cent Rs. 70/-, 6.8 per cent Rs. 90/- and 10.3 per cent Rs. 100/- or more. There was only one patient whose income was above Rs. 500/- per month.

(b) PATIENT'S FAMILY INCOME: Of the 652 patients for whom the information was available, 493 or 75.6 per cent belonged to the families with single earning member, 114 or 17.5 per cent to families with two earning members, 30 or 4.6 per cent to families with three earning members and 15 or 2.3 per cent to families with more than three earning members.

The information of family income was available for 606 families out of 615 investigated. The distribution of family income per capita per month among families of the cholera patients is given in Table IV.

TABLE IV.

Distribution of per capita per month family income among 606 families of cholera cases.

Family income per capita per month	Percentage of patients' families in each category
– Rs. 10	1.7
– Rs. 20	17.7
± Rs. 25	30.7
± Rs. 35	20.6
± Rs. 45	11.9
± Rs. 50	13.4
± Rs. 75	2.3
± Rs. 100 and above	1.5

It will be seen from Table IV that half the patients belonged to families whose per capita income was Rs. 25/- or less per month and only 3.8 per cent of the patients belonged to the families whose per capita income exceeded Rs. 50/- per month.

A good indication of the economic status in town life is the monthly house rent. It would be interesting to note than 11.7 per cent of the patients' families were paying no house rent, 37.3 per cent were paying less than Rs. 10/- per month, 30.8 per cent less than Rs. 20/- per month, 14.4 per cent Rs. 30/- per month and 3.3 per cent Rs. 40/-

or more per month; only 16 families or 2.1 per cent had their own house.

(c) SICKNESS EXPENSES AND ECONOMIC LOSS:

(i) Duration of illness: Fortunately the duration of illness in cholera is not long. More than half the patients, 51.2 per cent suffered for less than a week, the majority of deaths occurring within this period; 44.8 per cent had illness less than two weeks and 3.4 per cent less than 3 weeks. Only 4 patients suffered for nearly four weeks.

(ii) Sickness expenses: As to the sickness expenses 34.6 per cent of the patients had not incurred any expense, 26.2 per cent spent less than Rs. 5/-, 14.2 per cent less than Rs. 10/-, 10.8 per cent less than Rs. 20/-, 11.9 per cent about Rs. 35/-, 2.2 per cent about Rs. 75/- and 1.6 per cent more than Rs. 100/-, the average expenditure per patient being about Rs. 10/-, which is really not much in a town like Calcutta. This is due mainly to the availability of the hospital treatment.

(iii) Loss of earning: There was no loss of earning in 70.8 per cent of patients. In the remaining cases, the average loss was more than Rs. 100/- in 0.8 per cent, Rs. 75/- in 2.7 per cent, Rs. 35/-in 12.8 per cent, Rs. 15/- in 8.7 per cent, Rs. 7/8/- in 3 per cent and Rs. 2/8/- in 1.1 per cent of patients, the average loss per patient being Rs. 9/-.

(iv) Loss of family income: There were 138 deaths included in the present investigation, only 32 of them were wage-earners and loss of family income due to death occurred in 30 or 5.0 per cent families. Of these 17 or 2.8 per cent families lost whole, 1 family three-fourth, 8 or 1.3 per cent families half and 2 families lost one-fourth of their income and there was no loss in 2 families.

9. *General Sanitation :*

(a) DRINKING WATER SUPPLY: One-third of the houses (33.2%) had no arrangement for the supply of safe drinking water. It was inadequate in 24.2 per cent and grossly inadequate in 4.8% houses, the inadequacy being thus present in about 60 per cent of the houses. A few houses also had unfiltered water tap, open tank or surface well which the householders were often using for the supply of drinking water. In order to meet this inadequacy 51.8 per cent of the householders had to use outside sources, the commonest being street hydrants of filtered water. About 38 per cent of the families were using the latter source, 8.3 per cent tube wells, 1.7 per cent Corporation water van, 2.2 per cent *doba* or tank and 1 per cent river or canal.

(b) BATHING AND DOMESTIC WATER SUPPLY: More than a quarter (26.8%) of the households were without any domestic water supply and another 25 per cent had inadequate supply, a total of 51.8 per cent of households reporting inadequacy. These houses were using unfiltered water, open tanks, surface wells and in certain instances tube wells as well as outside sources to meet their requirements. The results of investigation shows that 60 per cent of the families were using street hydrants of filtered water, 15.8 per cent *doba* or tank water, 9.6 per cent tubewell water, 8.1 per cent river or canal water, 1.4 per cent surface well, 2.2 per cent Corporation water van or the *vistis* and 0.71 per cent street hydrants of unfiltered water. Some of these sources were obviously contaminated.

(c) DISPOSAL OF NIGHT SOIL: Three per cent of the houses had no latrines and 8.5 per cent of the families were using latrines outside their own houses; 55.9 per cent families were using water closet, 39.3 per cent bucket type, 1.1 per cent septic tank and 0.6 per cent other types. The number of seats available in these latrines was extremely inadequate. For instances, in 52.5 per cent latrines the number of persons per seat was more than 25, in 10.4 per cent between 20 and 25, in 15.5 per cent between 15 and 20, in 12.8 per cent between 10 and 15, in 7.6 per cent between 5 and 10 and only in 1.3 per cent latrines less than 5 persons. The sanitary conditions were unsatisfactory in 78.8 per cent of latrines and very unsatisfactory in another 12 per cent. There was no arrangement for ablution water in 6.3 per cent latrines and inadequate supply in 63.7 per cent. Only the remaining 30 per cent had adequate water supply.

(d) DISPOSAL OF REFUSE AND GARBAGE: The collection of refuse and garbage was satisfctory only in 8.6 per cent houses; it was unsatisfactory in 81.4 per cent houses and very unsatisfactory in the remaining 10 per cent.

(e) OTHER SANITATIONS: Drainage was completely absent in 3.6 per cent houses and it was bad in 41.0 per cent. In 6.7 per cent houses the latrines were connected with cesspools or ponds. Flies were numerous or many in 56.5 per cent houses, fair in 32.6 per cent and few in 8.3 per cent and absent in 2.6 per cent houses. Insanitary latrines, refuse and stable dumps and bad drains provided the veritable breeding grounds of flies, 81.5 per cent of the houses providing these through

insanitary latrines. Only 1.1 per cent houses were free from mice, rodents and cockroaches which were plentiful in other houses investigated.

The general state of cleanliness was satisfactory only in 7.8 per cent families, in the remaining 92.2 per cent it was either unsatisfactory or very unsatisfactory.

10. Personal and Family Convenience:

Only 4.6 per cent of the families had domestic servant and 1.3 per cent cook. Rooms were furnished in 8.6 per cent and just furnished in 13.7 per cent of houses, and none had any drawing room or personal conveyance. Only 16.5 per cent of families were sleeping on cot and two families had bath room and servant's room. Electric light was available in 7.3 per cent of the houses. Thus there were very few families enjoying real amneties of family life.

11. Ceartain Socio-Epidemological Findings:

It was interesting to note that multiple cases were not common. Only 7 per cent cases gave history of contact with known patient or possible case during its active and convalescent periods and 47 or 7.4 per cent cases were actually considered secondary in the family although on the average 3.4 persons were contacts per patient. There were two cases in 13 instances, 3 cases ni 4 instances, 4 cases in one case and 5 cases in one family of 11. Two cases had relapse and two cases (.3%) had second attack; 169 cases or 25.7 per cent had history of cholera inoculation, 5 within the incubation period 144 more than 1 year back, 19 or 3 per cent cases within 6 months and 1 case within 1 year of the attack.

Thirty-one or 5 per cent cases gave history of bathing in the River Hooghly or in the connected canal, 28 or 4.6 per cent having bathed within 3 days, 1 within one week and 2 more than two weeks before the attack of cholera. Thus cases attributable directly to bathing in the obviously contaminated water were only few, if at all.

In 8 instances food and/or drinks were imported into the patient's houses by visitors, being within the incubation period in 5 instances. Only 10 per cent of the patients were having meals outside home and in two instances the sources of infection was suspected. In another 8 instances food or drinks was taken from unusual sources but not suspected.

Isolation of patients was unsatisfactory in 87.7 per cent before sending them to the hospital but 56 cases (8.4% were detected in the field during the survey, who were not sent to the hospital, and 15 cases (2.5%) were treated by unqualified practitioners. In 80 per cent of cases the utensils used by the patients were not separate; in 89.4 per cent instances these were washed without antiseptic and in 6.4 per cent cases were not washed at all. Only 14 per cent cases stools and vomits were properly collected, disinfected and disposed of and clothings disinfected. In 1 per cent houses water was boiled before use. In 12 per cent instances the attendents (relatives) disinfected their hands properly and insecticides were also used. Rooms were properly disinfected in 39.8 per cent cases mainly by the disinfecting squad of the City Corporation.

All these data show that there was great possibility of spread of infection in most instances.

Summary and Comments:

The main facts that have emerged out of this study are as follows: (1) The heavily affected wards in the two consecutive cholera seasons, arranged in the order of frequency were: Tollyganj (27), Entally (19), Maniktala (29), Jorabagan (5), Bartola (3), Shampukur (1), Jorasanko (6), Tangra (18) and Beliaghata (28). Most of these wards, but not all, abut River Hooghly or its branch canals.

(ii) Temporary residents suffered proportionately more than the permanent ones and so also the Hindi and Oriya speaking populations. The age-groups 1-5 years and above 50 years suffered more than the age-groups and the females more than the males.

(iii) The Hindus and the Muslims are the two religious sects which suffered almost in the same proportions existing in the city population. Only 4 deaths out of 542 in 1954 belonged to other religions.

(iv) Persons staying at home, housewives, servants and labourers, shopkeepers and vendors and students, constituted about 90 per cent of the patients; the place of attack was generally the home.

(v) More than two-thirds of the cases occurred in the bustee huts, although the latter constituted only 5-6 per cent of the city houses. In 84 per cent of houses cooking was being done in the verandah or in the living room and there was no arrangement for storage of food; utensils were inadequate and poorly washed.

(vi) Overcrowding was extremely high. The average number of families per house

was 8.5 approximately and that for houses accommodating more than 8 families was 24.6. The average number of persons per house was 38 (for bustees—110), per room 4.5 and per family 4.4. The space per person was less than 25 sq. ft. in 88.2 per cent families. Both lighting and ventilation was bad in 85 per cent of the houses.

(vii) About 86 per cent of the cholera cases were illiterate, as against 47 per cent in the city population. More than 70 per cent were ignorant about the cause of the disease and 64.4 per cent about its prevention. More than 92 per cent were individualistic. Thus literacy and education were found important from the point of view of cholera infection.

(viii) More than 94 per cent of the cases were rice eaters including 10.7 per cent having rice as a part meal. Apparently, rice diet seemed to predispose to cholera infection.

(ix) Outlook on food in more than 93 per cent cases was traditional, 34.5% eating food on common plates or left over by others and 50 per cent were in the habit of eating foods cooked on the previous day, regularly or occasionally.

(x) Except mouth hygiene other hygienic habits of the patients were very unsatisfactory. Among addition the commonest was smoking (28.7%).

(ix) Like ignorance, poor economic states was also common in the majority of cholera cases. Only 41 per cent were wage earners including 4.4 per cent not astually earning. The average family income per month was less than Rs. 25/- in half the families. It exceeded Rs. 50/- in only 3.8 per cent of the families. About 11.7 per cent were not paying any house rent, 37.8 per cent were paying less than Rs. 10/- and another 30.8 per cent less than Rs. 20/- per month. Family amenities were non-existent.

(xii) The average sickness expense was Rs. 10/- and the average loss of family income was Rs. 9/- per patient, 70.8 per cent families having no loss at all. Only 5 per cent of the families lost income, wholly in 2.8% and partly in 8.8%, due to cholera deaths in the family.

(xiii) Conditions of general sanitation, to be short, were actually appalling. One-third of the houses had no drinking water supply, and it was inadequate in 60 per cent houses requiring additional supply from outside sources. The same applied to the water supply for domestic and bathing purposes; 11.5% houses were using other's latrines. Two-fifth of the latrines were bucket type and 52.3 per cent were being used by more than 25 persons per seat. Their sanitary conditions were very unsatisfactory. Collection and disposal of refuse, drainage, general cleanliness were equally bad.

(xiv) Multiple cases were comparatively uncommon in spite of the large number contacts and all facilities for transmission. History of cholera inoculations was present in as high as 25.7 per cent of the cases but only 2 per cent cases were inoculated within 6 months of their attack. History of bathing in the River Hooghly or canal was present is only 4.5 per cent cases. Isolation of patients and disinfection of stool, vomit and the contaminated material were unsatisfactory.

(xv) This study shows that some of the social factors play important roles in the spread and persistance of cholera in the city and gives sufficient indication of the lines of approach for the institution of control measures.

ACKNOWLEDGEMENT

The authors are thankful to Dr. C. G. Pandit, Dorector, Indian Council of Medical Research for his permission to publish the results in this journal. Thanks are also due to Sri P. M. Roy, Statistical Demonstrator, Section of Epidemiology, All-India Institute of Hygiene and Public Health, Calcutta for the calculation of the cholera death rates.

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APPENDIX I

ANNUAL DEATH RATES FROM CHOLERA IN THE CITY OF CALCUTTA FROM 1866 TO 1952

Year	Rate	Year	Rate
1866	15.98	1880	1.86
1867	5.31	1881	3.91
1868	9.78	1882	5.13
1869	8.36	1883	4.63
1870	3.63	1884	5.13
1871	1.85	1885	3.59
1872	2.57	1886	3.87
1873	2.57	1887	2.64
1874	2.89	1888	3.80
1875	3.89	1889	1.86
1876	4.29	1890	1.45
1877	3.29	1891	2.28
1878	3.10	1892	1.80
1879	2.74	1893	0.83

Year	Rate	Year	Rate	Year	Rate	Year	Rate
1894	1.53	1909	2.28	1924	1.07	1939-40	0.61
1895	1.74	1910	2.13	1925	0.89	1940-41	0.47
1896	3.12	1911	2.08	1926	1.50	1941-42	0.61
1897	1.98	1912	2.50	1927	1.89	1942-43	0.28
1898	0.58	1913	1.96	1928	2.23	1943-44	0.98
1899	0.74	1914	2.20	1929	2.19	1944-45	0.71
1900	2.14	1915	1.79	1930	1.48	1945-46	0.75
1901	2.04	1916	1.48	1931	1.03	1946-47	0.37
1902	3.20	1917	0.96	1932	1.00	1947-48	0.74
1903	2.33	1918	1.69	1933	1.00	1948-49	0.94
1904	2.39	1919	4.07	1934	1.10	1949-50	0.66
1905	2.69	1920	2.54	1935	1.37	1950-51	1.53
1906	2.88	1921	2.20	1936	0.94	1951-52	0.58
1907	4.35	1922	1.40	1937	0.37		
1908	4.20	1923	1.00	1938-39	0.97		

N.B.—The rates have been calculated by simple linear interpolation of the census figures of the two end years taking into consideration the areas added or detached from time to time.

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ROLE OF DIETARY FATS AND CHOLESTEROL IN THE PATHOGENESIS OF ATHEROSCLEROSIS

An Experimental Study in the Chick

By

K. N. GOUR, M.D., M.R.C.P. (Ed.), F.R.F.P.S. (Glas.), D.C.H. (Eng.), D.P.H., Professor of Medicine

S. D. TAYAL, M.D., Demonstrator in Medicine

From the Department of Medicine, Medical College, Agra

The subject of atherosclerosis has been attracting the attention of the clinicians, pathologists, biochemists, dieteticians and the experimentalists alike. The Insurance Companies have been busy in collecting statistics to lay some empirical rules to guide them for spotting at the future victims of the disease, while the public health authorities have been alert to find out the scope of preventive measures, but the disease is strongly evading all attempts to probe into its etiology and pathogenesis, leave aside prophylaxis and treatment.

It is not a new disease as it was equally severe and frequent even 1,500 years before the christian era[36,38] and has been thought to be a phenomenon of ageing, senility and decay. In fact, it was not until the third and fourth decade of this century that it became increasingly plain from the clinical, morphological and experimental observations that arteriosclerosis constituted more than a single morbid process and that its most serious manifestations were not essential concomitants of ageing[19,43] but rather an acquired abnormality which in Aschoffs' words is "A disease process super-added to ageing."[12]

Workers in the field now agree that lipid metabolism and dietary fats are in some way etiologically related to atherosclerosis but what is still undecided is the relative importance of various types of fats in the diet. The subject is very important as on this would be based all programmes of phophylaxis against the disease by relevant dietary restrictions. At the moment, diametrically opposite opinions exist[3] as to whether or not such measures play any part in retarding or retrogressing the march of atherosclerotic processes.

The disease is peculiar in as much as it is an insidious, slow and cumulative process yet the manifestations are sudden and grave like the coronary thrombosis or an apoplectic fit. These manifestations may, however, be very gradual like intermittent claudication or an impaired memory and lack of concentration. There is thus a great scope for investigation and research in this field, the importance of which is further emphasised by the everincreasing number of persons falling victims to the various types atherosclerosis, viz., coronary, cerebral, renal and diabetic, etc., the two principal causes of death in U.S.A. and certain other western countries being atherosclerosis and hypertension.

In the present study the role of dietary fats and cholesterol in the pathogenesis of atherosclerosis have been studied experimentally. The advantages of such studies are that the disease can be produced in a suitable animal (the chick in the present case), the diet can be regulated keeping other factors constant, and the experimental lesions thus produced can be correlated with the diets.

Nosological Consideration :

The imperfections in nomenclature have often played as a source of confusion and irritation in medicine. Arteriosclerosis is one such term, which coined originally by Lobstein[24] in 1883 and was applied to a group of vascular diseases characterised by hardening of vessel wall and covering such heterogenous conditions as Monkeberg's or medial sclerosis, the age changes in the blood vessels and also atherosclerosis. It lay undue emphasis upon the hardening aspect—a feature that is scarcely an adequate criterion for estimating the severity of changes within the arterial wall, for, hardening per se is relatively a benign process producing little

interference with the flow of blood, as in Monkeberg's sclerosis of the extremities which rarely impinges upon the calibre of the lumen unless it is complicated by other processes. Similarly the changes that bear with age in the walls of blod vessels consist primarily of the loss of elasticity resulting in tortuosity and dilatation, a phenomenon commonly seen in the temporal arteries of many individuals after the age of forty but that does not embarras or restrict the flow of blood.

Atherosclerosis, on the other hand, is a more serious condition for it is characterized not so much by the hardening of the vessel wall as by the narrowing or obliteration of the lumen. This is an occlusive disease that affects the nutrient vesssels of the heart or brain or kidney and by progressively choking off the flow of blood leads to functional alterations and too commonly to disability and death[25]. It is with this atherosclerosis that we are concerned in this presentation.

Biological Considerations and evolutionary phases :

Man is the only mammal in which the disease occurs regularly to any significant degree. Animals rarely exhibit this condition perhaps because wild animals in the natural habitat seldom live to the old age. Even experimental observations in which the animals were made to live their full span of life, such as in the scientific laboratories and the zoological gardens, and later carefully examined postmortem (10,000 autopsies were performed in the Philadelphia Zoo) revealed that while medial calcification was frequently encountered in th arteries the lesions of arteriosclerosis were exceedingly rare (Herbert Fox)[9]. Birds, on the other hand, not infrequently, do exhibit considerable atherosclerosis, although the lesions are seldom of sufficient severity to produce symptoms or to cause death.

This striking contrast between man and animal in the incidence of atherosclerosis sounds like a challenge to our thought and experiment which are applied to the metabolic or perhaps the environmental factors that may be involved in the process. Since this serious and fatal malady appears to be limited to the human species, the question arises whether it is relatively a new disease in our modern society or it is traceable to antiquity. Fortunately, unlike many other diseases the answer to this question is provided in one of the most intriguing chapter in the history of Medicine. Some 40 years ago, the archæologists working in the valley of the Nile unearthed hundreds of well preserved mummies dating back more than 1,500 years before the Christian era. Histopathological studies of arterial lesions of these Egyptian mummies by Ruffer[36] and Shattock[38] make it clear that atherosclerosis was not an uncommon disease even 3,000 year or more ago. Thus men seem to have been victims of atherosclerosis for thousands of years. Apparently the builders of pyramids were perhaps subjected to the same kind of anxieties and tensions as are the splitters of atoms today[39].

Role of lipids :

Some basis has already been obtained in support of the view that atheresclerosis is associated with the disorder of lipid metabolism. Not only the lesions themselves contain abundant lipid, the diseased state is characterised by abnormally high blood lipids which may even cause premature atherosclerosis. Perhaps the most important observation in this regard is the production of atherosclerosis in animals by experimental procedure that disturb their lipid balance. Thus, the sacrifice of animals for experiment is as necessary for human welfare as for food (Kartz and Stamber[23]).

Experimental production of atherosclerosis :

In 1908 Ignatowaski[25,24] and Saltykow[37] first induced atherosclerosis by feeding rabbits on diets containing meat, milk or eggs and blamed proteins for it. Later Stukkeu[40,41] in 1911 and Wesselkin[46] in 1913 showed that cholesterol containing foods are atherogenic. This was confirmed by Anitschkow[1] and Wacker and Hueck[45] who considered that the sterol provided the atherogenic stimulus. So far, experimental production of atherosclerosis has only been successful by cholesterol feeding except the endocrine induced atherosclerosis in birds[4,17,18].

Choice of experimental animals :

Atherosclerosis has been produced experimentally in rabbits, dogs and chicks. Many workers, however, do not consider rabbit as the suitable animal for the purpose because it is herbivorous and does not normally ingest cholesterol nor develop the vascular lesions of atherosclerosis. Dauber and Kartz[8-8] selected the chicks which do have atherosclerosis closely resembling that of human being. Besides, the chicks are omnivorous like man in dietetic habits. Dauber[8] noted spontaneous atherosclerosis in the abdominal aorta

from the inter-renal region to its bifurcation below. In these lesions the intima was found focally thickened by fibrous tissue with endothelium in tact, but often accompanied by hyaline and mucoid degeneration. No lipid was seen in the spontaneous lesions of birds reared in the Laboratory[14] without cholesterol.

In the cholesterol induced atherosclerosis, on the other hand, the lesions were found in the ascending aorta and elastic arch of the chick (Dauber and Kartz[6,7] and Horlick and Kartz[12-16]). Cholesterol feeding also leads to increased incidence of atherosclerosis of abdominal aorta. Morphologically the cholesterol fed chicks, according to Kartz and Stamler[23], exhibit the spectrum of changes seen in the atherosclerotic lesion in man, including the lipid-laden foam cells plaques, necrosis and atheromatous abscesses, fibrosis and hyalization, calcification and cartilaginous and osseous metaplasia. Ulceration of the atherosclerotic plaques with thrombus formation is the only lesion seen in man that was not observed in the chick. Among other arterial lesions, gross and microscopic atherosclerosis was found in the heart valves, endocardium and coronry arteries and occasionally in the blood vessels of spleen, adrenal and thyroid glands etc. (Chaikoff *et al*[4], Dauber and Kartz[7], Rodbard *et al*[35], Horlick and Kartz[12-16]). In the coronary arteries, pure atheroma formation was seen with lipid-laden foam cells almost completely occluding the vessel lumen and compressing the adjacent media but without disruption of the endothelium.

These changes have been produced in the absence of gross hypercholesterolæmia, organ xanthomatosis and venous and pulmonary artery lesions (Kartz and Stamler[23]). This negates the criticism by Moschowitz[29] about the significance of these experiments.

Material and Methods:

1flzThe Chicks—Two weeks old six Indian bred chicks of approximately same size and weight and unknown sex were selected. They were differentiated by their colours viz. R-I-Light grey, RII-Black, RIII-Dark-brown; BI-White; BII-Yellow with dark spots on wings, and BIII-Camel with dark brown spots. No other identification mark was used but they were kept in different cages and the sex was determined afterwards. R refers to *rice* group and B to *Bajra*.

2. Diet of the Chicks: There were two basic diets—*Rice* and *Bajra*. The composition of diet for different chicks given ad lib was as follows:

Chick R I—Boiled rice, multivitamin drops, leafy vegetables and white of egg. This chick served as a control for the *Rice* (R) group.

Chick R II—Diet of R I + 15% vegetable fat in the form of hydrogenated vegetable oil, *Dalda*.

Chick R III—Diet of R I + 15% vegetable fat (*Dalda*) + 0.5% pure crystalline cholesterol.

Chick B I—Bajra and vegetables. This served as a control diet for both the groups in this experiment.

Chick B II—Diet of B I + equal amount of boiled yolk of egg. This diet contained about 15% animal fat, $2\frac{1}{2}$% vegetable fat (from Bajra) and 0.5% cholesterol (yolk of egg contained about 30% fat and 3% cholesterol).

Chick B III—Diet of B I + 0.5% pure cholesterol.

Each chick in its own cage was kept strictly on its own special diet only. The fat and cholesterol content of these diets are summarised in Table I.

TABLE I

Fat and cholesterol contents of the different diets

Chick No.	Fat (%) animal	Fat (%) vegetable	Cholesterol (%)
R-I	nil	nil	nil
R-II	nil	15%	nil
R-III	nil	15%	0.5%
B-I	nil	5%	nil
B-II	15%	2.5%	0.5%
B-III	nil	5%	0.5%

3. Duration of Study: 13 weeks except for R I which died after $8\frac{1}{2}$ weeks.

4. Plan of Study:

(i) General features and growth: A careful weekly record was kept of each chick about its appearance, activity, ability to fly or run, character of feathers and hair, and any other feature of malnutrition or deficiency.

(ii) Weight: Fortnightly records of weight were maintained for each chick.

(iii) Photographic record: From time to time snapshots were taken to capture the special points at various phases of their growth and for comparison.

(iv) Biochemical estimations: These were done for each chick at 4, 8 and 13 weeks after the commencement of tht experiment. Each sample of blood was examined for (i) plasma total cholesterol (P.T.C.); (ii) plasma lipid phosphorous (P.L.P.) and (iii) P.T.C./P.L.P. ratio (C/P).

Method of estimation: P.T.C. was estimattd by the method of Myers and Wardell[30], P.L.P. by trichloractic acid precipitation method of King[27] and the C/P ratio was determined from the figures obtained as above.

Method of collection of blood sample: The undersurface of the wing was exposed as the bird was held tightly by an assistant, cleaned with spirit and, if necessary, the hair was removed gently with a blade. The vein which could be easily seen was compressed proximally by the thumb and a tranverse nitch in it was made by a blade and the blood collected by means of a syringe fitted with No. 1 needle. Every few seconds the blood was removed to a citrated tube till about 2 c.c. was collected. The nitch was then sealed with Tr. Benzoine. The sample was immediately centrifuged and the plasma separated before any hæmolysis could take place.

(v) Sacrificing of the chicks: After 13 weeks of observation the remaining 5 chicks (one having died after 8½ weeks) were sacrificed by decapitation. The last sample of blood was collected during this procedure directly in the citrated tube for biochemical estimations.

(vi) Study of the Gross Pathology: For this purpose the thorax and abdomen were opened up and the viscera examined. The consistency and the colour of liver was noted in each case. Then the heart and the large vessels were carefully dissected out. The aorta was included up to its bifurcation along with its branches, the brachio-cephalics. These were fixed in formalin solution for 24 hours. Next day the heart was opened up by the 'standard technique' and the heart and the large blood vessels were examined by naked eye and by magnifying lens.

(vii) Study of Histopathology: Small pieces were cut out from the heart so as to include a portion of coronary vessels, from the proximal and distal aorta and from brachiocephalics. Small pieces were also removed from the vtssels from any suspicious area to be studied under the microscope. The pieces were then fixed and sections made for histopathological studies after staining with hæmotoxylin and eosin.

(viii) Photographic rtcords of Gross and Histopathology: Photographs were taken of the heart and blood vessels wherever gross lesions were found. Photomicrographs were also taken from the proximal aorta of each chick and the coronary vessels wherever necessary.

OBSERVATIONS:

CHICK R-I.

A. Nutrition and Growth—There was slight retardation of growth and no other abnormality in its skin, feathers, gait or flight. (Fig. 1.)

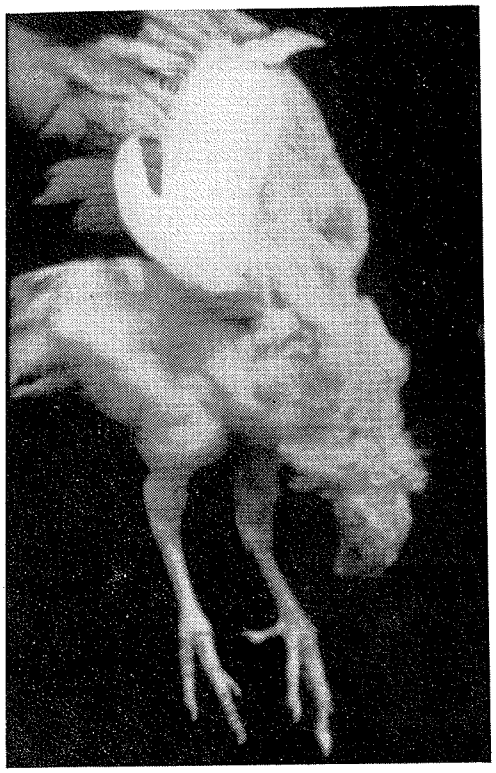


Fig. 1.

Weight—

Weeks after	0	2	4	6	8	10	12	13
Weight in ozs.	2.6	4.6	6.2	7.4	8.0	—	—	—

B. Biochemical Findings:—

Period	P.T.C. mg.%	P.L.P. mg.%	C/P Ratio
4th Week	98	6.1	16.0
8th Week	110	6.3	17.5
13th Week	—	—	—
Average	104	6.2	16.7

C. Autopsy Findings—

i. Gross: No Pathological finding in the heart or blood vessel.

ii. Microscopic: The proximal aorta and coronaries did not show any proliferation or

accumulation of lipophages or the intimal surface. (Fig. 2.)

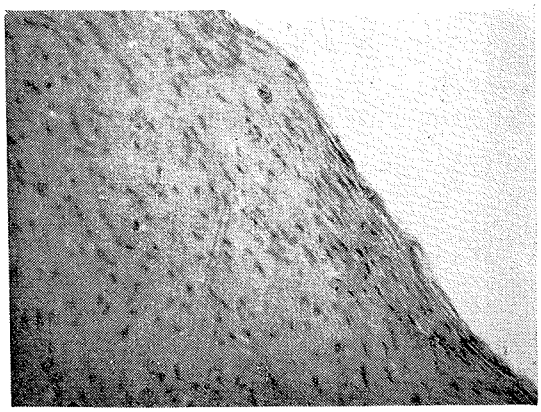


Fig. 2.

CHICK R-II.

A. Nutrition and Growth—The bird showed retarded growth, slow, gait less flight, fluffy appearance and greasy skin. (Fig. 3.)

Fig. 3.

Weight—

Weeks after	0	2	4	6	8	10	12	13
Weight in ozs.	2.6	3.0	4.0	5.2	6.5	9.5	12.0	14.0

B. Biochemical Findings—

Period	P.T.C. mg.%	P.L.P. mg.%	C/P Ratio
4th Week	105	5.8	18.0
8th Week	140	6.5	21.5
13th Week	155	6.7	23.0
Average	133.3	6.33	20.8

C. Autopsy Findings—

(i) Gross: The heart and vessels showed no atherosclerotic patch. Liver was very friable.

(ii) Microscopic: Intima was smooth and showed no lesion. (See Fig. 4) Liver showed marked fatty degeneration.

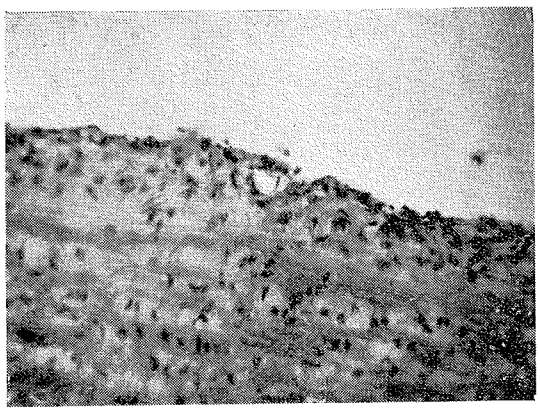


Fig. 4.

CHICK R-III.

A. Nutrition and Growth—There was marked stunting of growth, inability to run or fly, feathers had fallen and denuded skin showed bent bones under it. (Figs. 5-6.)

Weight—

Weeks after	0	2	4	6	8	10	12	13
Weight in ozs.	2.7	5.4	7.5	9.3	10.0	11.0	12.5	13.5

B. Biochemical findings—

Period	P.T.C. mg.%	P.L.P. mg.%	C/P Ratio
4th Week	110	5.6	19.5
8th Week	215	7.0	30.7
13th Week	280	7.8	35.4
Average	210.6	6.8	28.5

C. Autopsy Findings—

i. Gross: The shininess of proximal aorta was tarnished. There was no raised patch, lumen of vessels was patient. Liver was very firm in consistency.

Fig. 5.

Fig. 6.

ii. Microscopic—The proximal aorta showed raising of intima with lipophage accumulation under it. (Figs. 7 & 8). At another place there was a large collection of lipophages under the intima and slight fraying of the intima (fig. 9) Coronaries did not show this change (fig. 10). Liver showed some fatty changes.

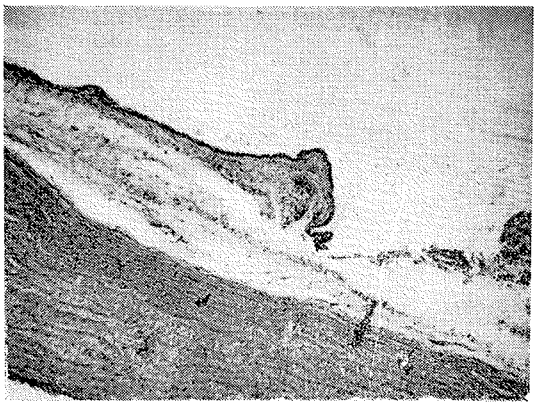


Fig. 7.

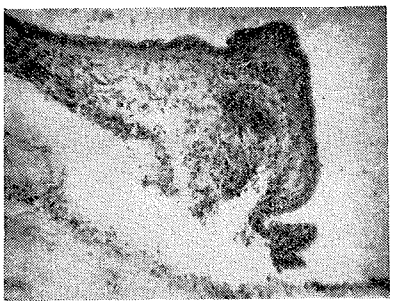


Fig. 8.

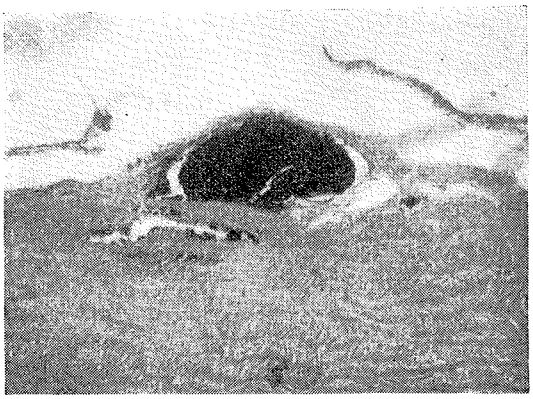


Fig. 9.

CHICK B-I.

A. Nutrition and Growth—Chick was normal looking, healthy and active. (Fig. 11).

Weight—

Weeks after	0	2	4	6	8	10	12	13
Weight in ozs.	2.7	5.7	7.8	10	12.5	16	20	22.5

B. Biochemical findings—

Period	P.T.C. mg.%	P.L.P. mg.%	C/P Ratio
4th Week	100	5.9	17
8th Week	115	7.2	16
13th Week	125	7.0	18
Average	113.3	6.7	17

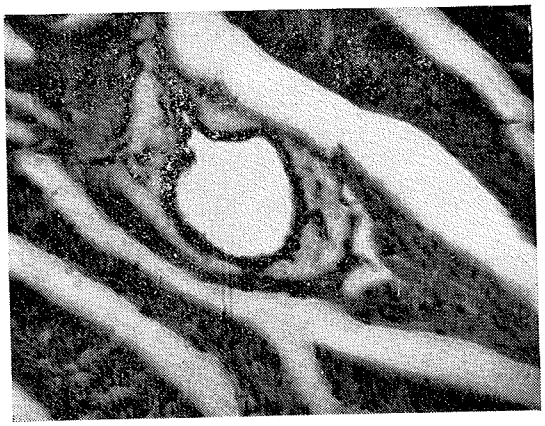


Fig. 10.

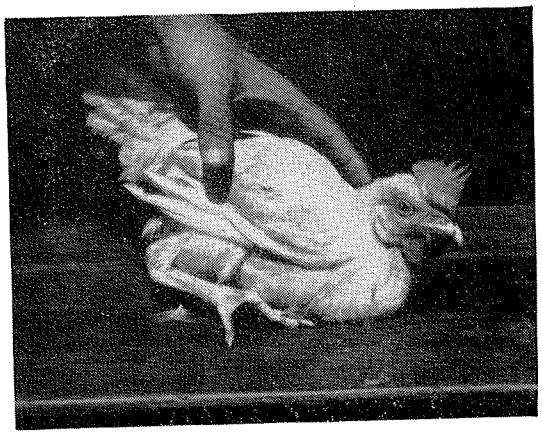


Fig. 11.

C. Autopsy Findings—

i. Gross: It was normal, the endothelial surface was smooth and shining in the heart and blood vessels.

ii. Microscopic: The proximal aorta did not show any atheromatous lesion. (Fig. 12) and there was no lesion in the coronary arteries.

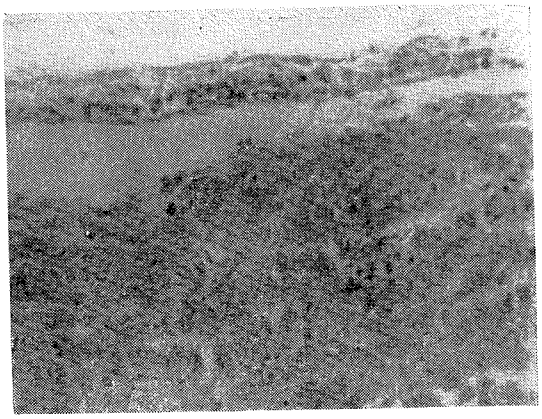


Fig. 12.

CHICK B-II.

A. Nutrition and Growth—An all-round excellent growth was seen. It was biggest in size, strongest and healthiest, ran fastest and flew highest. (Fig. 13.)

Fig. 13.

Weight—

Weeks after	0	2	4	6	8	10	12	13
Weight in ozs.	2.8	6.2	9.5	13.0	16.0	20.0	24.5	27.0

B. Biochemical Findings—

Period	P.T.C. mg.%	P.L.P. mg.%	C/P Ratio
4th Week	110	6.7	15.5
8th Week	175	9.7	18.0
13th Week	200	9.5	21.0
Average	161.6	8.63	18.5

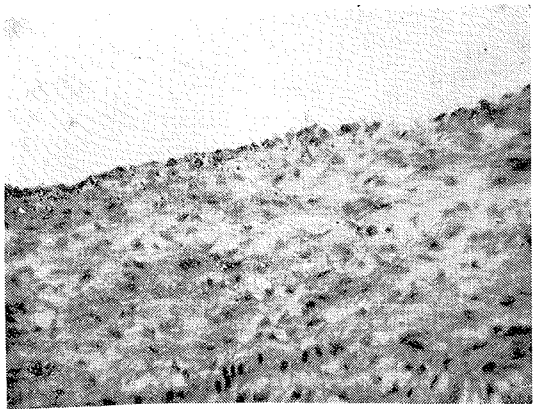


Fig. 14.

C. Autopsy Findings—

i. Gross: Normal.

ii. Microscopic: No atherosclerotic lesions any where. (Fig. 14.)

CHICK B-III.

A. Nutrition and Growth—Normal. (Fig. 15.)

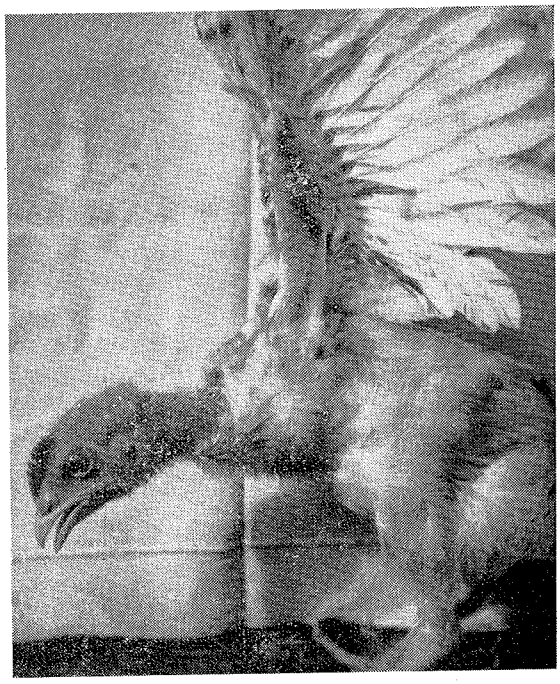


Fig. 15.

Weight—

Weeks after	0	2	4	6	8	10	12	13
Weight in ozs.	2.6	5.5	7.5	9.5	12.0	17.0	21.0	23.0

B. Biochemical Findings—

Period	P.T.C. mg.%	P.L.P. mg.%	C/P Ratio
4th Week	115	6.3	18.2
8th Week	200	7.7	26.0
13th Week	240	8.5	28.0
Average	185	7.5	24.0

C. Autopsy Findings—

i. Gross: There was a small raised rough patch somewhat bigger than the size of a pin-head on intimal surface in the thoracic aorta. (Fig. 16.)

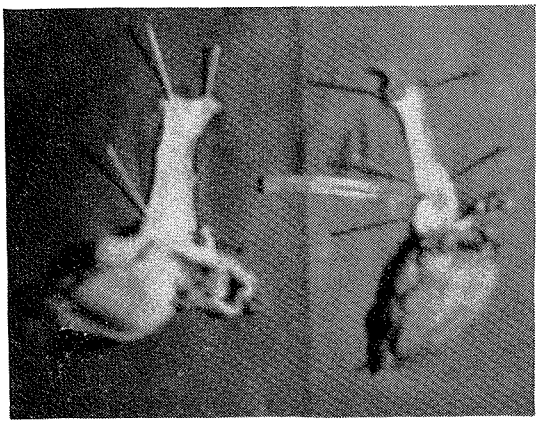


Fig. 16.

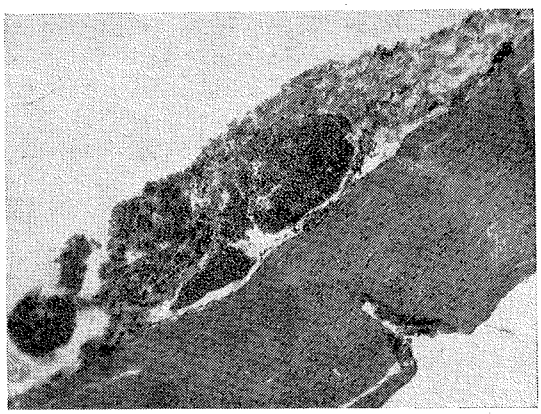


Fig. 17.

Fig. 18.

ii. Microscopic: Thoracic Aorta showed accumulation of lipophages in intimal layer. (Fig. 17.) Coronary arteries showed atherosclerotic lesion. (Figs. 18 & 19.)

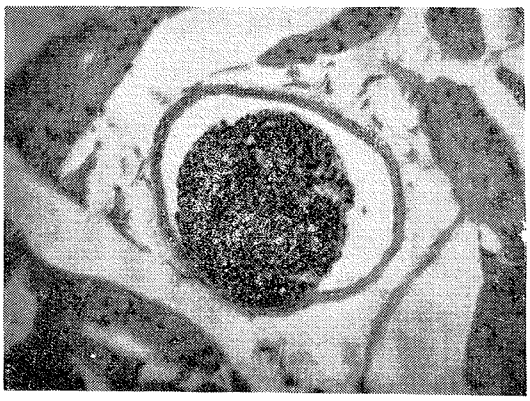


Fig. 19.

COMPARATIVE STUDIES.

A. Comparative Weights after 8 and 13 Weeks of Study—

Chick No.	After 8 Weeks	After 13 Weeks
R-I	8.0 Ozs.	
R-II	6.5 ,,	14.0 Ozs.
R-III	10.0 ,,	13.5 ,,
B-I	12.5 ,,	22.5 ,,
B-II	16.0 ,,	27.0 ,,
B-III	12.0 ,,	23.0 ,,

B. Average Biochemical Values of the Six Chicks—

Chick No.	P.T.C. mg.%	P.L.P. mg.%	C/P Ratio
R-I	104.0	6.2	16.7
R-II	133.3	6.3	20.8
R-III	201.6	6.8	28.5
B-I	113.3	6.7	17.0
B-II	161.6	8.6	18.5
B-III	185.0	7.5	24.0

C. Autopsy Findings of the Six Chicks (Histological)—

Chick No.	Sex	Proximal Aorta	Coronary Artery
R-I	Female	No lesions	No lesions
R-II	Female	No lesions	No lesions
R-III	Female	Lesions present	No lesions
B-I	Male	No lesions	No lesions
B-II	Female	No lesions	No lesions
B-III	Male	Lesions present	Lesions present

COMMENTS:

The effects of various dietary regimens having been studied, certain comments based on a 13-week-study, starting on 2 weeks old chicken may now be made regarding the following points:

(a) Role of dietary fats on growth, nutrition and bones:—

i. With normal diet containing 5.5% fats the growth and nutrition were normal (See Fig. 20 and Graph 1) and the bones were normal in all respects.

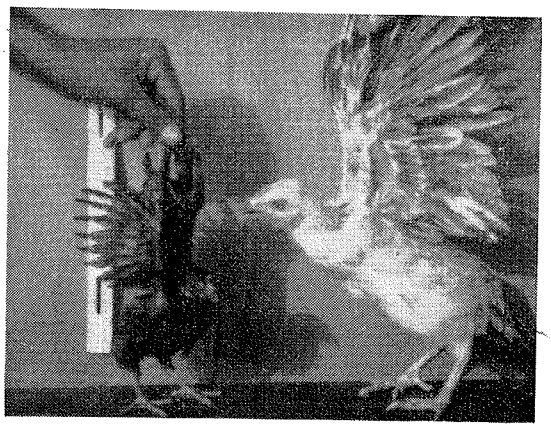
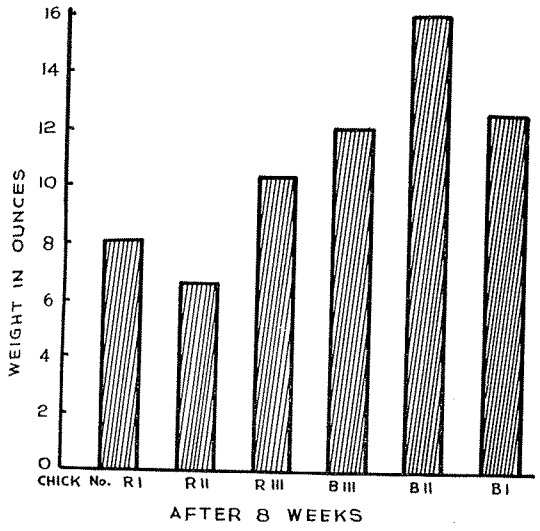


Fig. 20.

GRAPH No. 1

ROLE OF DIETARY FATS ON WEIGHT



(ii) With complete restriction of fats the growth was slightly retarded with no other abnormal features. (R-I.)

iii. With 15% fats (vegetable origin) there was much stunting of growth, bones were less calcified and the liver showed fatty changes. (R-II.)

iv) With 15% fats and 0.5% cholesterol the toxic effect of fats was much enhanced and besides stunting of growth other dificiencies e.g. falling of feathers, bony changes, skin changes etc. (R-III) were noted.

(v) With 5% vegetable fats and 0.5% cholesterol in chick No. B-III no such effects as in iv i.e. chick No. R-III were seen. Obviously 0.5% cholesterol had itself no toxic effect on growth neither there was any depressive action in the presence of small quantities of fats but with higher percentages of vegetable fats it certainly added to the toxic effects of the excess of fats. Bones were quite normal.

(vi) Diet containing 15% animal fat (Yolk of egg), on the other hand, accelerated the growth markedly (B-II). It might be mentioned that yolk of egg besides containing fats and cholesterol also contains other lipoprotein complexes and minerals which might be responsible for this fact. Bones here were very well formed, and calcified. (B-II).

(b) Effect of dietary fats on plasma cholesterol and lipid phosphorus and C/P ratio: Graph 2 shows the effect of dietary fats on plasma cholesterol only and Graph 3 shows the effect on C/P ratio also.

i. Complete restriction of fats slightly reduced all the values i.e. of P.T.C. and P.L.P. and C/P (as in R-I).

ii. Addition of 15% vegetable fats raised P.T.C. and C/P slightly but not P.L.P. (R-II).

iii. Addition of 15% vegetable fats and 0.5% cholesterol much elevated the P.T.C. and C/P values with only a negligible influence on P.L.P. (R-III).

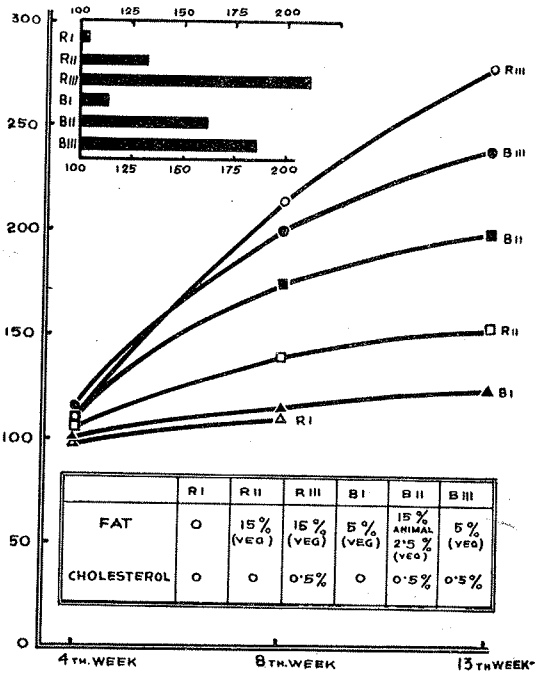
iv. Addition of 0.5% cholesterol to 5% vegetable fats raised P.T.C. and C/P, and P.L.P. only slightly (B-III).

v. 15% animal fats and 0.5% cholesterol in the form of yolk of eggs raised the P.T.C. and P.L.P. values without raising the C/P ratio (B-II).

In short, vegetable fats slightly elevated P.T.C. and C/P, but if both vegetable fats and cholesterol were combined the rise in values was much higher. During the same period 15% animal fats and 0.5% cholesterol in the form of yolk of egg raised not only the P.T.C. but also P.L.P and thus C/P value was not so much raised.

GRAPH No. 2

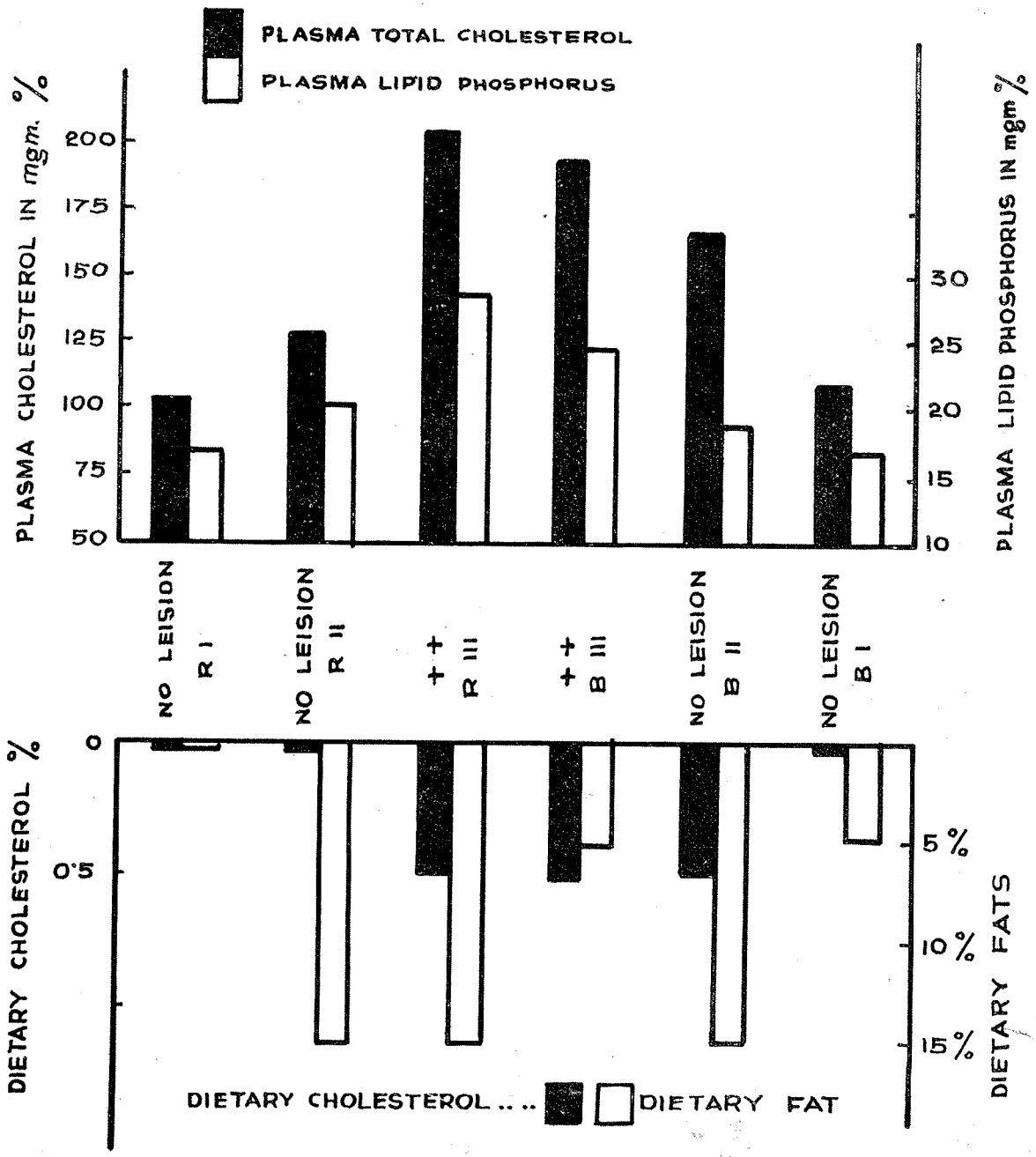
EFFECT OF DIETARY FATS ON PLASMA CHOLESTEROL LEVELS



	R I	R II	R III	B I	B II	B III
FAT	0	15% (VEG)	15% (VEG)	5% (VEG)	15% ANIMAL 2·5% (VEG)	5% (VEG)
CHOLESTEROL	0	0	0·5%	0	0·5%	0·5%

GRAPH No. 3

DIETARY FAT, LEISIONS & PLASMA LIPID LEVELS



(c) Vascular lesions associated with plasma lipid levels:

i. In both the chickens in which the lesions were produced we find that plasma cholesterol levels were much above the average and so also was the C/P ratio. In none of them P.L.P. was raised.

ii. In the three other chicks (R-I, B-I, and R-II) where plasma lipid levels were not much raised, the lesions were not produced.

iii. In B-II it was noted that P.T.C. and P.L.P. both were raised. This was the only group where P.L.P. was appreciably raised and where C/P was not much altered in spite of the raised P.T.C. levels, and here the lesions were not produced.

Obviously, the raised C/P ratio is more closely associated with the lesions than the plasma cholesterol value alone.

(d) Relationship of dietary fats and vascular lesions:

i. In none of the three chicks (R-I, R-II and B-I) which were not fed on any cholesterol could the lesions be produced.

ii. In the two chicks (R-III and B-III) getting cholesterol with varying amounts of vegetable fats the lesions were produced.

iii. In the chick (B-I) getting yolk of egg containing animal fats and cholesterol the lesions were not produced.

iv. Vegetable fats alone could not produce the lesions (R-II, B-I).

Thus the vegetable fats in any quantity alone does not seem to produce the lesion but cholesterol even in quite small amounts as 0.5% added to the normal diet (having 3-5% vegetable fats) produces the lesions. Further, it has been observed that the same amount of cholesterol in a different form (Chick B-II) where cholesterol is present (0.5% in egg yolk) does not produce the lesion depending upon the nutritional elements and biochemical relationship of plasma lipids. In other words, cholesterol can produce the lesions in the chick but not always. This depends upon the nature of the dietary fats.

(e) *Influence of sex on the location of lesions :—*

By comparing R-III (hen) with B-III (cock) it was noted that both were getting vegetable fats and 0.5% cholesterol and that lesions produced in both. But, where as the coronaries of B-III were affected besides the proximal aorta, only the proximal aorta of R-III (hen) was affected. The question arises whether this difference noted can be explained on the basis of difference in the sex.

(f) Age factor in chick and its effect on plasma lipid levels:

In all the chick sudden rise in plasma cholesterol levels in the 8th week readings was noted. The levels did not change to that extent in the next 5 weeks as it did in the previous 4 weeks on the same diet. It might be pointed out that puberty of the chick begins at the 8th week (6th week of study in the present series) at which age the plasma lipid levels rise quicker than in the earlier weeks.

DISCUSSION

The results of the above experiments show that in the chick, cholesterol when added in such small amounts as 0.5% to the normal diet can within the period of 13 weeks (starting the experiment on the two weeks old chicks) produces microscopic as well as gross lesions of aorta and microscopic lesions in the coronaries. This it can accomplish without producing gross hyper-cholesterolaemia. But it is also noted that atherogenic potentialities of cholesterol can, however, be significantly modified by other dietary or endogenous factors, as is shown by the absence of lesions in the chick few with cholesterol in the form of yolk of egg as in the diet of B-II and by the absence of the lesions in the coronaries in the female chick (R-III) which did develop aortic lesions. Further, the above experiments show that the vegetable fats alone in the absence of cholesterol failed to produce the lesions during the period of study.

These observations clearly point to the fact that in the chick certain combinations of fats succeeded in producing atherosclerosis, while in other it was not so. Further it can be inferred that certain constituents are potent while others are not so in their atherogenic capacity.

It may therefore be observed that diet is not the only factor in the production of lesions, but that it certainly plays an important role. Viewed overall, it may safely be said that this experimental investigation on atherosclerosis has yielded results greatly reinforcing the cholesterol-lipid theory of atherosclerosis. Further, it has demonstrated the profound influence of endogenous factors on lipid metabolism and atherogenic process.

It would not be out of place here to discuss the associated plasma cholesterol levels and

plasma cholesterol/lipid phospherus relationship in the experimental study in which these levels could be correlated to the diet and the lesions. Thus it was noted that the average plasma cholesterol level of both the chicks which on autopsy were found to be having the vascular lesions, was much higher than in others who did not develop the lesion. These two chicks (R-III & B-III) were also getting 0.5% cholesterol in their diets. It may thus be inferred that it was the cholesterol content of the diet that raised the plasma cholesterol which in turn was associated with the lesion.

The natural question arises whether the raised plasma cholesterol is always associated with the lesions in the chick. This is not so, because in the chick getting the yellow of egg (B-II) although the plasma cholesterol level was high no lesions were found in the vessels. Coming now to the question of plasma cholesterol/lipid phosphorus ratio we find that it was appreciably raised in both the chicks (R-III and B-III) which were fed on 0.5% cholesterol and which developed the lesions while it was not much raised in the chick B-II which was getting fat and cholesterol in the form of yolk of egg and in which lesions were not found within the period of study. Atherosclerosis is thus associated with the raised C/P ratio.

CONCLUSIONS:

1. Cholesterol could produce the atherosclerotic lesions; this it could be without producing gross hypercholesterolæmia but was associated with a raised C/P ratio.
2. Atherogenicity of cholesterol could be modified by other dietary factors and the condition was not always associated with the raised plasma cholesterol level which could be obtained by adding cholesterol in the diet.
3. Vegetable fats alone were not able to raise the plasma cholesterol level appreciably nor could produce the lesion in the concentration used (15%) during the 13 weeks period in the chick but it had a distinct retarding effect on growth.
4. Cholesterol in a concentration which could produce the atherosclerotic lesion had not much effect on growth but the cholesterol added to the vegetable fat (Dalda) diet increased the toxic effect on growth and also produced the atherosclerotic lesions.

SUMMARY

The study was undertaken to assess the role of dietary fats and cholesterol in the pathogenesis of atherosclerosis. Six chicks were taken for the animal experiment. They were fed on six different diets, that fat and cholesterol content of each being regulated. A record of each chick as regards its weight, growth, and blood biochemistry (plasma cholesterol and plasma lipid phosphorus) was kept. Photographs were taken from time to time. Autopsy was performed after 13 weeks of study and a complete gross and microscopic examination of the heart and blood vessels was done. Photographs of gross lesions as well as photomicrograph were taken.

These experiments point to a direct corelation between the dietary cholesterol intake and the genesis of atherosclerotic lesions under certain circumstances, and the endogenous and exogenous factors were found capable of modifying the dietary influences in the pathogenesis of these lesions in the chick.

ACKNOWLEDGEMENT

We are thankful to Dr. H. N. Bhatt, M.B., F.R.C.S., D.M.R.E., Principal and Superintendent, S. N. Medical College and Hospital, Agra, for his kind permission to carry on the investigations in the various departments of this hospital and for publishing the results.

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AN OUTBREAK OF SMALLPOX IN BHIWANI (PUNJAB)

by

JAGJIT SINGH, M.B.B.S., D.P.H.,

District Medical Officer of Health, Hissar
(Punjab).

Bhiwani is a flourishing town with a population of about 60,000 in the district of Hissar (Punjab). It is situated 62 miles north-west of Delhi and is located at one of the points of the confluence of the Punjab, Pepsu and Rajasthan States. There is a large to and fro movement between these three states in this area resulting in a frequent exchange of ideas and infections. It is inhabited by a mixed population consisting of industrialists, big and small merchants, labourers, servicemen, Harijans and a few agriculturists. Their habits and standards of living differ widely.

Smallpox raged in this town in an epidemic form from the 22nd of November, 1955, to the 1st of April, 1956. There were in all 103 cases with 33 deaths in the town and 9 cases in the surrounding rural areas of the Hissar district (Punjab). Infection also travelled from this town to the adjoining areas of Pepsu and Rajasthan States, although no definite records of its incidence in these states is available to the author.

The Origin

A Hindu male child, aged 6 years, an unvaccinated resident of the town, got an attack of smallpox on the 22nd November, 1955. The family, including the child, had been to Dadri, a neighbouring small town in Pepsu for a visit to some relatives and had come back a couple of days earlier. Dadri was reported to be heavily infected with smallpox.

The Epidemic Proper

After the first case, which was imported from Pepsu, the epidemic spread rapidly and cases were reported from six different localities of the town. In all 103 cases, 33 of them fatal, were reported up to the 1st April, 1956 after which date no fresh case was reported. The weekly distribution of cases and deaths is shown in Figure I.

The epidemic came in two waves, the first covering 4 weeks from the 2nd week of December 1955 to the 1st week of January 1956 and the second covering 7 weeks from the 2nd week of February to the 4th week of March, 1956. The total numbers of cases involved in these two waves were 50 and 43 respectively, the fatality rate being higher

CHRONOLOGICAL ORDER OF SMALL POX CASES AND DEATHS IN THE BHIWANI OUTBREAK 1955-56

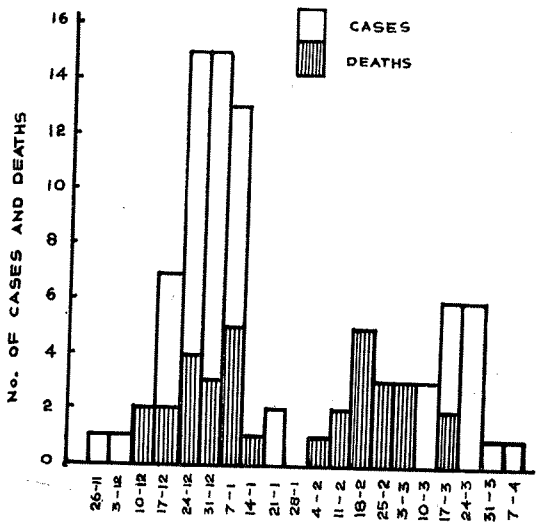


Fig. 1.

(34.9%) in the 2nd wave than in the first (28%). The epidemic came down partly due to the rise of herd immunity, no death being recorded among the 8 cases occurring during the last 3 weeks, and partly to the preventive measures taken by the department by way of isolation of early cases and mass vaccination campaign, the total number of vaccinations performed being 23,704 including 2,605 primaries. *Age :*

The age distribution of the cases and deaths is shown in Table I.

TABLE I

Distribution of smallpox cases and deaths by Age in the Bhiwani outbreak, 1955-56

Age Group	Number of Cases	Deaths	Fatality rate
Below 1 year ...	14	9	64.3
,, 5 years ...	40	11	27.5
,, 10 years ...	41	10	24.4
,, 15 years ...	5	2	40.0
Over 15 years ...	3	1	33.3
TOTAL ...	103	33	32.0

It will be seen that as many as 92.2 per cent of cases occurred in the age groups below 10 years. The fatality in infants was very high being 84.3 per cent as compared to 32.1 per cent for all ages.

Sex :

Among the 103 cases, 53 were males and 50 females with 19 and 14 death respectively. The fatality rates were 34.8% for the males and 28% for the females.

Vaccination

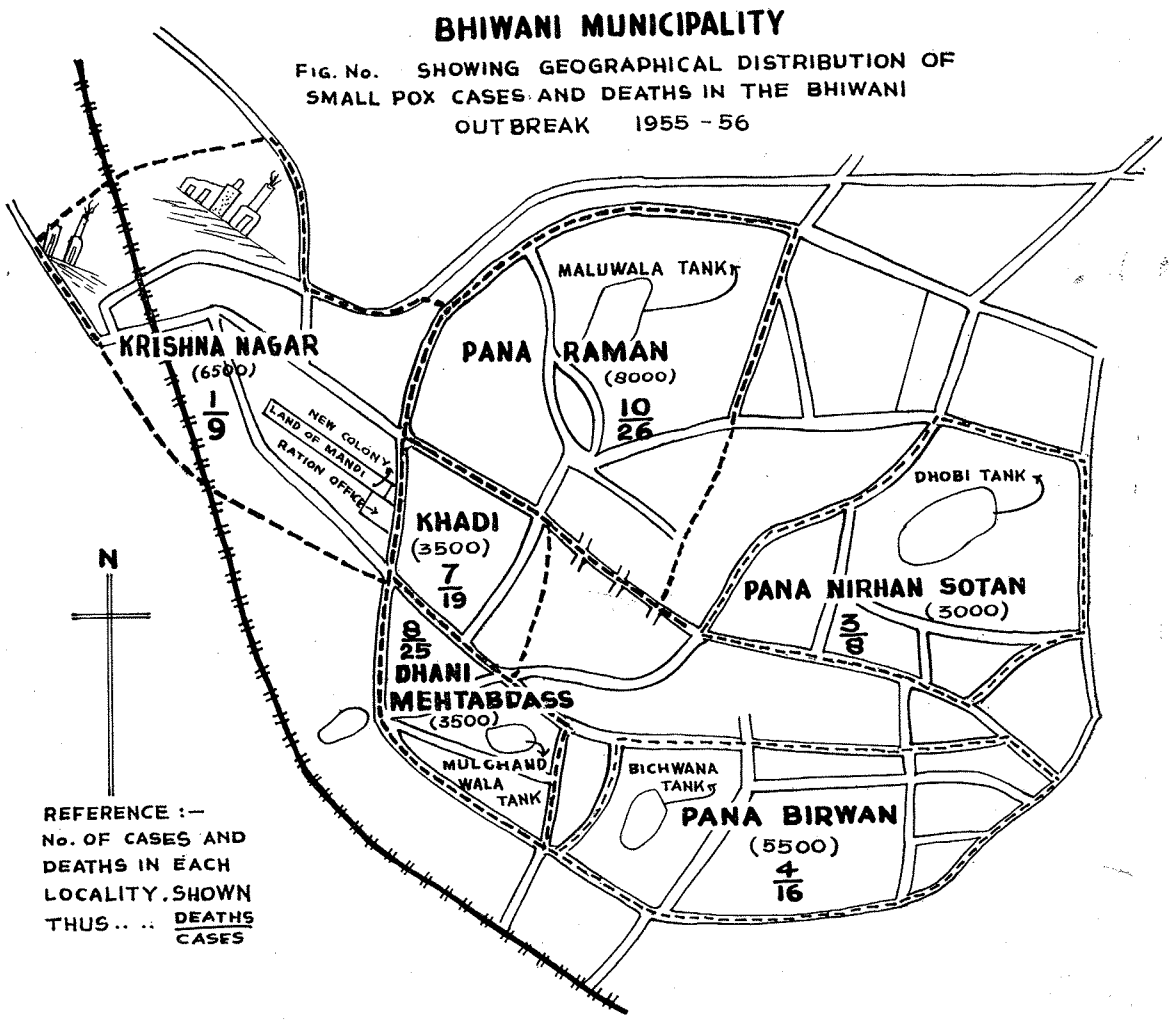
The distribution of cases according to the state of vaccination is given in Table II.

TABLE II

Distribution of Smallpox cases and Deaths by State of Vaccination in the Bhiwani Outbreak, 1955-56

State of Vaccination	Nunmber of cases	Deaths	Fatality rate
Vaccinated ...	17	1	5.9
Doubtful or unknown	18	5	27.8
Un-vaccinated ...	68	27	39.7
TOTAL ...	103	33	32.1

N.B.—Vaccinated group includes those



having one or more marks of successful primary vaccination.

It is clear that the state of vaccination has a marked effect not only on the onset of the disease, but also in its outcome. The majority, 81.8 per cent, of the total deaths occurred in the un-vaccinated group, fatality rate among the unvaccinated and doubtful groups being 39.7 and 27.8 per cent respective as against 5.9 per cent (1 death) among the vaccinated which occurred in a person vaccinated during the incubation period of the disease.

Distribution of Cases

The distribution of cases and deaths in the various localities of the town is given in Table III and Figure II. It will be seen from the table that the cases occurred mainly in insanitary localities with dark and damp houses, inhabited by poor and ignorant people, averse to vaccination.

Discussion

The first case was an imported one from the neighbouring state of Pepsu. The infection spread rapidly and soon covered most of the mohallas of the town. The poor localities were most affected. The epidemic, however, was controlled by means of mass vaccination. As fresh import of cases and susceptible population from the adjoining areas continued, the epidemic lasted as long as four months. If the vaccination operations in all the contiguous areas of the three different states (Punjab, Pepsu and Rajasthan) could be co-ordinated, the epidemic might have been controlled much more easily and rapidly.

Summary

An outbreak of smallpox occurring in Bhiwani town in the District of Hissar (Punjab) with the distribution of cases in time and space and according to age, sex and state of vaccination is reported.

Acknowledgement

My thanks are due to the Director of Health Services, Punjab, for permission to publish this report, to Sri Jage Ram, Sri Chhabil Dass, Sri P. C. Handa and Sri Bhale Ram for their help in collection the data of this outbreak and to Dr. S. C. Seal, Professor of Epidemiology, All-India Intsitute of Hygiene and Public Health, Calcutta, for suggestion and encouragement.

TABLE III

Geographical distribution of Smallpox cases and deaths in the BHIWANI outbreak 1955-56.

Sl. No.	Name of Locality	Approx. Population	Sanitary condition	Main Occupation and Sanitary habits of the people	Number of Cases	Deaths
1.	Pana Raman	8,000	Dark & Damp houses	Mostly leather work, poor people, afraid of vaccination.	26	10
2.	Dhani Mehtabdass.	3,500	Dark & Damp houses, adjoins the drainage disposal of the town.	Mostly Harijans (sweepers) very poor, insanitary habits.	25	8
3.	Khadi	3,500	Dark & Damp houses, rubbish heaps lying here and there.	Mostly Harijans, labourers, dirty habits, averse to sanitary measures try to avoid vaccination.	19	7
4.	Pana Birwan	5,500	Quite dirty, animals and human beings live together.	Agriculturists, averse to vaccination.	16	4
5.	Pana Nirhan Sotan.	3,000	Clean houses on the whole, but some demolished evacuee houses are very dirty.	Shopkeepers and merchants, clean habits.	8	3
6.	Krishna Nagar	6,500	Clean locality and well ventilated houses.	Mixed population, civil servants and mill labourers, clean habits but dislike vaccination.	9	1

HISTORY OF MEDICAL EDUCATION IN INDIA

1. Modern Scientific System

By

S. C. Seal, M.B., Ph.D., D.P.H., F.A.P.H.A., F.N.I.,
Professor of Epidemiology,
All-India Institute of Hygiene and Public Health, Calcutta.

The present system of practice of Medicine had ist origin in the early years of the 16th Century following the landing of the Portuguese at Calicut in 1498 and the arrival of English Physicians as Ship's Surgeon. The actual impact of the western civilisation was, however, felt when the British took over the control of the land, and the practitioners of western medicine (European doctors) arrived in India either to serve with the troops of the East India Company or to serve foreign missionary centres. A few were also employed by the Princely states as medical advisers but those in early employment as physicians at the court of the Indian and other Eastern rulers were French and also Dutch, Italian, Armenians etc. The English in this position was a later feature. A few others also came to India for private practice and often took the chance of filling up the vacancy in the services. These foreign medical practitioners selected local men to help them in their daily practice of western medicine and sometimes the latter, when sufficiently trained, were even given the chance of running a missionary medical centre. Eurasians and natives who served in the civil and military hospitals as compounders and dressers acquired some knowledge of western medicine. These apprentices were examined and got government recognition and qualification and were styled as "native doctors" and were appointed as gazetted subordinate in charge of regimental and civil hospitals particularly under the stress of the war when the medical services were strengthened by locally engaged men at Calcutta, Madras and Bombay.

Organisation of medical education—19th Century.

Although it is said that the western medicine was practiced in Goa before the British came to India and a prosperous hospital existed there before any British hospital was established in India no details about the institution offering the training are available. Organised medical teaching was actually started in the first half of the 19th century but the indigenous system of medical education in both Sanskrit (Hindu) and Arabic (Islamic) had been prevalent in the country long before the western system was introduced. The state of the indigenous medical practice by Vaids and Hakims was so intimately connected with the welfare of the people that even the western system at its initial stage could not ignore these systems for the purpose of imparting knowledge in western medicine. According to Rev. Long, prior to 1807, from 50 to 100 native doctors were allowed to attend the hospital run on western system to initiate its study and practice, and to introduce it among their countrymen. There was a vernacular medical school with 30 students under Dr. Jameson. It was a three years' course imparted in Hindusthani. The successful students were employed in the civil and military departments. During this time Dr. Breton published various medical subjects in Urdu.

The first medical school was established in Calcutta in 1824 under the name "Native Medical Institute" according to a scheme drawn up by the medical Board established for the purpose in 1822. Similar Schools were also started at Bombay in 1826 and at Madras in 1827. The Bombay School was however closed down after 6 years. At Calcutta, the period of training was for 3 years and the teaching was initially given in Urdu, the dissection was done only in lower animals and the students were shown the postmortem of patients dying at the general hospital. In 1826, medical classes were instituted in the Sanskrit College and the Madrassa, and the student were also allowed to study *Sushruta* and *Charaka* in the former place and *Avicenna* and *Unani* in the latter place. It cost the Government Rs. 1,000/- per student. In 1821 a small hospital was

attached to this Institute with 30 beds and an outdoor clinic, through the assistance of Ram Comal Sen. But this arrangement was found unsatisfactory by the then Governor-General, Lord William Bentinck. In 1834 the Committee of enquiry appointed by him recommended abolition of the Native Medical Institute and opening of a medical college for the natives to be taught European Medicine in English. During the period of 10 or 11 year's of existence the Native Medical Institute had trained 126 native doctors who after graduation were required to serve for 15 years in the military or civil employ of the Government.

On the 20th February 1835, by an order of Lord William Bentinck, the first medical college was formally opened in Calcutta, at the site where the present Calcutta Medical College is existent. The new college was open to youths between 14-20 years with knowledge of English and Bengali or Hindusthani. Dissection of human body, which was considered to be the foundation of all medical training, was undertaken by the students within two years of the establishment of the college, in spite of the existing prejudices. A few people led by Pandit Madhusudan Gupta were the first to dissect a human body on January 10, 1836 and it is said that guns were fired at the Fort William of Bengal in their honour. Mr. David Hare, the well-known philanthropist and educationist was nominated as the secretary of the College.

To meet the demand for subordinate native doctors in the Army, a "Secondary Class" was introduced in 1839 to teach Medicine and Surgery through the medium of Hindusthani. In 1851-52 a two years course of medical training in Bengali was established to furnish subordinate doctors for civil hospitals and jails. Of the first batch of students that appeared in the College examination at the end of $3\frac{1}{2}$ years, the four students who came out successful were Uma Charan Sett, Dwaraka Nath Gupta, Rajkristo Dey and Nabin Chandra Mitter. A large hospital for females was constructed in 1840 and in the same year classes for the military medical peoples were opened.

Three other medical institutions were established in succession following the first medical college at the then Capital city, Calcutta, namely the Medical School at Madras in 1835 and the medical college at Bombay in 1845 and the King Edward Medical College at Lahore in 1860. The School at Madras was upgraded to the college standard in 1850. With the increase of popularity of western medicine the demand for trained doctors soon became so high that the few students receiving training in the three colleges fell far short of the country's requirement, and it was considered desirable to train up large number of even substandard doctors. As a result, a large number of teaching institutions gradually sprang up all throughout the country through private as well as public enterprises. Even the colleges themselves introduced vernacular courses to raise a large number of substndard doctors in response to this demand. By the end of the 19th Century the total number of institutions offering training in medicine rose up to 20 of which only 4 were of University graduate standard and the rest were of undergraduate school standard. In addition, there were four other schools, e.g., one female medical school at Hyderabad (Sind) and one each at Madura, Nellore and Tanjore in the Madras Presidency which had been started near about 1887 but were short lived*. The chronological order of their establishment is given in Table I in the Appendix I.

Among the medical schools, the first school was started at Madras in 1835, the second at Agra in 1853, the third at Nagpur in 1867 and the fourth at Calcutta in 1873, the fifth at Dacca in 1874, the sixth at Patna in 1874 and seventh at Cuttack in 1875. It appears the first non-government school was started at Indore (King Edward Hospital Medical School) or at Poona (Byramjee Jeepeebhoy Medical School) in 1878 followed by the B. J. Medical School at Ahmedabad in 1879 and the Calcutta School of Medicine (later named as R. G. Kar Medical College) at Calcutta in 1886. Perhaps the last one was the first successful medical teaching institution by purely private endeavour. One small school in Hyderabad (Sind) and a larger one at Ludhiana, Punjab were exclusively for women. The medical college ran a course of 5 years and the school usually four years or three years (vernacular). The degree or diplomas awarded by the colleges were either Bachelor of Medicine (M.B.) or Licentiate in Medicine and Surgery (L.M.S.), depending on the marks obtained at the University Examination (Madras awarded M.B. & C.M.—Bchelor of Medicine and Master of Chirur-

* Attempts are being made to secure further information about these institutions.

TABLE II

Progress of Development of Medical Institutions in the 20th Century by Decennial periods.

Decennial preiods	Government		Non-Government		Missionary		Native State		Total		Total
	Sch.	Coll.	Sch.	Coll.	Sch.	Coll.	Sch.	Coll.	Sch.	Coll.	
1901-1910	1* Madras	—	—	—	—	—	—	—	1	—	1
1911-1920	2 Nagpur (R) Amritsar* Madura(?)	1 Women Delhi	1 (Bombay)*	2 Lucknow University Calcutta*	1 Women Vellore*	—	1 Bangalore*	—	5	3	8
1921-1930	7 Agra (women) Madras (women) Mymensingh (P) Darbhanga* Chittagong (P) Jalpaiguri† Burdwan†	3 Visagapatnam Calcutta (postgraduate) Patna*	4 Bombay* Bankura Calcutta Calcutta* Coimbatore(?)	1 Bombay	—	—	—	2 Mysore Hyderabad*	11	6	17
1931-1940	—	4 Calcutta (postgra- Madras* Agra* Gwalior	1 Ludhiana	—	—	—	—	—	1	4	5
1941-1950	—	15 Amritsar* Cuttack* Poona* Ahmedabad* Laheriasarai* Agra* Dibrugarh* Calcutta* Calcutta* Bombay* Calcutta (Lake Medical) Baroda Guntur Nagpur Jaipur	—	3 Vellore* Bombay* Bombay*		—	—	—	—	18	18
1951—	—	8 Indore* Trivandrum Patiala Madura Delhi Bhopal Bangalore (postgrad.) Calcutta (postgrad.)	—	4 Manipal Bangalore* Calcutta (postgrad.) Bankura (W. Bengal)	—	—	—	—	—	12	12
									18	43	61

[Sch = School; Coll = College; + School abolished—7; College abolished—1; * School upgraded—20; R = Running; P = Pakistan—2; College new—23.]

gery). A large majority of the students only succeeded in obtaining L.M.S. The schools were awarding diploma of Dressers, Hospital Assistants, Sub-Asst. Surgeons, V.L.M.S., etc. Progress of Medical Education in the 20th Century.

(a) Position at the turn of the Century:

In 1901 the four Medical Colleges at Calcutta, Bombay, Madras and Lahore were accommodating 1466 students and the 17 running schools 2,727 students and were spending about $4\frac{1}{4}$ and 3 lakhs of rupees respectively. While all the Colleges were run by the Government only 8 of the 17 schools were run by them or by their aid, eight were run by private bodies and one by a municipality. With the progress of time three men's College at Delhi under the management of a Governing Body, have been instituted, maintained or taken over by the Government, while eight are managed by private bodies. These include five post-graduate institutions, viz., the School of Tropical Medicine, the All-India Institute of Hygiene and Public Health, the Institute of Child Health and S.S.K.M. postgraduate College, stationed at Calcutta and the All India Institute of Mental Health at Bangalore. The first is now managed by a Governing Body with the Director-General of Health Services as its Chairman, but the finances are met by the Government and the Endowment funds. The third is private and the others are managed entirely by the Government.

Of the Colleges, 20 have been upgraded

TABLE III

Numerical Chronology of Development of Medical Institutions in India by decennial periods:

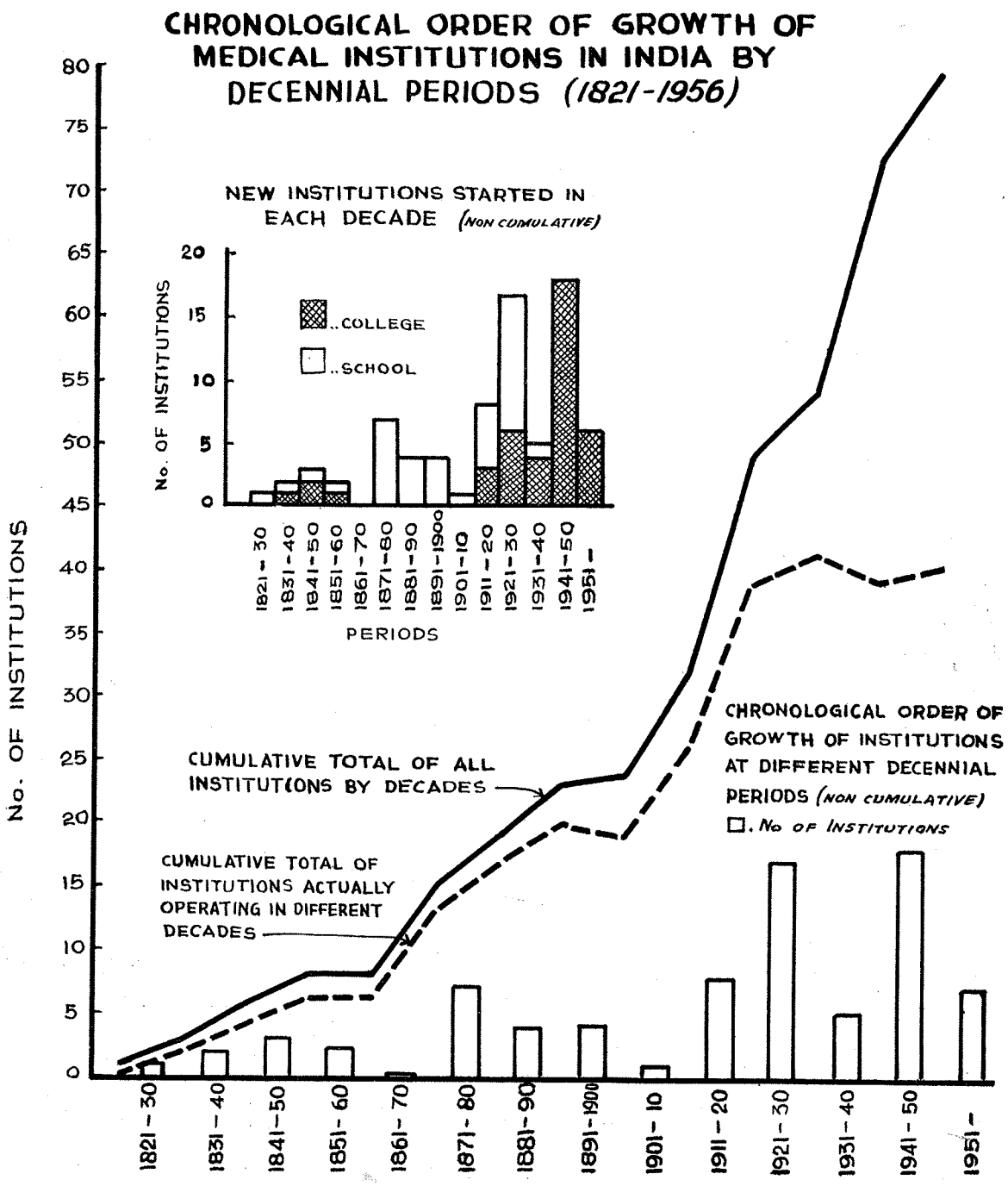
Decennium	Initiated			Cumulative Total	Abolished			Institutions actually running Cumulative Total
	Schools	Colleges	Total		Schools	Colleges	Total	
1821-30	1	0	1	1	0	0	0	1
1831-40	1	1	2	3	1	0	1	2
1841-50	1	2	3	6	1	0	1	4
1851-60	1	1	2	8	0	0	0	6
1861-70	0	0	0	8	0	0	0	6
1871-80	7	0	7	15	0	0	0	13
1881-90	4	0	4	19	0	0	0	17
1891-1900	4	0	4	23	1	0	1	20
1901-10	1	0	1	24	2	0	2	19
1911-20	5	3	8	32	1	0	1	26
1921-30	11	6	17	49	4	0	4	39
1931-40	1	4	5	54	3	0	3	41
1941-50	0	18	18	72	20	0	20	39
1951-	0	12	12	82	5	1	6	43
TOTAL	37	47	82	82	38	1	39	43

schools were abolished, twelve were upgraded and one College and two schools fell in the Pakistan State.

(b) Subsequent development:

The total number of new institutions established since 1901 is 61—18 Schools and 43 Colleges. Of the Schools 10 were instituted by the Government, 6 by private agencies, one by the missionaries and one by the native state. By 1954 nine of these Schools were upgraded to the College standard, six were abolished, two are in East Pakistan and one is still running(?) Of the 43 Colleges 33 including the two institutions established by the native states and one wo- from the School standard and 23 established during the present century. Only one of these, viz., the Lake Medical College at Calcutta has been abolished. All these Colleges have been brought to the same standard of the M.B.B.S. Degree as prescribed by the Indian Medical Council, except the College of Physicians and Surgeons of Bombay which awards M.C.P.S. and F.C.P.S. diploma recognised as equivalent to M.B.B.S. degree by the Indian Medical Council. The decennial progress of development of these institutions is shown in Table II.

The data in Table II show that during the first decade only one school was established at Madras, while in the second decade 8


CHRONOLOGICAL ORDER OF GROWTH OF MEDICAL INSTITUTIONS IN INDIA BY DECENNIAL PERIODS (1821-1956)
NEW INSTITUTIONS STARTED IN EACH DECADE (NON CUMULATIVE)
No. OF INSTITUTIONS
COLLEGE
SCHOOL
PERIODS
1821-30
1831-40
1841-50
1851-60
1861-70
1871-80
1881-90
1891-1900
1901-10
1911-20
1921-30
1931-40
1941-50
1951-
No. OF INSTITUTIONS
CUMULATIVE TOTAL OF ALL INSTITUTIONS BY DECADES
CUMULATIVE TOTAL OF INSTITUTIONS ACTUALLY OPERATING IN DIFFERENT DECADES
CHRONOLOGICAL ORDER OF GROWTH OF INSTITUTIONS AT DIFFERENT DECENNIAL PERIODS (NON CUMULATIVE)
No. OF INSTITUTIONS

institutions—5 schools and 3 colleges, were established. One more school was probably initiated at Madura in 1918 and closed down in 1928. Of the Schools two were Governmental, one private, one missionry and one was sponsored by the native state. Four of these institutions have been upgraded. Of the three Colleges, one, exclusively for women was sponsored by the Government and the other two by private bodies.

During the third decade 17 institutions, 11 Schools (7 Governmental and 4 private) and 6 Colleges, were started. Six of the Schools have been abolished, 3 have been upgraded and 2 have fallen in the Pakistan State. Of the 6 Colleges (3 Governmental, 1 private and 2 Native State) two were upgraded from the Schools previously established and one was postgraduate. During this decade 12 new institutions came up, which is the maximum for any decade.

The fourth decade was another lull period like the first, when four institutions 3 Colleges and one School, were established. The latter was later abolished. Of the Colleges one was postgraduate and the other two were converted from the existing institutions.

The most important period of developmental activities, however, was the fifth decade when as many as 13 Schools were upgraded to the College standard and 5 new colleges were added, one only of which was esablished on a temporary basis. The total number of institutions that came up during this decade was 18 and the initiative was taken largely by the Government sponsoring as many as 16 institutions.

The present decade which is only half through has not yet exhausted the momentum. Already twelve Colleges including the four established through private enterprise, have been aded to the list, the important of which is the All-India Institute for Medical Sciences at Delhi. Several others are already afoot, opportunities being taken to convert the remaining School into college. The numerical chronology of development of medical institutions by decenniel periods has been shown in Table III and graphically represented in Figure 1.

The total number of existing colleges in the Indian Union is, at the time of this compilation, 43 including the five postgraduate institutions, admitting about 3,000 students each year. Besides above there are four dental Colleges, two at Calcutta, one recognized and one unrecognized, and two both recognized, at Bombay and one College of Pharmacy (Lallubhai Matilal College of Pharmacy) at Ahmedabad.

Establishment of National Medical Institute:

It has now been thoroughly realised in India that the production of dependable and attractive consumers goods in the country at a cost commensurate with her economic conditions is essentially dependent upon the production of capital goods, and so for the improvement of the standard of medical education in India the Health Survey and the Development Committee in their report in 1946 strongly felt the necessity of organising better training facilities for the future professors and teachers needed by the growing number of medical Colleges in India. This consideration led the Committee to propose and strongly recommend the establishment of a high grade medical Institute at a national level primarily intended to train up the future professors.

Pending the establishment of such a institution, an upgrading Committee was established by the Government as an interim arrangement. In their report published in 1949 this Committee recommended upgrading of particular departments of certain medical institutions with research programmes, to be recognised as centres for teaching and research at postgraduate level. Thus the section of Physiological and Industrial Hygiene of the All-India Institute of Hygiene and Public Health, Calcutta, the Department of Anatomy in the Madras Medical College and certain departments of other institutions were upgraded. In the meantime the proposal for establishment of a national medical college has also been materialized through the announcement by the New Zealand Government of a substantial contribution towards the building and organisation of the All-India Institute of Medical Sciences at Delhi. This step may be considered as the next important milestone in the improvement of medical education in India. Certain states are also making headway for the development of postgraduate medical education. Thus, recently, one postgraduate Medical College has been started at Calcutta at the S. S. K. M. Hospital by the Government of West Bengal and the University of Calcutta has also announced the establishment of a Postgraduate Medical College.

Progress on the standardisation of Medical Education

(a) During the 19th Century:

Since 1857 the standard of teaching in Medical Colleges was being guided by the different Universities, viz., Calcutta, Madras, Bombay and the Punjab, which controlled the examinations, while the standard of teaching in the Medical Schools which were much larger in number, was controlled by the autonomous Examining Boards from time to time. Till 1894, however, the medical education was placed under the Director of Public Instruction, as there was no Health Ministry in the Government in the 19th century and even during the early part of the 20th century. Apart from the first report published in 1861 some records of medical education can be sifted from the quinquennial reports of the Department of Public Instruction published since 1887, the last one being in the year 1937. One decinniel report for 1937-47 and are quiquennial report 1947-52 have since been published. In 1899, the administrative control of the medical education was transferred from the Director of Public Instruction to the Inspector-General of Civil Hospitals.

(b) During the present century:

An Indian University Commission was appointed, which submitted its report in 1902 and accordingly the Indian University Act of 1904 was passed empowering the Universities to put forth new regulations to revise the medical curricula. Though the degrees granted by the different Universities were made more or less identical the Calcutta and Madras Universities retained M.B. and L.M. & S., Bombay maintained both M.B.B.S. and L.M.S., while the Punjab only M.B.B.S.

Provincial and Central (India) Medical Councils

Beginning from 1912 different provincial medical acts were passed, e.g., Bombay in 1912, Bengal, Madras and C.P. in 1914, Orissa, Bihar and Punjab in 1916, U.P. of Agra and Oudh in 1917. Along with these acts different provinces established their respective Medical Councils through the provincial legislations and these helped to establish uniform standards in medical education, particularly of the school standards, and to regularise medical practices. Some of these councils also provided for registration of qualified doctors who were practising in the state prior to the passing of the Act and afterwards. Certain privileges, such as issuing of medical, vaccination and death certificates, medical examination of insurance cases, legal witness in the law courts, etc. were granted to the practitioners of scientific medicine but no penalities were imposed on unqualified practitioners. These Councils also controlled the ethics and behaviour of the registered medical practitioners, and were named as Provincial (Bengal, Madras, etc.) Council of Medical Registration, and a separate body under the name of State Faculty of Medicine or Examining Board was established to control examinations conducted for the award of diplomas and certificates. The State Medical Faculty of Bengal (now of West Bengal) conferred three kinds of diplomas namely, L.M.F. on the passing of the School Final Examination (4 years course), M.M.F. (Member Medical Faculty—a higher diploma with 5 years' course) and F.S.M.F. (Fellow of the State Medical Faculty), generally conferred on persons of scientific eminence.

Even at the very early stage of the medical education in western medicine, the teacher of the Calcutta Medical College like Goodeve and others considered it necessary to send Indian students to U.K. for higher studies in medicine. This was made possible as early as 1844 through the munificence and generosity of Sri Dwarka Nath Tagore and the efforts of Professor Dr. Goodeve. The first batch of students to avail of this opportunity consisted of Gopal Chandra Seal, Bholanath Bose, Dwarka Nath Bose and Goodeve Surjya Kumar Chakrabutty, who acquainted themselves very well in English and passed the examination with great credit. Thereafter a gradually increasing number of doctors went abroad (particularly to U.K.) for higher studies in different specialised branches of Medicine. But no reciprocity or recognition of the standard of medical education in the Indian colleges was granted by the General Medical Council of Great Britain till 1895 when this council announced, for the first time, recognition of some of the medical colleges in India. Sometime after the First World War I, between 1924 and 1929, this recognition was tempoprarily withdrawn from some colleges including those under the University of Calcutta. After negotiation and inspection of examinations by the members of the General Medical Council of Great Britain in 1929 the reciprocity and the recog-

nition of the standard was revived permitting the graduates of the Indian University to sit straight for M.R.C.P., FRC.S., etc.

The Indian Medical Council comes into being

The necessary stimulus given by the question of standard and reciprocity brought into being the Indian Medical Council, as existent to-day. The Indian Medical Council Act No. 27 was passed in 1933 and it came into force on the 1st February 1934. Major General C. S. Sprawson, I.M.S., was the first President of the Council and Mr. Furquhar Macrae its first Secretary. This Council took over the task of inspection of the standard of University education, i.e. of the graduate colleges, and it played an important role in substantially raising the standard of medical education in India. This council employed Inspectors of Examinations, on whose report the college was recognised if the standard was considered up to the mark. The Indian Medical Council had already recognized those training centres and standards which had been primarily accepted by the British Council, but to maintain the standard the inspection system is still continuing since the 1935. In the initial stage the standard of medical education of all the universities in India were recognised except those of Andhra and Patna. This non-recognition stimulated these two Universities to quickly bring the standard up to an optimum level and the recognition was granted.

A reciprocity has been established by the Indian Medical Council with the various universities in the world in regard to the medical education and thus the graduate standard of medical education in India as recognised by this council is also recognised by the universities in Great Britain and Ireland, U.S.A., Canda, France, Italy, Germany, etc. In fact, just before the World War II British Council in conjunction with the Royal College of Surgeons and Physicians set up an Examination Centre in India itself for preliminary selections of candidates for the final examination in higher British diplomas like F.R.C.S and M.R.C.P., etc., held in the United Kingdom. In fact, the British Council from the very beginning considered the standard of University medical education in India as fairly high and comparable to the British standards.

The maintenance of this standard was to a certain extent due to the British trained top-ranking medical officers of the Indian Medical Service who were holding most of the Professorial posts of all the Government institutions till the World War I. These officers were not only given chances to transfer themselves from the military to the civil posts but were also given facilities to obtain higher training in their specialities in Great Britain at Government's cost. Following the World War I many Indian I.M.S. officers were also holding the professorial and civil administrative jobs. Since the very beginning of this century the Indian doctors began to take greater interest in obtaining higher medical training in Great Britain and also in their respective Universities. By the twenties a good number of them proved themselves proficient and ready to take up the professorial jobs in both under graduate and postgraduate medical education. Thus from 1921 onwards there was a move to Indianise the professorial chairs. As a result of this movement the process of Indianisation of the teaching post was hastened and by the thirties I.M.S. professors gradually relinquished their chairs keeping only a few (three or four) senior posts still reserved for them.

In 1938, the Government of India held a conference to review medical education in the schools in India. The important recommendations made by this conference namely, abolition of subordinate grade of doctors and maintenance of a uniform graduate standard of medical education all throughout the country by either abolition or upgrading of the existing schools, helped further improvement of medical education in the country. On the basis of these recommendations the Indian Medical Council in 1942 passed a resolution that all schools should be abolished by 1947.

In taking up this decision the Indian Medical Council was greatly influenced by the move made by the members of the Indian Medical Association who not only made resolutions to the above effect but pursued the matter with certain amount of zeal and enthusiasm. The decision was also partially hastened by the circumstances during the World War II which necessitated appointment of these school-passed doctors to the same rank as that of the graduates of medicine under the I.A.M.C. Service. However, to give effect to the resolution of the Indian Medical Council admissions to the schools eventually stopped on the one hand and the revised regulations were adopted, on the other hand, by several Universities in

India, the most prominent among them being the Calcutta University. By those regulations licentiates were encouraged to attain the minimum standard of graduate education by studying for an additional period of two years. A short course covering the principal subjects in Medicine was organised and run in several medical colleges, while the Government of India set up a temporary medical college at Calcutta, named the Lake Medical College, exclusively for this purpose This College was started initially with buildings and materials left over by the hospitals run by the American Army Camps in the Lake area of the city, at which the teaching was conducted for 5 years from 1947. Both civil and military licentiate students were admitted but preference was given to the war-returned candidates. This condensed M.B.B.S. course, as it was called, is still being run in several Colleges in Calcutta. Thus the medical graduates all over India now get the degree of M.B.B.S. in conformity with the unification of the basic medical education.

Time and future will show whether the steps taken to abolish these institutions were wise enough at this stage for a country like India where there is a huge deficiency in the number of medical personnel in the rural areas Paradoxically, both the Government and the voluntary organisations are in great need of this substandard medical personnel for their innumerable health centres, Community Project areas, rural dispensaries and hospitals, both from the economic point of view as well as from that of medical care required to be catered for the country at large.

(To be continued)

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
1	1824	Native Medical Institute	Calcutta	Government	Urdu and partly in Sanskrit and Arabic.	Below School
2	1835	Calcutta Medical College.	Calcutta (W. Bengal).	Government	English	(*i*) Graduate (*ii*) Apprentice class for Europeans, Anglo-Indians & Indian Christians. (*iii*) Undergraduate for Military Asstt. Surgeons.
					Hindusthani—1839-73. Bengali—1851-73.	Licentiate Vernacular—1860.
					Ceylon Classes—1860.	Native Apothecary—1860. Postgraduate.
3	1835	Madras Medical School.	Madras	Government	English	(1) Apothecary grade. (2) Second grade dresser of the Medical Department.
4	1845	Grant Medical College.	Bombay	Government	English	Graduate
5	1846	Beharam Medical School (Hyderabad Medical	Hyderabad Deccan.	Native State	Urdu & English 1901—English 1927-52—Urdu ; 1952 English again.	Under-graduate school.

Qualification for admission	Course—Diploma! Degrees	Duration	Stages of Development	Present status
Traditional school training.	Native Assistant	3 yrs.	1835-Abolished	..
F.A. for M.B. ; F.A. & Entrance Examination for L.M.S. Test Examination for Europeans etc. under Matric. for Bengali Classes. 1921—I.Sc. with Physics and Chemistry.	Upto 1906—M.B., L.M.S. Upto 1893—V.L.M.S., N.A., Passed Hospital apprentice. Passed Hospital Assistant.	5 yrs. 3 yrs. 3 yrs.	1846—recognised by Royal College of Surgeons University of London & Society of Apothecaris, England. 1847—Military Sub-Medical Department opened. 1857—Affiliated to Calcutta University. 1861—Dentistry introduced 1865—First Chair of Hygiene 1870—Midwives training class opened. 1873—School classes transferred to Campbell Medical School. 1874—Graduates designated as Asst. Surgeon. 1875—Hindusthani classes transferred to Agra, Lahore & Patna. 1878—Vernacular students were called Hospital Assistants. 1881—Lady students admitted. 1892—G.M.C. of Great Brktain recognised the graduate degree of Calcutta University. 1894—Military students called Military Assistant Surgeon. 1899—Administrative control transferred from D.P.I. to I.G. of Civil Hospitals. 1906—L.M.S. abolished. M.B. course extended to 6 yrs.	Professional college for both graduate and Post-Graduate Medical education in non-clinical or basic clinical and public health subjects.
1926—I.Sc. with Physics, Chemistry & Mathematics.	Military Assistant Surgeon.	3 yrs. later 4 yrs.		
1947—I.Sc. with Physics, Chemistry and Biology.	After 1906—M.B. (now M.B.B.S.). M.M.F. after 1916. At present : M.D., M.S., M.O., T.D.D., D.G.O., D.Phil., D.C.H., D.O.M.S., D. A. etc.	5 yrs. 6 yrs. 5½ yrs (1948)		
Knowledge in English.	..	4 yrs. 3 yrs.	1850—Upgraded to College standard.	1950—abolished
Earlier—School Final standard and First Arts. Now—I.Sc. B. group with Chemistry, Physics and Biology.	Present : M.B.B.S., M.D., M.S., B.Sc., M.Sc., Ph.D., D.Sc., D.O.R.L., D.D., B.Hy., D.P.H., D.G.O., D.P.M., D.A., D.V.D., M.C.P.S., F.C.P.S.	5 yrs ; now 5½ yrs.	1845—Established in memory of late Sir Robert Grant, Government of Bombay. 1960—Affiliated to the Bombay University. 1897—Framji Dinshaw Petit Research Laboratory opened. 1913—Physiological school and Laboratories were added.	College for graduate and post-graduate studies in non-clinical, clinical and public health subjects.
Present—I.Sc. with Physics, Chemistry, Botany, Zoology & Elements of Genetics.	4 years—Diploma of Hakim. 3 yrs.—Dressers later Hospital Assistant. 1901—L.M.&S., L.M.P. 1927—M.B.B.S.	4 yrs & 3 yrs. 1901-5 yrs. Present—5½ yrs.	1946—recorded as Hyderabad Residency school. 1851—students admitted regularly. 1921—upgraded to graduate standard school section—abolished named changed to Osmania Medical College. 1927—affiliated to the Osmania University. 1951—M.B.B.S. Degree recognized by I.M.C. 1952—Administration handed	College of graduate standard.

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
6	1850	Madras Medical College	Madras	Government	English	Graduate ; Post-graduate Pharmacy earlier—Hospital Assistant & Apothecary, Sanitary Inspector.
7	1854	Medical School	Agra (U.P.)	Government	Vernacular to start with ; later English.	Undergraduate school
8	1860	King Edward Medical College.	Lahore (Punjab).	Government	English 1902—Urdu also used in lectures in the school section.	Graduate and Undergraduate.
9	1873	Campbell Medical School.	Calcutta (W. Bengal).	Government	Vernacular (Bengali) to start with. English after 1895.	Undergraduate school also Compounder's class under the state Medical Faculty of Bengal.

Qualification for admission	Course—Diploma! Degrees	Duration	Stages of Development	Present status
			over to Medical & Public Health Dept.	
Originally—Entrance Examination and F.A. standards. Now—I.Sc. standard with Chemistry, Physics & Biology.	Originally L.M.&S. 1874—M.B. & C.M. Present—M.B.B.S., M.D., M.S., D.L.O., D.G.O., T.D.D., B.S.Sc., L.P.H., S.I., Dip.L.P.A., B.Sc. (Pharmacy). D.V.	5 yrs : Now 5½. Earlier—3 yrs for Hospital Assistant & Anothecary course.	1850—Upgrade from the Madras Medical School. 1863—Affiliated to the Madras University. 1905—Sanitary Inspectors class introduced serve positions same as in Bengal. 1900-1—Five Sections : (1) College, (2) Apothecary, (3) Chemists and Druggist, (4) Hospital Assistant, (5) Sanitary Inspector. 1908—Hospital Assistant section transferred to medical school at Royapuram. 1914—B.S.Sc. class opened. 1925—L.M.&S. abolished.	College for graduate and post-graduate medical education (clinical and public health, pharmacy etc.
High school examination with Physics & Chemistry with competitive periodical test.	Military Medical Assistants, Hospital Assis- L.S.M.F., M.S.M.F.	3 yrs. 4 yrs.	1854—Students admitted on stipendary or indenture system. 1878—Civil Hospital Assis- class started. 1883—Women students admitted. 1913—Affiliated to U. P. State Board of Medical Examination. 1883—Women students admitted. 1913—Affiliated to U. P. State Board of Medical Examination. 1923—Women section completely separated. 1926—Affiliated to U. P. State Medical Faculty. 1939—Upgraded to college. 1947—School section completely abolished.	1947—abolished.
High School Exam. and later First Arts and now I.Sc. with Physics, Chemistry & Biology.	Present—M.B.B.S., M.D., M.S., D.L.O., B.D.S., D.M.R.E., D.O., D.T.D., M.Sc. (Physiology).	4 yrs. school section 5½ yrs.	1860—College & School sections run simultaneously. 1902—English Text book introduced 1910—College named as King Edward Memorial College. 1920—School section transferred to Amritsar. 1930—D.L.O. introduced.	Now in West Pakistan.
Under Matric. for Vernacular class 1895-6 Entrance Exam. for the English course. 1910—Matric. later Matric and I.Sc.	V.L.M.S. (Vernacular). L.M.P. (mixed Vernacular or English). 1916—L.M.F. (English).	3 yrs. 4 yrs.	1875—Opened by Lt. Governor Sir John Campbell. 1895—Course extended to 4 years. 1885—Women students admitted. 1914—Affiliated to the State Medical Faculty of Bengal. 1948—Upgraded to College standard.	1954—School section abolished.

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
10	1874	Dacca Medical School.	Dacca (East Pakistan).	Government	Vernacular mixed vernacular English after 1896.	Do.
11	1874	Temple Medical School.	Patna (Bihar).	Government	Vernacular (Hindi) to start with, now English.	Undergraduate School.
12	1875	Orissa Medical School.	Cuttack (Orissa).	Government	Mixed Vernacular later English.	Undergraduate school also Compounders training course.
13	1878	King Edward Hospital Medical School	Indore	Native State (Holkar II of Indore).	English	Undergraduate school and Compounders' class.
14	1878	Byaramjee Jeejibhoy Medical School.	Poona	Government ; originally started by the donation of Shri Byaramjee Jeejibhoy.	English	Undergraduate school.
15	1879	Byaramjee Jeejibhoy Medical School.	Ahmedabad	Government ; originally started by the donation of Shri Byaramjee Jeejibhoy.	English	Do.
16	1881	Medical School	Hyderabad, Sind.	Government ; originally managed by local fund ; taken over by Govt. in 1928.	English	Do.

Qualification for admission	Course—Diploma! Degrees	Duration	Stages of Development	Present status
Originally—Vernacular Middle Exam. 1895-95—English Middle Exam. 1905-6—Matric. 1910—Matric. and later Matric. & I.Sc.	V.L.M.S. 1895-6—L.M.P. 1916—L.M.F.	3 yrs. 4 yrs.	1895-6—4 years course introduced.	Now in East Pakistan.
Originally middle English and under Matric. later Matric. Exam.	L.M.P.	3 yrs. later 4 yrs.	1916—Affiliated to Bihar and Orissa Medical Examination Board. 1925—Upgraded to college and School section transformed to Laheria-Sarai, Darbhanga.	1925—abolished.
Do.	L.M.P.	Do.	1916-17—Affiliated to Bihar and Orissa Medical Examination Board. 1940—Upgraded to college.	1947—School course abolished.
At the initial stage—under Matric., later Matric. or equivalent exam. & preference to I.Sc. Also an Entrance Exam. is held.	Originally Diploma of Hospital later Sub-assistant surgeon. Lately L.M.P., L.M.F, & L.C.P. & S.	Do.	1878—Started by Dr. Beaumont for training Medical personnel for the Holker State. Later extended to other Princely States of Central India. Women candidates were also admitted. The institution was affiliated to the three examining bodies : (1) C. P. Medical Board, (2) State Medical Faculty of Bengal and (3) College of Physician & Surgeon, Bombay. 1927—Upgraded to college standard.	1951—School Course abolished.
Under Matric. later Matric. 1937—I.Sc. with Chemistry, Physics and Biology.	Originally—Diploma of Hospital Assistant later Sub-assistant Surgeon. 1916—L.C.P. & S. (Bombay). 1943—L.M.P.	Originally 3 years. 1906—4 yrs. 1906—3½ yrs.	1906—the course was extended to 4½ yrs. 1916—Affiliated to the College of Physicians and Surgeons, Bombay. 1943—Affiliated to the State Medical Faculty, Bombay. 1946—Upgraded to College standard.	1946—School Course abolished.
Do.	Originally—Diploma of Hospital Assistant. Later Sub-assistant 1917—L.C.P. & S. 1943—L.M.P.	Originally 3 years. 1906—3½ yrs.	1917—Affiliated to the College of Physicians and Surgeons, Bombay. 1946—Upgraded to College standard.	1946—School abolished.
Middle English School Exam. for Hospital Assistant tant Matric. for tant Surgeons. 1937—I.Sc. with Physics, Chemistry and Biology.	Originally—Diploma of Hostal Asstt. later Assistant Surgeon. 1917—L.C.P. & S.	Originally 3 years. 1917—4 yrs. for Hospi-Asstt. 5 yrs. for Assistant Surgeons.	1897-1902—Female section existed as a part of the school.	Now in West Pakistan.

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
17	1886	Calcutta School of Medicine (R. G. Kar Medical College).	Calcutta (W. Bengal).	Private ; First institution entirely by Voluntary donation.	Originally Vernacular later mixed Vernacular and English.	Undergraduate
18	1887	Board Medical School.	Nellore (Andhra).	Private	..	Do.
19	1887	Medical School	Taniore (Madras).	Municipality	..	Do
20	1894	Women's Christian Medical College.	Ludhiana (Punjab).	Missionary	English	Undergraduate school. Arrangements exist for training of nurses, midwives, dais and lady compounders.
21	1895	College of Physicians and Surgeons of Bengal.	Calcutta (Bengal)	Private	English	? Graduate
22	1900	Berry White Medical School.	Dibrugarh (Assam).	Government	English	Undergraduate school also compounders' and dai training class.
23	1900	Christian Medcal School.	Miraj (Bombay).	Missionary	English	Undergraduate school.
24	1903	Stanley Medical School (Old name—Quxiliary Medical School, Royapuram).	Madras	Government	English	Do.

Qualification for admission	Course—Diploma! Degrees	Duration	Stages of Development	Present status
Originally Under-Matric. later Matric. for 4 yrs. course.	L.C.P. & S.	Originally 3 yrs. later 4 yrs.	1886—Started as Calcutta School of Medicine. 1887—renamed as Calcutta Medical School. 1903—amalgamated with College of Physicians and Surgeons of Bengal. 1916—Upgraded to College standard.	1916—under-graduate course abolished.
Under Matric.	Hospital Assistant ?	3 years	1902—Closed	Abolished.
Originally under Matric. later Matric.	Do.	Do.	1906—Taken over by Government. 1912—Name changed to Prince of Wales Medical School. 1933—School closed.	Abolished.
Matric. with Mathematics. Later I.Sc. or F.Sc. (admitted first on 3 months' probation).	L.S.M.F. (State (Medical Faculty of Punjab).	4 yrs.	1894—Founded by Dr. Edith Brown. 1915—Training for sub-assistant surgeon. 1930—State-aided. 1953—Upgraded to college standard.	1953—School course abolished.
Entrance Exam.	..	5 years	1903—Amalgamated with Calcutta School of Medicine later designated as R. G. Kar Medical College	1903—abolished
Entrance Exam. and later Matric.	L.M.P. (Assam Med. Ex. Board)	4 years	1900—Founded by John Berry White, Tea garden doctor (who donated Rs. 50,000) for training of Medical personnel for tea gardens. 1937—2 seats reserved for women. 1948—Upgraded to College standard.	1948—School course abolished.
Under-Matric. with Entrance Exam. later Matric.	L.C.P. & S.	Originally 3 yrs. 1904—4 yrs. 1935—5 yrs.	1900—Established by Sir William Wanless. 1915—Affiliated to the College of Physician & Surgeons, Bombay. Admission—preference to candidates supported by Missions, Native States and private institutions.	Last student in L.C.P.&S. course completed in 1955. Attempts are going on to upgrade it to college standard.
Originally Under-Matric. later Matric. and still later preference to I.Sc. and graduates.	Originally— Hospital Assistant. 1913—L.M.P. (Under Board of Examinations, Madras).	..	1882—Established as auxiliary to Madras Medical College. 1887—Closed down. 1903—School reorganised. 1920—Women students admission referred to Vellore. 1933—renamed after Sir George Fredrick Stanley—Governor of Madras. 1938—Upgraded to college standard.	1938—School course abolished.

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
25	1911	King George's Medical College.	Lucknow	University of Lucknow.	English	Graduate & Post-graduate.
26	1913	College of Physicians and Surgeons.	Bombay	Government control.	English	Both under graduate school and graduate college standards.
27	1914	Robertson Medical School.	Nagpur (Madhya Pradesh).	Government	English	Undergraduate school.
28	1816	Lady Hardinge Medical College for Women only.	Delhi	Government managed through a governing body and Countess of Dufferin Fund.	English	Graduate
29	1916	R. G. Kar Medical College (Old name—Belgachia or Carmichael Medical College).	Calcutta (W. Bengal).	Private ; First institution entirely by private donation of Rs. 20 lakhs, besides Rs. 67,500 from Corporation. Now gets recurrent grant from Govt., Corporation & the University.	English	Graduate

Qualification for admission	Course—Diploma/ Degrees	Duration	Stages of Development	Present status
I.Sc. with Physics, Chemistry & Biology. Admission by competitive exam. ; women students admitted.	M.B.B.S., M.D., M.S., D.P.H. (now abolished) D.M.R.E., D.G.O., D.L.O., D.T.D.,D.C.P. D.O.M.S., B.D.S., D.orth.S.,	6 yrs. Now 5½ yrs. 5½ yrs.	1906—Foundation laid by King George V, the then Prince of Wales. Opened and through the efforts of Sir Tasadduq Rosool Khan and citizens of Lucknow. 1911—Named as King George's Medical College— Affiliated to the Allahabad University. 1921—Affiliated to the Lucknow University. 1928—Provincial Hygiene Laboratory established for D.P.H., L.P.H., Sanitary Inspector and Lady Health Visitors course.	College for Graduate and Post-graduate studies in Medicine and Public Health.
Matric. for Undergraduate and I.Sc. for graduate course.	L.C.P.S., M.C.P. & S., F.C.P. & S., Condensed course for L.M.P.'s.	4½ yrs. academic and 1 year internship and 3 months public Health work under rural M.O.H.	1913—Established on the model of Royal College of Physi and Surgeons of England. 1914—Upgraded to M.B.B.S. standard and recognised by the I.M.C. College appoints a Board of Examiners.	Institutions affiliated for the diploma are—(1) G. S. Medical college, (2) Grant Medical College, (3) T. N. Medical College, (4) B. J. Medical College, Poona and (5) B. J. Medi-College, Ahmedabad.
Matric. and I.Sc. Competitive Exam. for boys except graduates and State candidates and Test Exam. for women by D.P.I.	L.M.P.	4 years	Affiliated to the Madhya Pradesh Examination Board.	Still running ?
I.Sc. ; 7 posts reserved for the Punjab and 3 for Bihar in lieu of annual grant of Rs. 10,500 and Rs. 4,500 respectively.	M.B.B.S.	5½ yrs.	1916—Founded to commemorate Queen Mary's visit in 1911. Named after Lady Hardinge who raised a dona- Rs. 30 lakhs in accordance with the wish of H. M. Mary. 1917—Opened by Lord Hardinge.	Running as a graduate college; affiliated to the Delhi University.
I.Sc. with Physics, Chemistry and Biology.	M.B.B.S., M.D., M.S., M.O., D.G.O., D.O.M.S.	1916—6 yrs. Now 5½ yrs.	1916—Upgraded from the Calcutta School of Medicine and named as Belgachia Medical College. 1917—Affiliated to the Calcutta University. 1919—Renamed as Carmichael Medical College, Belgachia. 1948—Renamed as R. G. Kar Medical College after the name of the Founder.	College for graduate and Post-graduate Medical studies.

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
30	1917	Medical School	Bangalore	Native State (managed by the Mysore Medical Department).	English	Undergraduate school.
31	1918	Medical School	Madras	Government	English	Do.
32	1918	Missionary Medical School for Women.	Vellore (Madras).	Missionary & Govt. grants.	English	Undergraduate school.
33	1920	Medical School	Amritasar (Punjab).	Government	Urdu, 1915—English.	Undergraduate school.
34	1921	Topiwala National Medical College.	Bombay	Private	Originally Vernacular later English.	School with Ayurvedic and Unani Departments.
35	1921	National Medical Institute (alies Jutiya Ayurvejnam Vidyalaya).	Calcutta (W. Bengal).	Private ; also receives Govt. and Municipal grants.	English	School standard
36	1922	Bankura Sammilani Medical School.	Bankura (W. Bengal).	Private	Do.	Do.
37	1922	Bonaldshay Medical School.	Burdwan (W. Bengal).	Government	Do.	Do.

Qualification for admission	Course—Diploma! Degrees	Duration	Stages of Development	Present status
S.S.L.C.	L.M.P.	4 yrs.	1924—A medical college was inaugurated by the University of Mysore and run for 10 years as combined institution. 1930—College section transferred to Mysore. 1955—Upgraded into the college standard.	1955—School section abolished.
Do.	Do.	Do.	1886-87—A school under Madura Board—Closed. 1918—School re-established.	1928—Closed.
S.S.L.C. with good marks in English and Science, also I.Sc. some seats I.Sc., some seats Travancore State.	L.M.P. (Under the the Board of Examination, Madras). Madras).	4 yrs.	1900—Missionary Medical work was started. 1914—A committee was formed to open a Medical School for women in South India. Money raised by Mrs. Peabody. 1918—Lord Pentland declared the School open. 1942—Upgraded to the college standard for both men and women.	1942—School course abolished.
Under Matric. 1915—Matric. or F.Sc. 1938—F.Sc.	Upto 1918—M.P.L. Diploma. 1918—L.S.M.F. 1938—L.M.S. Dispensary and Dresser's course, Nursing probationers course.	Originally 3 years. 1915—4 yrs.	1864—Started as Hindusthan Course in the Lahore Medical College. 1915—Urdu class stopped. 1920—School transferred to Amritasar. 1933—Co-education started. 1943—Upgraded to college standard.	1943—School Course closed.
Originally Matric. 1937—I.Sc. 10 seats reserved for women.	L.C.P. & S.	4 years	1924—Ayurvedic and Unani Department affiliated to Tilak Maharastra Vidya Pith abolished. 1927—Affiliated to college of Physicians and Surgeons, Bombay, and new building open by Sir Leslic Wilson. 1948—Upgraded to College standard.	1948—School Course abolished.
Matric	L.M.F- (State Medical Faculty of Bengal)	5 years at the start later 4 years.	1921—Originally started as a College with 5 years course. 1927—Affiliated to the State Medical Faculty of Bengal, 1948—Amalgamated with the Calcutta Medical Institute and upgraded to a college.	1941—School Course Affiliated.
Matric. also I.Sc.	Do.	4 yrs.	Affiliated to the State Medical Faculty of Bengal.	1952—abolished.
Matric. also I.Sc., territorial selection.	Do.	4 years	1920—Founded by Lord Ronaldshay, Governor of Bengal. 1927—Affiliated to the State Medical Faculty of Bengal. 1952—Opened for Nurse training.	1955—abolished.

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
38	1922	School of Tropical Medicine.	Calcutta (W. Bengal).	Government ; managed through a Governing Body and financed by the Govt. of W. Bengal and Endowment Funds.	Do.	Postgraduate ; famous for researches on Tropical diseases.
39	1923	Women's Medical School.	Agra (U.P.)	Government ; also supported by Dufferin Fund.	Do.	School
40	1923	Calcutta Medical School.	Calcutta (W. Bengal).	Private ; managed by an Registered Society.	English	School
41	1923	Lady Willingdon Medical School for.	Madras	Government	English	Do.
42	1924	Lytton Medical School for men only.	Mymensingh (East Pakistan).	Government	English	Do.
43	1924	University Medical College.	Mysore	Native Sate ; Now University.	English	Graduate
44	(?) 1924	Medical School	Coimbatore	Government	English	School
45	1925	Darbhanga Medical School.	Laheria-Sarai.	Government	English	School

Qualification for admission	Course—Diploma/ Degrees	Duration	Stages of Development	Present status
After M.B.B.S., M.M.F., L.M.F. and L.T.M.	D.T.M., L.T.M. and Now D.T.M. & H. Courses.	3 months for L.T.M. 6 months for D.T.M. (abolished). 9 months for D.T.M. & H. (Cal. U.).	1916—Hospital for Tropical Diseases established through the efforts of Sir Leonard Rogers and Sir Kailash Chandra Bose. 1920—First D.T.M. Class opened and affiliated to the Faculty of Tropical Medicine and Hygiene. 1922—School officially opened by Lord Ronaldshay. 1922—Outdoor section opened. 1949—Management transferred to the Governing Body with the D.G.H.S. as Chairman.	
Matric.	L.S.M.F. (U.P. State Medical Faculty).	4 years	1883—Women students admitted in Agra Medical School. 1928—Women Medical School and Hospital completely separated from the Agra Medical School.	1947—School abolished conduction organised in the Agra Sorojini Naidu Medical College.
Matric. & I.Sc.	LM.F. (State Medical Faculty of Bengal).	4 years	1923—Founded by Late Dr. K. S. Mallick. 1924—Affiliated to the State Medical Faculty of Bengal. 1948—Amalgamated with the National Medical Institute and Upgraded to a college.	1948—School Course abolished.
Matric.	L.M.P. (Board of Examiners, Madras).	4 years	1923—Opened by Lady Willingdon in the Victoria Building—Egmore. 1933—School removed to Laxmi Villa.	1938—Abolished.
Matric. & I.Sc. 25% reserved for muslims.	L.M.P. (State Medical Faculty of Bengal.	4 years	1920—Medical School Foundation Committee formed. 1921—Government approved the scheme. 1924—School opened.	1947—Fallen in East Pakistan.
I.Sc.	M.B.B.S. T.D.D., M.Sc. (Bischem)	5 years	1924—First opened at Bangalore in 1924. Affiliated to the Mysore University. 1930—College transferred to Mysore.	Graduate College.
Matric.	L.M.P. (Board of Examiners),	4 years	1924—Mentioned in Government Records.	1930?—Abolished.
2nd Division Matric. of Patna University and 1st Division of other Universities.	L.M.P. (Bihar & Orissa Medical Examiners Board).	4 years	1925—The Temple Medical School of Patna was upgraded through the donation of Late Maharajadhiraj of Darbhanga and the School section was transferred to Laheria-Sarai (Darbhanga).	1946—School courses abolished.

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
46	1925	Prince of Wales Medical College.	Patna (Bihar).	Government	English	Graduate
47	1925	Set Gordhan Das Medical College.	Bombay	Private & Municipal Corporation.	English	Graduate
48	1927	Osmania Medical College.	Hyderabad (Deccan).	Native State ; later Govt.	Urdu since 1927 1952—English.	Graduate
49	1930	Chittagang Medical School.	Chittagong (East Pakistan).	Government	English	School
50	1930	Jackson Medical School.	Jalpaiguri (W. Bengal).	Government	English	School
51	1932	All-India Institute of Hygiene & Public Health.	Calcutta (W. Bengal).	Government ; Buildings & equipments by the Rocekfeller Foundation of New York.	English	Postgraduate teaching and research Institute.
52	1934	Ludhiana Medical School (for men (also called Arya Medical School.	Ludhiana (Punjab).	Private	English	School

Qualification for admission	Course—Diploma! Degrees	Duration	Stages of Development	Present status
I.Sc. with Physics, Chemistry & Biology, seats reserved for different communities and for Nepal State.	M.B.B.S., M.D., M.S., Ph.D.	Originally 6 years. Now 5½ yrs.	1912—Bihar & Orissa made into a new province. 1920—Maharajadhiraj of Darbhanga offered 5 lacs and the public raised 9¼ lacs to convert the Temple Medical School into a College. 1925—College established and named as Prince of Wales M.C. to commemorate his visit to India in 1921.	Affiliated to the Patna University. for both graduate and post graduate studies.
I.Sc. with Physics, Chemistry & Biology. 60 students taken from the Bombay subur, 5 reserved for city & suburbs, 5 for C. P. Govt. No. seats reserved for women.	M.B.B.S., M.D., M.S., Ph.D., D.O., L.C.P.S., M.C.P.S., F.C.P.S.	Formerly 6 years. Now 5½ yrs.	The institute owes its origin to the endowment of 15½ lakhs rupees by Seth Gordhondas Sundardas. 1925—Affiliated to the Bombay University.	Offers both graduate and Post-graduate Medical studies.
Inter. Science	Previously L.M.&S., L.M.P. 1927—M.B.B.S.	5 years.x	1927—Affiliated to the Osmania University. 1951—Recognised by the I.M.C. 1952—Administration handed over to the Medical and Public Health Department.	Graduate College.
Matric. & I.Sc. Preference to candidates from the Chittagang Division & depressed class.	L.M.F.	4 years	Affiliated to the State Medical Faculty of Bengal. 1947—Fallen in East Pakistan.	Now in East Pakistan.
Matric. & I.Sc.	L.M.F. & L.Pharm.	4 years	Affiliated to the State Medical Faculty of Bengal. Training of Pharmacist.	1947—School Course abolished but now utilised for Pharmacy.
Graduate degree in Medicine, Engineering, Nursing, Science etc. for Post-graduate courses, Undergraduate qualification for certificate	D.Sc., D.Phil., D.P.H., L.P.H., D.M.C.W., D.M.C.H., D.C.H., D.I.H., C.P.H., C.P.H.N., M.E.(PH), D.H., D.D., Certificate for Lab. Technician, Health Education, Statistics, M.&C.W., Nutrition Statistics etc.	Usually 1 year for diploma courses and 6 months or 3 months for certificate	Fouhded as a joint enterprise of the Rockefeller Foundation and Government of India through the efforts of Dr. Carter of Rockefeller Foundation and General J. D.Graham of the Govt. of India.	The Institute has now become an international centre for the training of Matenal and Child Health personnel for the South East Asiatic countries.
Matric. with Science or F.Sc.	L.S.M.F. (Punjab State Medical Faculty).	4 years	1934—Founded at the initaitive of Late Dr. D. B. Soni. 1935—Affiliated the Punjab Medical Faculty.	1947—Abolished.

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
53	1936	Gajra Raja Medical College.	Gwalior (Madhya Bharat).	Native State ; Later Government.	English	Graduate
54	1938	Stanley Medical College.	Royapuram (Madras).	Government	English	Graduate
55	1939	Sorojini Naidu Medical College.	Agra (U.P.)	Government	English	Graduate
56	1942	Christian Medical College.	Vellore (Madras).	Missionary (aided by Govt.).	Do.	Do.
57	1943	Medical College	Amritsar (Punjab).	Government	Do.	Do.
58	1944	Sriram Chandra Bhanj Medical College.	Calcutta (Orissa).	Government	Do.	Do.
59	1946	B. J. Medical College.	Poona (Bombay).	Government	Do.	Do.
60	1946	B. J. Medical College.	Ahmedabad (Bombay).	Government	Do.	Do.
61	1946	Darbhanga Medical College.	Lahiria-Sarai (Bihar).	Government	Do.	Do.

Qualification for admission	Course—Diploma/ Degrees	Duration	Stages of Development	Present status
I.Sc. with Physics, Chemistry & Biology.	M.B.B.S., M.P., M.S.	5½ years	1936—Opened in Memory of the Late Mother of Highness Gajra Raja of Seindhia to to provide medical education to the students of the old Gwalior State. 1948—New Building opened. Affiliated to the Agra University and recognised by the I.M.C. & B.M.C.	Facilities available for graduate and Post-graduate studies.
Do.	M.B.B.S., M.D., M.S., Dip.Pharmacy. M.Sc. (Anat.) Ph.D. (Anat.)	5½ years	1939—Upgraded from the School. Affiliated to the Madras University.	Do.
I.Sc. with Physics, Chemistry & Biology.	M.B.B.S., M.D., M.S. etc.	5½ yrs.	1939—Upgraded from Agra Medical School. Affiliated to the Agra University. 1948—Recognised by I.M.C. & B.M.C. with retrospective effect. 1949—Renamed as Sarojini Naidu Medical College after the famous Indian Woman patriot Late Sarojini Naidu, Governor of Uttar Pradesh.	Facilities available for graduate and Post-graduate studies.
Do.	M.B.B.S., B.Sc., Nursing Course. Dip. Thoracic Surgery	5½ yrs. 4 yrs.	Upgraded from the Missionary Medical School for women, Vellore and opened for both men and women—affiliated to the Madras University.	Graduate College.
F.Sc. (Medical, 4 seats reserved for Pepsu, 3 for Jammu & Kashmir, 13 for women, one for outside Indian National & 3 for centrally administered areas.	M.B.B.S., D.O.M.S., D.T.D., Diploma in Pharmacy, Bachelor in Pharmacy.	5½ yrs.	Upgraded from the Medical School, Amritsar, affiliated to the Indian Punjab University.	College for graduate and Post-graduate studies.
I.Sc. (Medical)	M.B.B.S.	5½ yrs.	Upgraded from the Orissa Medical School. Affiliated to the Utkal University.	Graduate College.
Do.	M.B.B.S.	5½ yrs.	Upgraded from the B. J. Medical School ,Poona. 1949—Affiliated to the Poona University (Maharastra).	Graduate college.
Do.	M.B.B.S.	5½ yrs.	Upgraded from the B.J. Medical School, Ahmedabad. 1953—Affiliated to the Gujrat University.	Graduate college.
Do.	M.B.B.S., M.D., M.S.	5½ yrs.	Upgraded from the Darbhanga Medical School. Affiliated to the Bihar University.	College for graduate and Post-graduate studies.

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
62	1946	Guntur Medical College.	Government (Andhra).	English	English	Graduate
63	1946	Topiwala National Medical College.	Bombay	Government	English	Graduate, condensed course.
64	1946	Swai Mansingh Medical College.	Jaipur (Rajasthan).	Government	Do.	Do.
65	1947	Lake Medical College.	Calcutta (W. Bengal).	Government	English	Graduate, Condensed Course.
66	1947	Medical College & Hospital.	Nagpur (Madhya Pradesh).	Government	English	Graduate
67	1947	Assam Medical College.	Dibrugarh (Assam).	Government	English	Graduate
68	1948	Nilratan Sircar Medical College.	Calcutta (W. Bengal).	Government	English	Graduate
69	1948	Calcutta National Medical Institute.	Calcutta (W. Bengal).	Government	English	Graduate

Qualification for admission	Course—Diploma/ Degrees	Duration	Stages of Development	Present status
I.Sc. (Medical)	M.B.B.S.	5½ yrs.	Originally founded in 1930 but functioned (?) for a few years only. Re-established in 1946 as college Affiliated to the Andhra University, Visekhapatnam.	Graduate College.
Do.	M.B.B.S.	5½ yrs.	Upgraded from the Topiwala National Medical School. Affiliated to the Bombay University.	Graduate college.
Do.	M.B.B.S. M.B.,M.S., M.Sc. (Medical) in Anatomy, Physiology and Pharmacology	5½ yrs.	1946—Foundation laid by Lord Wavell, the then Viceroy of India. Affiliated to the Rajputana University.	College for Graduate and Post-graduate studies
Under-graduate School Diploma.	M.B.B.S.	2 years.x Under the Calcutta Un. Regulation, Chapter XLVI-B.	Opened particularly for the training of the Ex-school passed doctors under the Calcutta University.	1953—Abolished.
I.Sc. (Medical)	M.B.B.S. also training of auxiliary Health Services.	Before 1953 5 yrs. After 1953 5½ yrs.	1943—Committee set up for establishment of the college. 1947—Planned and built under the supervision of the Late Col. Ambuj Bose covering 189 acres, the largest camp in India affiliated to the Nagpur University. 1953—Recognized by the I.M.C.	Graduate college.
I.Sc. (Medical)	M.B.B.S.	5½ yrs.	Upgraded from the Dibrugarh Medical School. Affiliated to the Gauhati University, Assam. Residential College 1952—Recognized by the I.M.C.	Graduate College.
I.Sc. (Medical)	M.B.B.S., M.D., M.S., M.O., D.G.O. etc.	5½ yrs.	Upgraded from the Campbell Medical School. Affiliated to the Calcutta University.	College for Graduate and Post-graduate studies.
I.Sc. (Medical)	M.B.B.S.	5½ yrs.	Jatiya Ayurvijnan Parishad or National Medical Institute was amalgamated with the Calcutta Medical School and upgraded to the graduate standard. Affiliated to the Calcutta University.	Graduate College.

Ser. No.	Year founded	Name of the Institution	Location	Financed by Govt./ Private/Missionary/ Municipality	Medium of instruction	Standard
70	1949	Medical College	Baroda (Bombay).	Government	English	Graduate
71	1951	Government Medical College.	Trivandum	Government	English	Graduate
72	1951	Mahatma Gandhi Medical College.	Indore	Government	English	Graduate
73	1953	Kasturba Medical College.	Manipal (South India.	Private Academy based on membership.	English	Graduate
74	1953	Government Medical College.	Patiala (Pepsu).	Government	English	Graduate
75	1954	Medical College	Madura (Madras).	Government	English	Graduate
76	1955	Bangalore Medical College.	Bangalore (Mysore).	Private : organised by the Mysore Medical Education Society, Balapet, Bangalore.	English	Graduate
77	1955	Medical College	Bhopal (M.B.)	Government	English	Graduate
78	1956	All-India Institute of Medical Sciences.	Delhi	Government (through a Governing Body).	English	Graduate
79	1956	All-India Institute of Mental Health.	Bangalore	Government	English	Postgraduate
80	1956	Institute of Child Health	Calcutta	Private	English	Postgraduate
81	1956	Bankura Sammilani Medical College	Bankura (W. Bengal)	Private	English	Graduate

Qualification for admission	Course—Diploma/ Degrees	Duration	Stages of Development	Present status
I.Sc. (Medical)	M.B.B.S.	5½ yrs.	Affiliated to M. S. University of Baroda.	Graduate College.
I.Sc. (Medical) (eligibility test for admission ; students of the State are bound by an agreement to serve the state for 3 years.	M.B.B.S. also Health Inspectors' Course.	4½ yrs.	Affiliated to the Travancore University.	Graduate College.
I.Sc. (Medical)	M.B.B.S.	5½ yrs.	Upgraded for the King Edward Hospital Medical School, Indore. Affiliated to the Agra University.	Graduate College.
I.Sc. (Medical) some seats are reserved for children of doctors & for the students of the Karnatak University.	M.B.B.S.	4½ yrs.	Members can reserve seats on payment of donation Rs. 3,750. Clinical course is given as Mangalore. Affiliated to the Karnatak University.	Graduate College.
F.Sc. (Medical group).	M.B.B.S.	5½ yrs.	Affiliated to the Punjab University.	Graduate College.
I.Sc. (Medical)	M.B.B.S.	5½ years	Affiliated to the Madras University and attached to the Erskin Hospital with 665 beds.	Graduate College.
I.Sc. (Medical)	M.B.B.S.	5½ yrs.	Upgraded from the Bangalore Medical School. Affiliated to the University of Mysore.	Graduate College.
I.Sc. (Medical)	M.B.B.S	5½ yrs.	1955—Classes opened	Graduate College.
I.Sc. (Medical)	M.B.B.S.	?	Sponsored by the International aid.	College for both Graduate and Post-graduate studies.
M.B.B.S.	D.P.M. D.M.P.	?	The Course will start from January, 1957	Post-graduate studies.
M.B.B.S.	D.C.H.	1yr.	1956 July—Course started	Post-graduate College
I.Sc. (Medical)	M.B.B.S.	5½ y.s.	1956 July—Revived as College (Served as a School from 1922—1952)	Graduate College

N.B.—Besides above provision for post-graduate studies have been made at the Indian cancer research centre, Bombay, at the Patel Chest Institute, Delhi at the Chittaranjan Seva Sadan and S. S. K. M. Hospitals, Calcutta.

ORIGIN, PROGRESS AND INTERPRETATION OF SERODIAGNOSTIC TESTS FOR SYPHILIS

R. V. RAJAM, M.S., F.R.C.S.
Director and Professor of Venereal Diseases
and
C. W. CHACKO, M.B.B.S., D.T.M., PH.D. (LOND)
Serologist and Associate Professor of Serology,
Institute of Venereology, Government
General Hospital, Madras

The year 1956 in which the first number of the Indian Public Health Journal is to be published coincides happily with the 50th year of the discovery of a serological test for the diagnosis and control of syphilis, the ancient scourge of "homo-sapiens". When the editor of the journal requested the senior author (R.V.R.) to contribute a paper to the first number of the journal, the authors of this paper thought that a contribution on the origin, progress and interpretation of serological tests in Syphilis will be an appropriate one, not only to pay homage to the discoverers on the 50th anniversary of their discovery but also to bring home to the readers of the journal, the great part serology has played in the diagnosis, progress, epidemiology and control of syphilis. The discovery of the organismal cause of syphilis by Schaudin and Hoffmann in 1905, the application of the complement fixtion test in the diagnosis of syphilis in 1906 by Wassermann, Neisser and Bruck and the synthesis of organic arsenical (Salvarsan) by Ehrlich in 1909, constitute the famous triad of discoveries in such rapid succession in a particular disease without parallel in the history of medicine. Although the credit for the discovery of the phenomenon of complement fixation reaction on the blood serum should go to Bordet and Gengou (1901) it was Wassermann, Neisser and Bruck who applied the test in the diagnosis of syphilis in 1906 and since then, the test has been known by the name of the first of the three scientists.

Syphilis is an exquisite example of chronicity in disease with periods of clinical activity alternating with shorter or longer or even life long latency during which the infection may remain submerged like an iceberg below the threshold of clinical recognition. But for sero-diagnosis, vast fields of syphilis, the latent, the osseous, the ocular and the visceral types would have gone unrecognised. There is no branch of medicine where the Wassermann reaction did not explain some obscure and disputed problems. The asymptomatic syphilis of women, especially during the reproductive period of their lives could only be uncovered by a serological test. For the prevention of congenital syphilis, most of the civilized countries of the West have laws making routine serological screening of all pregnant women obligatory. Besides, in industry, in the army, in insurance, in marriage, pre-marital and pre-employment blood tests for syphilis have been made compulsory in many countries. Thus it may be seen that the original Wassermann test for syphilis with the subsequent modifications and improvements is an epoch-making event in the onward march of 20th century medicine.

BLOOD TESTS FOR SYPHILIS

Complement Fixation Tests for Syphilis :

Wassermann and his associates first reported their complement fixation test for syphilis on May 10, 1906, from Berlin. The original Wassermann reaction (W.R.) for syphilis was later supplanted by technically improved and modified complement fixation methods in different countries, the better known of which are Harrison and Wyler's modification of W.R. (1918) in use in Commonwealth countries and Kolmer W.R. (1922) in the U.S.A. in the diagnosis of syphilis.

Precipitation Tests for Syphilis :

Since complement fixation technique of serological tests involved the use of several reagents and their standardization making it rather cumbersome, simpler precipitation or flocculation techniques were soon devised. They involved only two reagents namely, the antigen and the antibody which reacted and precipitated when favourable technical conditions were provided. Micheles in 1907

was the first to carry out precipitation studies in syphilitic sera and Meinicke reaction (1917) was the first practical precipitation test devised in Europe. Since then many modifications and improvement in the precipitation techniques has been reported by many author serologists including Eagle, Mazzini, Hinton and Price. The most familiar of these precipitation methods is the "Kahn Standard Test for Syphilis" (1922). The precipitation tests were in the beginning performed in test tubes and results were read with the naked eye. This was soon followed by slide precipitation methods in which minute volumes of the antigen and serum were mixed in shallow wells on the slides and the precipitates were read microscopically. The slide precipitation tests have the merit of quickness of performance, cheapness and the ease with which result can be read. Kline (1930) was the first to popularise the slide test in the United States of America.

There are many a standard test for syphilis of either of complement fixing or precipitating type, one or another preferred by a particular country. Although each author serologist claims some special virtue for his test, that sets it apart from others, all are based on identical physico-chemical or immunologic phenomenon differing only in minor technical details. In fact the numerous number of STS is evidence of some inherent fault in these tests.

Antigen in Standard Tests for Syphilis :

Serodiagnostic tests in all diseases of microbial origin are based on in-vitro, antigen antibody reaction of either complement fixing or precipitating and agglutinating nature. The antigen is usually derived directly from the particular etiological agent and it reacts with a specific antibody in the serum under diagnostic test. The antigen in use in standard serologic tests for syphilis (STS) is unique, in that they are not derived from virulent *T. pallidum,* the etiological organism in syphilis. They are tissue extracts, lipoidal in nature, of animals or other species usually of ox-heart origin, so selected for convenience. When Wassermann first applied his serodiagnostic complement fixation test for syphilis he used a tissue extract of liver of synphilitic foetus as the antigen, for want of methods available to grow virulent *T. pallidum* in artificial culture medium. He believed then that he was extracting a specific antigen from *T. pallidum* infecting in numbers the syphilitic liver, to pick up the specific antibody of syphilis. It was later proved that a similarly reacting lipoidal extract could be obtained from normal human liver or from any animal, fish or plant tissue and used in serological test for syphilis with comparable sensitive and specific results. Therefore, the antigen was non-specific in the usual immunologic sense. Although the result of the tests gave useful correspondence between clinical and serological findings in syphilis the incidence of false positive reactions was evident from the very beginning.

Antibody in Standard Test for Syphilis :

When man is infected with syphilis it is probable at least two and possibly more antibodies are elaborated and appear in his serum. The antibody detected by Wassermann in the complement fixation test is obviously one of these antibodies in syphilitic serum and on it is based all the standard test for syphilis. The want of a specific antigen in sufficient strength derived directly from pathogenic *T. pallidum* grown in artificial culture medium, compelled the serologist from the days of Wassermann to resort to tissue extract lipoidal antigen which logically reacted with an anti-lipoidal antibody in complement fixation and precipitation tests. This antibody is produced invariably in syphilitic patients serum but it is quite possible that the same or similar antibody could be produced to some extent in infections other than syphilis, the antigenic stimulus being the "lipoid" present universally in tissues in nature, as well as in microorganisms. This antibody is therefore nonspecific with reference to syphilis and is referred to as Wassermann antibody or reagain. In the STS the non-specific antigen detects Wassermann antibody in other infections causing the socalled biological false positive (BFP) reaction for syphilis. It is possible that this ubiquitous antibody is produced even in normal healthy persons, as an auto-antibody to lipoidal antigenic substances produced as a result of normal tissue wear and tear. Usually the amount is too low in normal persons to be detected by the STS which is set to a certain level of sensitivity with reference to infection with syphilis but may be increased in amount by the increased lipoid antigenic stimulus in many infections with no etiological relationship to syphilis, causing BFP reactions.

The incidence BFP reactions for syphilis was apparent from the beginning but it has been recognized increasingly in recent years, as a result of widespread serologic testing in prenatal syphilis and other mass serological screening of populations. They occur at varying intervals and frequencies in apparently healthy individuals as well as in patients affected with diseases like Leprosy, Malaria, Tropical Eosinophilia, Infectious Mononucleosus, many virus infections and collagen diseases. The problem of false diagnosis of syphilis with the stigmata and other ocnsequences attached to it, has assumed great importance particularly in countries whose incidence of syphilis has registered a precipitous decline.

Attempts made to eliminate the false reactions and improve the utility of the STS proceeded along many different lines.

False reactions with STS could be and is often due to technical faults, including errors in the collection and labelling of the specimens in the hospital, defects in the technical performance of the test, in the recording and reporting of results from the laboratory. These technical false reactions should not be confused with biological false reactions and could be prevented with improvements of techniques and with proper checks, controls and care. They are usually at a minimum in well run laboratories.

Cardiolipin Antigen :

In 1941 Pangborn of New York isolated by purification of the crude ox-heart extract of lipoids "Cardiolipin" a chemically definable antigenic substance. It is believed to carry most of the serological activity of the crude tissue extracts of Wassermann and Kahn and its use as an antigen improves the specificity and sensitivity of STS. In practical use, Cardiolipin is fortified with purified lecithin and cholesterol, the proportion of which may be adjusted in the final mixture to influence both specificity and sensitivity so that it can be easily standardised at optimum level of sensitivity and maximum level of specificity. Further cardiolipin may be adapted for use in all complement fixation and precipitation techniques described. When cardiolipin was first introduced there were high hopes that it might replace the old crude antigen and become the basis for an improved standard antigen, to be used on a world wide scale in STS. This has not been achieved yet. Each author serologist has actually attempted to adapt cardiolipin antigen to his own particular technique and there is wide disagreement as to the optimal concentration of the reagents for a standard reaction. Neverthtless, while there is no universally accepted standard cardiolipin test and even under the widely varying conditions of its use, there is evidence from the results of extensive trials with it, all over the world that this antigen is more sensitive and specific than the crude tissue extract antigen. Pangborn's discovery stands thus as a landmark in the recent progress of serodiagnostic techniques. It must however be admitted that cardiolipin is still a non-specific antigen and detects only the non-specific Wassermann antibody produced in syphilis and probably does the measure the specific antibody against *T. pallidum.*

Venereal Diseases Research Laboratory (VDRL) Test for Syphilis :

This is a slide precipitation test using cardiolipin antigen, devised by Harris and his associates of the Venereal Disease Research Laboratory of U.S.A. in 1948. It has been extensively used and evaluated in the U.S.A. and in Europe and has been accepted as a simple useful standard slide test for syphilis for routine use in those countries and by the W.H.O. for others. VDRL test was introduced in V.D. Laboratory of this Institute as a single routine quantitative test in 1953. As a result of our critical evaluation of its worth with our rich and varied venereal diseases clinical material during the last three years, we have proved its utility as a technically easy, quick, routine test for syphilis with useful sensitivity and effective specificity in syphilis. The test has been further evaluated in a carefully controlled study sponsored by the ICMR. Eight laboratories in India participated in the enquiry by performing three parallel tests on each serum sample sent from the institute, the tests being Wassermann and Kahn standard tests using the crude tissue extract antigen and the VDRL test using the cardiolipin antigen. A statistically significant number of sera from known cases of syphilis in various stages from normal controls and from non-svphilitic diseased conditions were subjected to the tests. The results of the analysis are not finalised yet but from the data available, it would appear that the VDRL test is comparatively dependable from the point of view of sensitivity, specificity and

reproducibility. Cardiolipin antigen is now manufactured on a commercial scale by the Government of India at the "Antigen Production Unit", Calcutta. It should be possible now for us to have one standard test with uniform procedures and using reagents available from one central source, so that we may eliminate the confused and undisciplined state in which tests for syphilis are now being performed in the country.

Battery of Standard Test for Syphilis :

Some laboratories submit each specimen to testing by a number of different tests simultaneously. This is confusing to the Physicians particularly when the results conflict and therefore it should be discouraged. The major purpose of a serologic battery of tests is for an intra-laboratory check of their technical performances. However, in a busy laboratory which tests several hundred speciments a day, a hypersensitive tests for syphilis in which reagents are so adjusted as to produce maximum sensitivity is used to screen first all specimens received. If the result is negative, it is presumed to be negative with the less sensitive standard test and reported to the Physician without further ado. If the result is doubtful or positive, the test is repeated with the standard test and then reported. Further, in teaching institutions or in a reference laboratory a battery of tests, possibly limited to a complement fixing type and a precipitating type, may be very usefully performed. Otherwise, for routine use, any one type of standardised quantitative test performed with proper controls and strictly according to the authors directions would provide all the information at present available from the sero-diagnostic tests for syphilis.

Quantitative Tests for Syphilis :

All laboratory tests must lend themselves to quantitation. This applies to serodiagnostic tests for syphilis too. Too much emphasis is being placed on the pseudo quantitative method of reporting positive reactions as 1 plus, 2 plus, 3 plus and 4 plus in the routine qualitative tests. The physician is often lulled into a sense of security on serologic re-check if the laboratory reports a reduction in titre from 3 plus to 1 plus and again he and the patient may be unduly concerned if the titre rises from 1 plus to 3 plus reaction. Further a 4 plus reaction does not necessarily indicate a strongly positive reaction since some "4 plus" sera may only be positive in a dilution of 1 : 2 whereas another 4 plus serum may continue to give a positive reaction in a dilution of 1 : 256. Obviously the latter serum is 128 times more positive than the first serum, yet both are reported 4 plus or strongly positive by routine qualitative method (Rein 1951). All STS should be properly quantitated and the clinician must ask for a quantitative titre of positive reactions from the laboratory. The standard method of quantitation of STS measure the antibody only relatively i.e., by a serial falling dilution of positive sera in normal saline and reporting the last dilution at which the reaction is still definitely positive. The titre is expressed in "Dils" the number being the reciprocal of the particular limiting dilution. Quantitative STS is not necessarily an aid to diagnosis as it merely measures the maximum dilutions in which a particular serum gave a positive reaction. A patient whose serum is positive in 16 dils is no less syphilitic than the individual whose serum is position in 256 dils. The chief value of the quantitative test is in the fact that the physician can more adequately evaluate the serologic response of his patient to a particular treatment schedule from the beginning of the treatment throughout the period of clinical and serological follow up. A reduction in STS titre significantly is often the only evidence of the success of the previously administered anti-syphilitic treatment Quantitative serum testing has received considerable emphasis in recent years with the introduction of rapid anti-syphilitic therapy with penicillin. A carefully performed and properly interpreted quantitative STS may be of value to the physician:

1. As a guide of response to treatment.
2. To differentiate between true and false reaction in STS.
3. To differentiate between active congenital syphilis and passive transfer of syphilitic antibody from the mother to the infant, and
4. To determine sero-resistence.

Verification Tests for Syphilis :

For many years serologists have attempted to develop techniques of differentiating true positive reactions in syphilis from those positive reactions produced in non-syphilitic diseases and conditions. Some of these have been called 'Verification tests" a name popularised by Kahn (1942). They all have a common basis of an empirical modification of standard serologic procedures rather than

of any immuno-chemical or immunologic basis, involving the antibody or antibodies concerned in the reactions. None of them have actually verified anything and have proved of any practical value. In 1947, Neurath and his associates in U.S.A. by extensive highly technical immuno chemical work on the Wassermann antibody suggested the existence of two types of that antibody (1) syphilitic (2) false positive syphilitic. They isolated a thermostable inhibiting substance from the albumin fraction of normal human serum which selectively inhibited the precipitation of tissue extract antigen by the euglobulin fraction containing the antibody in false positive sera. In syphilitic sera no such inhibition was noticed. On this is based the "Neurath's" Englobulin inhibition test which appeared when reported, as a promising verification test. After a recent survey of its worth by United State Public Health Service, however, Neurath's test also has been found to be of little practical value in the verification of false reaction for syphilis.

National and International Evaluation surveys of Serological Tests for Syphilis :

Since the reliability of STS is of a great public health and social importance, there have been a number of evaluation surveys of serological tests for syphilis at national and international levels to stimulate, improved and more uniform standards of their performance and to eliminate the less reliable procedures. The League of Nations held international serologists conference in 1923, 1928 and 1930. Attempts were made to measure the performance of all the standard tests carried out by the respective author serologists and recommend the best of the standard methods and procedures. In U.S.A. annual national serological test surveys have been held since 1936. Parallel testing of sera with various tests in current use is done in the state laboratories and their sensitivity and specificity ratings are published annually. As a result the standard of performance of STS has improved and the inadequate procedures have been discarded. This may be very usefully followed in our country. This institute was actually given the lead in this direction in recent years by conducting two sample serological surveys of tests in the laboratories in India (Rajam 1953-54; Chacko et al 1955).

The World Health Organisation has continued the work of the League of Nations and a special sub-committee on serology have been studying the various problems involved in the serology of syphilis all over the world. On their recommendations it is hoped that in the near future standard methods and materials and uniform methods of reporting of results will be accepted by all nations using serological tests with more effective control of syphilis. There have been already established two Regional Reference Serological Laboratories one at Chamblee, Georgia U.S.A. and another at the State Serum Institute, Copenhagen, Denmark, the latter serving as a W.H.O. Reference Laboratory where reference standard antigen preparation and stable preserved positive serum controls are available in addition to routine reference service with specific tests on problem sera and further research into fundamental problembs in the serodiagnosis of syphilis.

Specific Tests for Syphilis :

The logical answer to the problem of biologic false positive reactions with the current standard tests for syphilis using more or less purified tissue extract lipoidal antigen is to use instead an antigen derived directly from virulent *T. pallida* to react with a possible specific antibody in syphilis. The presence of a specific treponemal antibody have been demonstrated by earlier workers in the field by Eberson in 1921 and Turner in 1939 and 1948. However no practical tests for Syphilis could be devised owing to technical difficulties involved in preparing specific antigen from virulent *T. pallidum* which has not even been grown in artificial culture medium for that purpose. The so called cultured spirochetes like the Reiter strain of *T. pallidum*, have been proved to be non-pathogenic to human beings and animals. Antigen derived from them were used in serodiagnostic complement fixation and agglutination tests for syphilis as early as 1929 by Gaeghten and later by Eagle in 1941 and Kolmer in 1941. In the Washington syphilis serology survey of 1941, the use of these cultured spirochetal antigens received a set back with the demonstration of their lack of specificity in syphilis. According to Kolmer, antigen of cultured spirochetes cannot be used with any advantage in the serodiagnosis of syphilis because of the frequency of its cross reaction with antibodies in normal subjects to common saprophytic mouth spirochetes to which they are probably antigenically related more than to virulent *T. pallida*.

In 1949 Nelson nd Meyer of U.S.A. demonstrated conclusively the presence of a specific anti-treponemal, immobilizing antibody in syphilitic serum. On this antibody is based the Treponemal Immobilization (T.P.I.) test for syphilis, devised by the above authors as a truly specific test for syphilis. The discovery of this test must be considered as yet another important land mark in the progress of serodiagnosis of syphilis.

T.P.I. Test for Syphilis :

The antigen in the test consists of a suspension of live and motile pathogenic strain (NICHOLS) of *T. pallidum* grown and extracted, relatively tissue free from rabbit testes syphiloma, in a special sustaining medium. In the test proper this antigen is mixed with the test serum and fresh G. pig complement and incubated anaerobically over night. The motile treponemes are immobilized by a specific antibody in syphilitic serum. The motile treponema are counted under dark field microscope before and after mixing and incubating the reagents and the percentage immobilized is a measure of the positive reaction. This immobilization takes place only in the presence of fresh complement and does not do so in the presence of sera from normal persons and diseases other than syphilis, including those giving B.F.P. reaction with S.T.S. Therefore, the test is considered truly specific in nature. Further, the immobilizing antibody has been shown to be distinct and separate from the Wassermann antibody in Syphilis serum by absorption experiments. In untreated syphilis, the apparance of the immobilizing antibody parallels that of the Wassermann antibody and it is almost continuously present for the duration of the syphilitic patient's life, even though the Wassermann antibody may disappear. It probably plays some part in immunity in syphilis while Wassermann antibody does not. The T.P.I. test has been reproduced and evaluated extensively in 30 laboratories in America and Europe with reference to its specificity and sensitivity. The data available permit the tentative conclusion that the test detects an antibody specific in syphilis and it may be expected to replace S.T.S. eventualy at least in a modified form. The technic in its present form, involving intricate equipment and costly materials is too difficult to be used as a routine test for syphilis in all laboratories. From the clinical point of view its particular value would be as a reference test in problem cases to differentiate between true and false reactions in syphilis given by current standard tests. The techniques provides a very useful tool to do researches into the fundamental problems in the biology of *T. pallidum*. It is time that better facilities for the performance of the T.P.I. test are set up in one or two of the major laboratories in our country where staff experienced in it is available.

Treponema Agglutination (T.P.A.) Test for Syphilis :

Attempts have been made to simplify and modify the T.P.I. technique by several workers and the T.P.A. test has been recently introduced (Tani 1951, Cain 1953, McLeod 1953, Hardy 1953). The antigen in this test consists of saline suspension of heat killed virulent *T. pallidum* extracted from rabbit testes syphilomia. When mixed with sphilitic serum and incubated overnight the dead treponemes are agglutinated. The clumps are seen under the dark field of the microscope and is indicative of positive agglutination test for syphilis. The test is still in the experimental trial stage and its specificity in syphilis involving a specific agglutinating antibody similar or identical with immobilizing antibody of the T.P.I. test is yet to be confirmed. The T.P.A. test has been reproduced and established in the V.D. Laboratory of the Institute of Venereology, Madras and its specific value is being critically evaluated with parallel current standard tests (Chacko 1954). It would appear that the Wassermann antibody in syphilitic serum can also agglutinate dead virulent *T. pallidum* causing a fallacy in the test. It, however, can be absorbed from the serum with lipoidal tissue antigen leaving a distinct specific agglutinating antibody in the sera so that a "test-after-absorption" technique would provide a specific reaction. The T.P.A. test, technically still difficult but easier than T.P.I. test, shows, therefore, promise of making available another specific test for syphilis in the near future.

Treponema Immune Adherence (T.P.I.A.) Test for Syphilis :

The basis of this potential specific test for Syphilis reported by Nelson in 1952, is that a suspension of killed virulent *T. pallidum* disappears when mixed with syphilitic serum and normal heparinized human blood. It is thought, that virulent *T. pallidum* sensitized by a specific antibody in syphilis, adhere

specifically to red blood cells and are later on phagocytised by the white cells in the presence of complement. The number of *T. pallidum* per dark field of the antigen suspension is counted before and after the reagents are incubated and centrifuged is counted again in the supernatent. The percentage disapperance is the measure of positive reaction by this test. On evaluation of the test by Nelson the reactions appear to agree with the results of T.P.I. test suggesting that a similar specific antibody is involved. The test apparently simple in technique needs further extensive experimental trial.

Treponema Pallidum Complement Fixation (T.P.C.F.) Test :

This is a standard complement fixation type test, described very recently by Magnuson and his co-workers (1956) from the U.S.A. involving the use of an antigen prepared from virulent *T. pallidum* obtained from rabbit testicular syphiloma. The lipoidal antigenic material in it is removed by acetone and ether, followed by extraction with 0.2% solution of sodium desoxycholate so that false positive reactions involving antilipoid wassermann antibody in syphilitic serum is eliminated. According to the authors the T.P.C.F. nd T.P.I. test results agreed significantly pointing to the possible specificity of the test in syphilis which however needs further evaluation.

Treponemin Skin Test for Syphilis :

This consists of a specific allergic intradermal reaction in syphilis, of the delayed tuberculin type. The skin tests, have been experimented upon from early times but had been largely given up owing to the occurrence of non-specific reactions with the type antigenic material then used. In the laboratory of the Institute of Venereology in Madras, recent trials are in progress using cryolysed (rapidly frozen, thawed and broken up) virulent treponemal material in saline suspension as the intradermal antigen. When 0.1 c.c. of the antigen is injected intradermally, it has been found to produce an indurated papule of at least 5 mm in diameter with or without erythema when read at 48 hours in known cases of syphilis beyond its early stages and not in non-syphilitic conditions. An allergic state appears to develop in syphilis in the latent and late stages so that the test using purified specific material from *T. pallida* promises now to provide a simple specific skin test for the clinician to use in his office in the diagnosis of syphilis in its late and latent stages even probably in the presence of a negative serology (Chacko 1955).

Test on Cerebrospinal Fluid in Syphilis :

In examining the cerebrospinal fluid (C.S.F.) as laboratory aids in the diagnosis of syphilitic infection in the central nervous system, four different tests are usually done as a routine:

1. Tests for the treponemal antibody or reagin.
2. The cell count.
3. The total protein.
4. Colloidal tests.

Tests for the antibody in the C.S.F. is the only specific test for syphilis. When positive, it constitutes strong proof not only that the patient has syphilis but also that he has neurosyphilis. The passive transfer of the antibody from the blood to the spinal fluid does not normally occur in syphilis. In early syphilis a high titre of the antibody is present in the blood without being detectable in C.S.F. There is further proof that in neurosyphilis the antibody is locally elaborated in the nervous system. The Wassermann complement fixation test using the tissue lipoidal extract antigen on C.S.F. and its modifications were being performed from the early days of serological tests for syphilis. They have been considered more satisfactory than the standard precipitation tests on C.S.F. However, it has been shown by American workers (Cannafax 1952) by doing parallel tests on a statistically significant number of spinal fluids, with both a complement fixation and recently introduced VDRL precipitation tests using cardiolipin antigen that, comparable specific results can be obtained with the precipitation techniques which have the advantage of simplicity. We have been able to confirm these findings by our own independent investigation along the same lines on the Madras Institute of Venereology. Whatever technique is performed, the result of test on C.S.F. must also be quantitated. The simple report "spinal fiuid WR positive" should not be accepted. If the test is negative it is essential to know that it is so, with significantly large amount of fluid. If

positive, it is important to know the smallest amount which gives a positive result. In routine spinal fluid W.R. performed in this country, it is usual to follow a semi-quantitative method of reporting the reaction using 0.1 ml and 0.5 ml quantities of C.S.F. It would be preferable to use a serial falling method if dilution of C.S.F. and expressing the titre of positive reaction in Dils. as in serum specimens. The degree of positivity is important in diagnosis, progress and control of the adequacy of treatment. Anticomplementary results on a freshly drawn spinal fluid is considered as a positive result and signifies presence of syphilitic antibody unlike the situation with serum which may be anticomplimentary even if sero-negative. False positive reactions with STS is less frequent in C.S.F. than on blood serum. It has been reported occasionally in clinical syndromes such as acute bacterial meningitis, tubercular meningitis, sub-arachnoid haemorrhage and brain tumour. These conditions are fairly easily differentiated from neurosyphilis and further when it occurs in these conditions, the false reactions are believed to be often due to a passive transfer of the antibody from the sero-positive blood (not neurosyphilis) to C.S.F. due to the alterations in the blood brain carrier in the above conditions.

The recently introduced specific tests using treponemal antigen like the T.P.I. and T.P.A. test have been performed on C.S.F. but the advntage over the standard test is not quite apprent in C.S.F. tests at the present stage of its development. The cell count, the protein content and the Langes colloidal gold tests on C.S.F. are useful aids but not necessarily specific tests for syphilis. The cell count and the total proteins in C.S.F. are usually increased in neurosyphilis but the tests are non-specific, dependent only on the existence of an inflammatory or degenerative lesion which may be due to cause other than syphilis within the nervous system. Their importance lies in the early recognition of mild forms of asymptomatic neurosyphilis and in following the results of treatment. In the Lange's test the different types of curves obtained depend upon the balance between albumin and globulin protein fraction in C.S.F. Some observers feel that for this reason colloidal tests with many limitations may be eliminated if proteins are quantitatively estimated but most workers still feel that information both of diagnostic and prognostic value in neurosyphilis is provided by them particularly the paretic or first zone type of curve which may however occur in other neurological disorders.

Problems in the Interpretation of Results of Standards Tests for Syphilis :

None of the standard tests using more or less purified lipid antigen are completely specific in syphilis. Therefore, when a test is reported positive it does not necessarily mean syphilis always.

False Positive Reactions versus Latent Syphilis :

Physicians are often confronted with individuals in whom a routine serological examination reveals a positive test for syphilis incoroborated by anamnestic or clinical evidence of the disease. The uncritical tendency to diagnose latent syphilis merely on the strength of a positive reaction by one of the standard tests, has received a rude check when it was reported that about 30% of such sera were found negative when tested for the presence of the specific immobilizing antibody in the T.P.I. test. Evidently such reactions by the standard tests are false positive reections and the patients havt no syphilis. Since penicillin is cheap and easily available, it is administered in such cases on the slightest selologic evidence without subjecting the patient to all the time consuming prescribed investigations to establish or exclude the diagnosis of syphilis. Apart from the fact that the approach is unscientific, it may be responsible for grave unnecessary psychic injury to the patient. Many non-syphilitic sero-positive reactors become negative soon after penicillin therapy and physicians cannot know whether seronegativity was obtained because of penicillin therapy or inspite of it. In others sero-positivity may persist in low fluctuating titres after initial penicillin therapy and the uncritical physician is liable to pump in more penicillin with the unpredictable hazard of inducing serious sensitivity reactions. So when STS conflicts with clinical findings and before latent syphilis is diagnosed the physician should take time to carry out the following investigations:

1. To repeat the test on another specimen of the material of the patient to exclude first a possible technical false positive reactions due to technical mistakes made in the laboratory or the clinic due to mislabel-

ling, interchange of specimens and errors in reporting and registering of results.

2. In the case of repeated positive serology in the absence of clinical evidence of syphilis, latent syphilis should not be diagnosed unless specific treponemal antibodies are demonstrated with specific tests like the TPI test. As such a specific test is neither available nor practicable in the current situation, the physician should re-examine the patient thorough with the object of detecting any of the known conditions or diseases referred to earlier which are known to be potential causes of biologic false positive reactors. If the cause is found, the patient should be treated for the particular condition and the false reaction will usually revert to negativity. It has been recently reported that some of the chronic repetative false reactions are the earliest indication of serious collagen diseases like rheumatoid arthritis and lupus erythematosis Moore (1952). In the absence of evidence of other diseases, these false reactors may be kept under observation without anti-syphilitic treatment explaining the situation to the patient, with trimonthly or monthly quantitative serologic check up for 6 months. False reactions are usually temporary and of low titre and become negative or diminish in titre in a few months time. On the other hand, if due to latent syphilis, the positive reaction will persist and the titre will increase in time. Syphilis is not a medical emergency except in the case of the pregnant woman.

3. When latent syphilis is suspected on the basis of a positive S.T.S. and careful anamnesis, clinical and roentgenographic examination of the cardiovascular system and neurological examination including a spinal fluid test are obligatory before labelling the condition as one of latest syphilis. Where adequate work up is not feasible due to lack of facilities or poor patient co-operation, therapy should be probably administered and the patient should be followed up as a treated proved syphilitic case. Questions are frequently asked regarding the significance of positive (VDRL) test with low titre in clinically doubtful cases. No definite rule can be laid down in this direction. The B.F.P. reactions are usually but not necessarily of low titre. In known cases of syphilis the titre of a standard test could be low particularly in primary syphilis and treated cases. However, it may be taken as a working guide that test of low titre (e.g. VDRL 4 dils and less) may be considered as "false" provided there is no clinical or historical evidence of syphilis.

Sero Positive Pregnant Women :

Every immediate effort should be made to determine whether a pregnant woman with a positive serology is syphilitic or not by careful anamnesis, obstetrical history, examination of the sexual partner and other siblings of the family. There should not be unnecessary delay in coming to a decision especially in an advanced stage of pregnancy. The safest rule is when in doubt, the woman should be treated not primarily for her sake but to afford protection to the unborn offspring. After the birth of the baby, the mother and the baby should be observed clinically and serologically for a period of six months. In the routine prenatal serological screening of expectant mothers in vogue, in many countries as part of a V.D. control programme, it is inevitable that a small percentage of false positive reactors wihtout syphilis will be routinely treated in order to afford maximum protection to the unborn children.

The question is frequently posed by physicians and obstetricians whether an adequately treated syphilitic woman prior to her pregnancy or during a pregnancy requires retreatment during subsequent pregnancies to prevent a possible transmission of infection to the foetus in utero. Such a question does not admit of a categorical answer. It may be stated that treatment is not necessary to a syphilitic woman during every one of her pregnancies provided the mother had received previously adequate treatment with penicillin shows no clinical signs of active infection if she is serologically negative and if still positive in a low titre only and if reinfection does not occur. It has been suggested however that in the absence of regular observation of the obstetrical career of an adequately treated syphilitic woman, a persistent serological reaction even if low titre discovered during a pregnancy is an indication for retreatment particularly if the infection is of recent origin. Quantitative serological testing of blood of syphilitic pregnant women both before and after treatment and of the infant at birth and during the first six months of post-natal life is essential for the ideal handling of such patients and should form

part of a well conducted ante-natal and obstetric service.

Prenatal Syphilis versus Passive Transfer of Maternal Antibodies to a Normal Foetus :

A single routine serological test performed on a new born infant at delivery does not detremine the presence or absence of true prenatal infection. A negative serological test does not exclude prenatal syphilis since infants infected late in pregnancy may develop positive serological test at variable times after delivery. A positive test at birth does not establish a diagnosis of prenatal syphilis since this may only indicate a passive transfer of material antibodies to seronegativity without treatment within a maximum of four months following birth. The higher the titre of the mother at the time of delivery the greater the incidence of new born reactors and higher their respective titres.

During the first four months of post-natal life if there be persistence of the positive reaction without showing any tendency to reduction in titre or exhibiting a progressive increase in titre with or without clinical and roentgenological evidence of syphilis, treatment with penicillin should be immediately instituted.

In known cases of syphilis when the STS is reported positive, it does not always mean active syphilis requring treatment or retreatment. In early syphilis following penicillin therapy, treponemes disappear rapidly from the lesions with prompppt healing but the serologic response is comparatively slow as there is a time lag taking 9 to 12 months for complete serological reversal. In late symptomatic and late latent syphilis and late congenital syphilis, there is only infrequent reversal to seronegativity within five years after treatment. Persistence of positive STS does not necessarily indicate persistence of infection. It has been found that retreatmnet of latent syphilitics with persistently positive STS does not produce a more rapid reduction in titre than in a control group of patients who are not subjected to retreatment. However, a significant reduction in titre of the test performed at difinite intervals in the serological control of treatment of syphilis does help as a criterion of cure.

When a S.T.S. is reported negative it does not exclude syphilitic infection always. A patient with clinical syphilis may give "false negative" reaction with the standard tests and it is a definite drawback which must be kept in mind. Such discrepancies are often observed in patients with dark-field positive primary syphilis. The antibody begins to appear in the blood serum soon after infection but it must reach a certain threshold level to be detected by a standard test which is set at a standard level of sensitivity. It is expected to produce 100 per cent reactivity only in darkfield positive untreated florid secondary syphilis. It takes usually about 10 days after the appearance of the primary chancre for the S.T.S. to be positive in primary syphilis. It is not uncommon to find that the patients with cardiovascular syphilis and tabes dorsalis may have negative serological reactions for reasons not quite obvious.

STS in C.S.F.:

The persistence of positive S.T.S. does not necessarily indicate persistence of active infection. There may not be constant relationship between spinal fluid results and clinical findings. There may be definite clinical improvement and yet the spinal fluid tests may show an active syphilitic process. The reverse may also be true as in some cases of advanced "Tabes" when the spinal fluid tests may be normal but the clinical condition may persist or progress. However, reactivation of the neurosyphilitic process is usually indicated by persistence or increase in quantitative STS and increase in cell count and total protein. In such cases retreatment is indicated.

It is quite obvious therefore, that there should be close co-operation between the serologist and the clinician in the use of a standard serologc test, if the patient is to get the maximum benefit in the diagnosis and therapy of syphilis. The clinician should always correlate the serologist's report on his tests with his clinical findings before a diagnosis of syphilis is made. The standard serologic test either of the complement fixing or precipitation type is a good servant of the clinician but t bad master and is no substitute for good clinical judgment. The serologist should not ever diagnose syphilis on the strength of his test alone. He has to depend upon the clinician well trained in the field of syphilis to evaluate and standardise his tests.

There has been significant advances re-

cently in the serodiagnosis of syphilis. The utility of standard serologic tests for syphilis inspite of their drawbacks has improved with the use of purified standardized antigens and improvement in technical methods. The truly specific tests such as T.P.I. and TPA are not yet available for routine performance. They still require further research, evaluation and technical modification before they can replace the standard serological tests in current use.

On a personal note, the authors of this paper, feel that the Institute of Venereology with its abundant, varied clinical material and its attached laboratory staffed by well trained, enthusiastic and experienced superior personnel and with two strains of *Treponema pallidum* successfully established in the rabbit colony will be suitable for the establishment of a reference laboratory with the newer specific serodiagnostic tests for syphilis, provided the necessary specialised equipment are supplied by the authorities.

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PUBLIC HEALTH IN INDIA MARCHES ON

With the inauguration of the Indian Public Health Association its journal also sees the light of the day on this date. An all India Public Health Association should have come into existence years ago and played its own role in the development of Public Health activities and patterns of health services in the country. Though late it can yet render valuable services in the cause of Public Health which, to-day, in its concept, scope and goal has changed beyond all recognition.

From the narrow confines of its activities in the field of environmental sanitation and control of communicable diseases public health work has now emerged out as a service that permeates and pervades the entire fabric of the social life of the Community it serves. Through the development of Health Centres, Community Projects & National Extension Services, environmental sanitation programme, social security measures and welfare and rehabilitation services, the Employees' State Insurance Schemes, industrial health services, public health nursing and health education programmes, rural medical relief and improvement of vital statistics, laboratory services and control of communicable diseases including the national schemes of malaria, filaria, leprosy and T.B. control, India is marching towards the goal of Health.

Our country is vast and our health problems are numerous and complex. A concerted, coordinated and cooperative team effort on the part of all health agencies is the need of the hour. The second Five Year Plan period has begun and the targets set for achievement are high. If we are to discharge our responsibilities satisfactorily and reach these targets we have to apply ourselves to the task without loss of time.

There is an acute shortage of trained personnel required for carrying out the programme planned for the Second Five Year period and in respect of certain categories of personnel the deficiency will not be filled up before two or more plan periods are over. Newer needs of the country disclosed by surveys and studies, and newer developments in the different phases of health work such as public health engineering, public health nursing, health education, medical social work, physiotherapy, occupational therapy and the like are bringing forcibly into light the problem of having trained workers in those fields, the available number of whom is extremely limited at the moment. This, therefore, is an important aspect of work to which the teaching institutions all over the counry must apply their minds seriously and with promptitude.

In India we have a number of medical associations with independent

journals serving the cause of the particular speciality or discipline. Except the journal of the T.B. Association and the one on Leprosy most of them deal with clinical aspects of diseases, their diagnosis and treatment. While they serve their objectives admirably well it is considered necessary that sufficient emphasis on the preventive and social aspects of diseases should also be laid and that we appreciate not only our individual role but what is of greater importance our combined role in the integrated health services of the country.

The Indian Public Health Association provides a forum for the presentation of the views on and experiences in matters pertaining to health and health services and invites all categories of workers—Social, Medical, Public Health and Nursing—to participate actively in the task so that our combined effort may promote the interest of the profession, the Sicence and the Society we serve.

It is also hoped that the association will maintain a close touch with the people and their problems on the one side and the Government departments and social organisations on the other and render all cooperation and assistance it can in order to secure for the country a progressively rising standard of health.

For the association to reach its influence, guidance and counsel to the innumerable workers scattered over the country and to keep them apprised of the latest trends and developments in Preventive and Social Medicine the association has embarked upon the publication of its own journal. It is through this that the association will ventilate its ideas on problems pertaining to preventive and social medicines, maternal and child health, public health administration, health education, social health, family planning, medical education, history of medicine, hospitals and their role in community health protection, epidemiology and communicable diseases, nutrition and biochemistry and other cognate subjects.

The inauguration of the association brings into the team of professional associations a new colleague and the publication of the journal opens a new, and let us hope a useful chapter, in the history of Health journals in India.

ATHEROSCLEROSIS AND PUBLIC HEALTH

While the nation-wide activities against certain important communicable diseases launched by the Government have already proved their worth by almost dramatic reduction in the incidence and death rates other diseases which were obscure or relatively less important are now coming up and taking their place as new(?) public health problems. Sudden death almost without any warning due to cardiac failure is progressively increasing in number. In common parlance such deaths are generally ascribed to coronary thrombosis. To the clinicians it is a disease with little treatment. The pathologist is baffled by its ill-undersood pathogensis, the biochemists still wonders whether the changes in the blood are the cause or the effect of the disease, the dieteticians are at work to impose specific dietary restrictions and the experimentalists are trying to reproduce the disease in animals to obtain the clue to its pathogenesis. On the other hand, the insurance companies are interested in discovering some guiding rules to detect the future victims of the disease, and

while the public health authorities are looking for scope of prevention the politicians, managers, lawyers, and doctors are often in the grip of an unknown fear of the moment when it may strike them.

Atherosclerosis, the basic disease in most instances of coronary thrombosis, is one of the most significant chronic diseases with which the civilized world is being plagued to-day. Though our knowledge of the cause and the natural history of this condition is still rather poor, researches in the laboratory by workers in various countries have thrown some lights on certain important factors of the problem, and means have been found to produce similar conditions in animals. Workers in the field now agree that dietary fats and lipid metabolism are in some way etiologically related and what is needed now is to find out what types of fat are involved and their relative significance with other dietary principles. This was the subject of study of Gour and his associate Tayal at Agra,[1] which has been reported in this issue of the journal and to which the readers' attention is specifically directed. Before any comment is made on their findings it might be worth while to briefly review some aspects of the knowledge on the subject.

One of the basic questions that has often been asked is whether it is a disease of the aging population of modern times. Historical approach reveals that it was present even 3500 years ago or as far back as history can trace, but the animals do not show any evidence of this disease. Apart from the question of age factor it may be pointed out that man is the only animal who has continuously experimented with his dietaries, whether for curiosities (in the earlier times) or for necessities (modern times) and have brought about artificial changes with increasing intensity in the recent decades. This change in dietaries has been more marked in case of fat, one of the proximate principles which has been extensively adulterated with the result that a chronic relative deficiency now pervades the upper strata of the civilized world which largely consume it, in regard to the polyethnoid essential fatty acids (E.F.A.). The causes of death that have increased most in recent years in many countries are coronary thrombosis, lung cancer and leukaemia, in all of which deficiency of E.F.A. may be important[2]. The body has only slight ability to synthesize E.F.A.'s the most important number of which—the arachidonic acid with four double bonds (tetraeonic)—can be formed in the body from dienoic linoleic acid but vitamin B_6 is needed for its conversion[3]. On the other hand, oleic acid with one double bond, can readily be synthesized in the body. Peculiarly the requirement of male animals for E.F.A. is at least five times that of females[2]. With fat and sterol free but otherwise adequate diet a large deposition of esterified cholesterol was noted in the epidermis[2] and liver[4] of rats, and recently it has been shown that linoleic acid lowers the serum cholesterol in man[5]. The hypothesis advanced in regard to the deposition of this esterified cholesterol is worth considering here.

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Cholesterol is normally esterified mainly by unsaturated fatty acids[6] and when the latter are extremely deficient in the body it is esterified with much more saturated fatty acids synthesized in the body from carbohydrate and possibly thereby some abnormal esters are produced which tend to be deposited in the tissues. Such deposition would be enhanced by a diet relatively high in saturated fat or high in cholesterol which increases the dietary requirements of E.F.A.[7] A diet deficient in vitamin B_6 and relatively low in arachidonic acid may be the reason for the occurrence of atherosclerosis in pyridoxine deficient monkeys[8]. Atherosclerosis might therefore be regarded as a chronic deficiency of arachidonic acid and this deficiency can be brought about particularly under diets fairly low in E.F.A. with high cholesterol or saturated and/or unnatural fats or deficient in vitamin B_6.

Based on the various consequences observed in animals and man due to deficiency of E.F.A. by different workers in the field the following possibilities have been suggested to occur in man due to deficiency of E.F.A. or use of saturated and unnatural facts: Cholesterol, esterified with abnormal or unusually saturated fatty acids are less readily disposed of from the body and thus cause atheroma e.g. phospholipids such as phosphatidyl ethanolamins are retained in the plasma and increase the coagulability of blood thereby contributing to coronary or cerebral thrombosis. In this connection Sinclair[9] who noted some evidence of the production of such abnormal compounds remarked that there was a correlation between dietary intake of vegetable fat and death from coronary thrombosis. The explanation might be that the level of total dietary fat was related to atheroma but the level of dietary *vegetable* fat was related to clotting upon athermatous plaques and hence to coronary thrombosis. According to him it was the vegetable fats that are hardened may give rise to abnormal phospholipids. Thus what matters in atheroma is the structure of the dietary fatty acids.

Incidentally, it may also be mentioned here that apart from the question of atherosclerosis the E.F.A. deficiencies and abnormal phospholipids have been considered to be directly or indirectly related to causation and increase of the following diseases (1) bronchial carcinoma[10], (2) leukaemia[11], (3) seborrhoeic eczema[2,12,13]. Furthermore, it has been claimed that duodenal ulcer which is also increasing in males can be produced by feeding saturated fat causing deficiency of normal phospholipids in the gut.

Let us now examine in the above context our diets which we have been consuming in recent times. For sometime past both animal and vegetable fats are being increasingly oxidised and deprived of E.F.A. before being consumed. In India, vegetable oils though generally rich in E.F.A. are being hardened and partially saturated by hydrogenation and being extensively sold and consumed under the name *vanaspati or dalda* which corresponds to mar-

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garine of the western countries produced by hydrogenation of cotton-seed, soya bean, pea nut and certain other oils. During this hydrogenation much of the E.F.A.'s are destroyed and unnatural trans fatty acids are formed[2,9]. This kind of change has not only been brought about in the fats and oils but also in the bread that we daily use. Wheat germ oil which is an excellent source of unsaturated fatty acids survive little in the 70% extraction flour, which is further reduced by the use of improvers (bleaching or oxidising agents) and so also vitamin B_6 for which is needed for conversion of linoleic acid to arachidonic acid.

In the light of the above discussion the findings of Gour and Tayal, though refer to the chicks, assumes great practical importance. They have produced atherosclerosis with vegetable hydrogenated fats, now extensively used in India, in the presence of cholesterol but not with animal fat under the same conditions. In other words, if this experience is applicable directly to man it is no wonder that the disease should be increasing now in this country as in the West. Firstly, the change from natural fat to unnatural or saturated and hardened fat with relatively low linoleic and arachidonic acids has rather been sudden and secondly, its consumption is perhaps leading to the formation of abnormal esters of cholesterol and phospholipids in the body and finally in some cases to atherosclerosis. The question why it is affecting the particular groups of population may have reasonable explanation in the fact that these groups not only consume greater quantities of fat but also other substances causing simultaneous increases of cholesterol in their blood particularly in the absence of physical exercise unlike the population of lower economic and intellectual strata. In other words, the above combination of food and lack of exercise, perhaps leads to metabolic changes with rise in phospholipid contents and C/P ratio in terms of Gour and Tayal. It is also interesting to note that they found that mere consumption of hydrogenated fat in the absence of cholesterol did not produce the lesion pointing to the suggestion that a similar condition might be prevailing in the lower economic strata of our population. In any case, these findings should create sufficient interest among the workers to carry out intensive investigation in these lines.

Again, if the above results are substantiated it would open up the preventive aspect of the problem and may also give clue to the lines of researches for the discovery of effective treatment. It seems the root of the trouble is in the changing of our dietaries particularly in respect of fat containing high saturated (hydrogenated) and unnatural (adulterated) fatty acids and white bread. There is thus a strong indication that steps should be taken to increase our dietary content of polyethnoid fatty acids (ordinary vegetable oil, milk, butter, ghee or other animal fats), decrease the unnatural fatty acids and manufacture of bread out of flour of high extraction with added oxidising agents and perhaps completely ban or reduce to the minimum the manufacture of hydrogenated ghee (vanaspati or hardened fat).

SOCIAL FACTORS IN DISEASE PREVALENCE

The progress of medicine has strictly followed the paths of knowledge it has traversed through centuries and the twentieth century medicine is the total accumulated experience of the entire past as far as can be traced. For thousands of years nothing was known about what disease is. At an earlier stage it was thought to be the design of a demon or some supernatural being or powerful man, living or dead. This was followed by the idea that it was God's will to punish the people with disease or pestilence for their sins, and that a man was mentally deranged because an evil spirit had got hold of him and so on and so forth. Gradually the conception of natural causes of disease developed, and following the successive growth of knowledge in anatomy, physiology, pathology and finally the microbic origin of disease, the seed of preventive medicine was sown.

Not very long ago, towards the middle of the 19th century, it was thought that the health problems could be solved by putting every sick person in a hospital bed and treating him adequately. But now we know that even granting an increasing number of diseases can be cured and therapeutics has reached an unprecedented level of efficiency the incredible improvement in morbidity and mortality rates and also in life expectancy, as already achieved in certain countries of the world, is largely the result of public health work or of socio-economic improvement—that is, of the organised effort of the community to prevent and combat disease as well as to improve individual health and well-being. For instance, Tuberculosis mortality came down much before we knew how to treat or fight against the plague efficiently. Similarly reduction in Diphtheria is not considerably greater or less than scarlet fever, although for the former we have had an excellent serum and millions of children have been vaccinated against that infection while neither serum or vaccine is available for the latter. Again, the so-called tropical diseases e.g., Cholera, Plague, Dysentery, Hook-worm, Leprosy etc. disappeared from the European field long before the etiology of these diseases were known, and yet these have not been removed from our country. We can treat these cases successfully but when they go back to their own environment they also get back the disease. Even small-pox, a thoroughly preventable disease still occurs in epidemic form in our country. Thus even with improved knowledge and experience of modern times when the curative medicine is being largely replaced by preventive medicine we find that the methods at our disposal are not enough for complete control of the disease in a locality. What is the cause? The approach has to be deepened to explore from below the surface. To-day we have to recognize disease as a complex phenomenon of various factors conciding in time and space though it might not have been always so. For instance, the nature of disease in the advanced countries have shifted from ordinary infectious types to mental and metabolic spheres whereas in the primitive races the diseases are generally of acute types, and if infectious, cause devastation. The condition in the under-developed countries is actually intermediate between the above and it shifts towards the former with their processes of so-called development, but in every case the essential etiological factors remain the same. Again paradoxically virus diseases, such as poliomyelitis, encephalitis etc. seem to rise in countries with improve-

ment of environmental sanitation. The disease is thus a complex phenomenon of Bio-Socio-Geogens (Seal, 1954)[1] and the focus of interest should now widen to encompass the relationship between the various biological factors of this complex and their respective socio-economic and geographical environment. This conception is now partly expressed in the term 'Social Medicine' which is defined as the Science that studies the social, economic, cultural, psychological and genetic factors that have bearing on health and disease.

In the above context, factors other than biological, which perhaps differ from place to place and time to time, may have been playing an important role in the prevalence and persistance of the so called tropical disease in India. Some of these factors are: (1) population growth, (2) standard of living, (3) state of culture and education, (4) religious customs, beliefs and superstitions, (5) communication, (6) state of natural and artificial immunisations, and (7) community efforts etc.

The report of an investigation by Sea *et al*[2] as published in this issue of the journal is an attempt to study these factors in relation to cholera in the city of Calcutta. Some of the interesting facts brought out by this investigation and which deserve consideration apart from the peculiarity of distribution of the disease in the city are: (1) High incidence among the temporary residents, (2) women and children including infants staying at home, constituted the major bulk of cases, (3) bustees, though forming a small part of the city dwellings were the main targets of attack, (4) illiteracy, ignorance, poor economic conditions and overcrowding were the general features for the cases, (5) apparent predisposition of rice eaters and (6) bad environmental sanitation with shortage of drinking water and inadequate latrine facilities.

Thus it may be that the so-called tropical diseases have not much to do with the climate and are mainly due to the chnge of the social and economic conditions.

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2. Seal, S. C., Mathen, K. K., Ghose-Hazra, A., Dasgupta, K. and Raman, M. V.—Ind J. Pub. Health, 1: , 1956.

HALF A CENTURY OF WASSERMANN TEST FOR SYPHILIS

It was in May, fifty years ago that AUGUST VON WASSERMANN described first, his serodiagnostic test for Syphilis. It was such an epoch-making advance in medicine forming an important land mark in the history of diagnosis and control of syphilis, that the fiftieth anniversary of the discovery of the test has been fittingly remembered recently by the publication of a special number of the Archives of Dermatology.* It is but appropriate that we in India particularly public health workers should pay our measure of tribute to the discoverers of the test in the first number of the Indian Public Health Journal.

On the tenth of May 1906, Wassermann reported from BERLIN a

* Arch. Dermat. Vol. 73, May 1956.

complement fixation test for Syphilis. He was associated in this discovery with Albert Neisser who provided the antigen consisting of an aqueous extract of liver of a congenital syphilitic foetus and serum specimens from syphilitic apes. CARL BRUCK also collaborated in the actual performance of the tests. Therefore the test was really Wassermann, Neisser and Bruck (W.N.B.) reaction. Due credit must be given to all those who are immediately or remotely concerned in discoveries. DETRE of Budapest investigating simultaneously and independently of Wassermann, reported, using a similar technique, positive reactions in human syphilitic sera on 24th May 1906—only two weeks later and therefore he has been considered worthy of sharing in the honour of this discovery with Wassermann and his colleagues. Let us recall in this connection the discovery of *T. pallidum* by Schaudin and Hoffman in 1905, which focussed the attention of the medical world to syphilis, the successful artificial inoculation of apes with syphilis in 1903 by METCHNIKOFF AND ROUX and the discovery of the phenomenon of complement fixation by BORDET and GENGOU in 1901. If it were not for these significant discoveries, there would have been no serologic test by Wassermann, Neisser and Bruck but it should not lessen the debt which the world owes to these scientists who were the first to apply the test in the diagnosis of syphilis. At this moment it is interesting to recollect further that EHRLICH synthesized Arsephenamine (Salvarsan) in 1907, so that within a short period of about 3 years, the cause of syphilis, a serologic test for syphilis of great value in its detection and a sovereign remedy for its treatment, were discovered, constituting a triad of rapid discoveries, in a particular disease without parallel in the history of medicine.

Although the original concept of Wassermann of an antigen—antibody reaction between the specific antigen in the Syphilitic tissue extract and the specific antibody in the syphilitic patient's serum was sound in principle, later workers proved that the same reaction could be obtained using any normal tissue extract as antigen. From a strict immunological point of view the test is therefore considered non-specific. But in the practical diagnosis of syphilis the test has proved of immense value. During the past half a century, the original Wassermann test has blazed the trial as it were, for great advances in the serological tests for Syphilis as witnessed in the various simpler precipitation tests in the tube and on the slide, the introduction of quantitation of the tests, successful attempts to purify and improve the antigen and finally the recent discovery of truly specific tests of treponemal origin like the Treponema Pallidum Immobilization and Agglutination tests.

The serological tests have been of inestimable value in the diagnosis of latent and late syphilis of the Cardiovascular and Central Nervous System, in uncovering latent syphilis of women during the reproductive period of their life and prevention of congenital syphilis. Actually there is no branch of medicine where the Wassermann reaction did not explain some obscure and disputed problem. Mass serological screening of specific population groups, the prenatal, premarital, pre-employment examination with serologic tests has become a routine practice in many advanced countries of the World. Let us pay our due homage to these discoverers on the fiftieth anniversary of their discovery.

CURRENT PUBLIC HEALTH LITERATURE

Maternity and Child Welfare

EASTMAN, N. J.—**Global Aspects of Midwifery** —*Am. J. Pub. Health*—46: 310-12, 1956

Each year about 80 millions of babies are born in the World. Not less than 60 millions of them are delivered by a vast army of untrained attendants, ignorant of the rudiments of clear and safe maternity care.

The total number of midwives needed in the World, according to the estimate of UNICEF is 400,000. To supplement the traditional birth attendants over a period of years by fully trained midwives is impractical, as best illustrated in case of India and Pakistan. In 1951, India had about 16 millions births which would have required 130,000 midwives at the rate 120 attendants per midwife. With 200 midwifery schools she can produce only 1,500 midwives a year. Similarly Pakistan needs 12,000 midwives. At the rate of 110 midwives which she has proposed to train, it would require more than a century to reach the target.

According to the author, therefore tutelage of these traditional birth attendants over short periods is (1) the only practical way of meeting the needs of maternity care in economically under-developed countries, (2) feasible and (3) will reduce dramatically both maternal and prenatal mortality rates.

As for the feasibility of providing short term courses and on the job tutelage for these traditional birth attendants 6,000 have received such instruction in Indonesia in 1955, 3,000 in India and 1,200 in the Philippines: By teaching only a single rudiment of clean maternity care to several hundred thousand of them untold millions of lives can be saved. Similarly of the three great causes of maternal deaths—hæmorrage, infection and toxæmia, the majority of women now dying of these causes in under-developed countries could be saved by the application of just a few elementary principles of parental care and cleanlines. Such training programme should be the part and parcel of the activity of every rural health unit.

VERHOESTRAETE, L. J.—**International Aspects of Maternal and Child Health.** Am. J. Pub. Hlth. 46, 19-29, 1956.

Only one-fifth of the World population live in areas where the infant death rate is below 50 per 1,000 live births, another fifth live in areas with rates between 50 to 100 and at least three-fifth live in areas with rates exceeding 100. Approximately 35 per cent of the World population are represented by children under 15 years of age. In the undeveloped countries this proportion is about 40 per cent as against 25 per cent in the developed countries. The difference in the birth and death rates is about 20 per 1,000 as against 10 per 1,000 in the developed areas, the rate of increase of population thus being double (2%) that of the developed countries.

There is also a variation in problems with differences in technical development. In the less developed countries the programme of services aims at increasing survival of the child population through personal advice to mother and the family (ante-natal, natal and post-natal care) improvement of nutrition and environment, and control of major communicable diseases. In contrast with this, the technically developed countries have programmes which, with the disappearance of the problems mentioned before, aim essentially at control of developmental factors related to accidents and child birth. The other difference is that while in the technically developed areas the services of highly skilled specialists and other auxilliary personnel are readily available there is a severe shortage of health and medical care, sanitary facilities and of professional and auxilliary personnel in the undeveloped areas with an extreme mal-distribution between the urban and rural areas. The author has worked out an interesting table in this connection which is reproduced below.

Estimated Population per Doctor, Nurse, and Midwife in areas of the World grouped according to Infant Mortality.

Infanta mortality	Population per		
	Doctor	Nurse	Midwife
Less than 50 per 1,000 live births ...	900	500	1,940
50-99 ,, ,, ...	1,000	2,000	4,400
100- ,, ,, ...	4,100	8,100	18,400

Excessive child mortality in the less developed areas is chiefly due to gastrointestinal, respiratory, infectious and parasitic diseases, i.e., causes which are readily preventable and have almost been completely eliminated in the developed countries. The author suggests that besides organising extensive maternal and child welfare services in these areas emphasis should be laid on breast feeding, supplementary feeding of animal and vegetable protein and the supply of safe water.

FOOD AND NUTRITION

PACE, F. C.—**Effect at Atomic Bomb Radiations on Human Food.** Canadian J. of Pub. Hlth. 47, 133-141, 1956.

The author, a medical consultant, special weapons section of the Civil Defence Health Services, Canada, describes in this paper the radiation hazards of atomic explosions. There is an initial hazard lasting for a minute after detonation consisting of high energy, highly penetrating electro-magnetic radiation, gumma radiation and more powerful is the heat-flash and blast effects which cause immediate destruction of all materials including the food supplies and converts atom of some elements into radioactive isotopes through neutron-flux. The second type of hazard is the "Residual hazard or fallout". Some forty radio-isotopic daughter-elements are formed from explosion of original bomb-material due to crater formation and simultaneous pulverization and vaporization of the ground material. As the fireball of explosion rises from the ground level and cools, condensation and resolidification of the particles occur and a proportios of them, with radio-active material adhering, returns to the earth as fall out.

One explosion might cover as much as 7,000 square miles. The emanations are of two principal types, gumma rays and beta particles. Gumma rays, being highly penetrating, cause injury to the whole (human) organism and are responsible for the clinical condition known as the acute radiation syndrome. Beta-particles are much less penetrating and are stopped in the integument; in sufficient dosage they produce skin burns. Further, if the radio-active material gains access to the organism (by ingestion or inhalation) damage can be done from within. Thus the triple effects explosion are the external and internal hazards and the acute radiation syndrome.

The most important of these radio-active isotopes are the two isotopes of the elements Strontium (S 89 and S 90) and one of iodine. Strontium behaves metabolically in both animal and plant systems affecting the bones in mammals and causing serious local changes leading to neoplasm. It remains active for a long period (25 years). Iodine 131 causes damage to the gland.

Experimental data and acceptable opinion reviewed for these notations indicate that human foods are potentially at risk from atomic bombing, for several reasons. Fist, there are direct destruction of supply, dislocation of supply-systems and loss of sanitary control over food-stores and sources. Another danger is serious fallout-contamination of food-stocks over extensive areas of the country far beyond the range of direct destruction. Next, one notes the probability of radiation injury to living food-animals, including the fish, sufficient to render them unfit or of questionable fitness for consumption. A further hazard to such animals lies in ingestion of water and fodder contaminated by radioactive fallout. More directly, radioactive material metabolized by plants or animals might render them undesirable for human consumption, or such animal products as eggs and milk might be found to contain low but appreciable quantities of radio-poisons.

[We can only guess at this stage the long term effects of heavy radiocontamination of wide areas of a food-producing country and while the entry of dangerous bomb-products such as strontium 90 into the food-chain is a possibility of atomic warfare, a quantative assessment of the risk cannot be made at tht present time. The long-term somatic and genetic effects of other than naturally-occurring radioactive material in food or over the earth generally are at present highly specialized and somewhat speculative studies which hold, nevertheless, much interest for the future.]

TUBERCULOSIS

B.C.G. and Vole Bacillus Vaccines : Report by the Tuberculosis Vaccines Clinical Trial Committee—M. R. C. London—Brit. Med. J. 1: 413, 1956.

A controlled clinical trial of B.C.G. and vole bacillus vaccines in the prevention of tuberculosis in adolescent boys and girls started in September, 1950. By December,

1952, approximately 56,700 volunteers, all in their final year at secondary modern schools in or near North London, Birmingham, and Manchester, had been included; nearly all were aged between 14 and 15 years. Those found at an initial radiographic examination to be suffering from tuberculosis, and those known to have been in recent contact with a case of pulmonary tuberculosis at home, were excluded from the trial. This first report presents preliminary results after each participant had been in the trial for two and a half years, with supplementary incomplete information up to four years.

At the initial examination, each entrant had a chest radiograph and in intracutaneous test with 3 T.U. (Tuberculin Units); those with negative reactions to 3 T.U. were tested with 100 T.U. Those negative to both strengths were allocated by a random process to an unvaccinated, a B.C.G. vaccinated, or a vole-bacillus-vaccinated group. The participants were thus automatically classified on entry into the following five groups: tuberculin negative, left unvaccinated (13,300 entrants); tuberculin negative, B.C.G vaccinated (14.100); tuberculin negative, vole bacillus vaccinated (6,700); tuberculin positive to 3 T.U. (16,000); and tuberculin positive to 100 T.U. but not to 3 T.U. (6,600).

A total of 165 definite cases began within two and a half years of entry to the trial. Of these, 63 per cent were of pulmonary tuberculosia and 22 per cent of pleural effusion without evidence of pulmonary tuberculosis; 68 per cent of the cases were severe enough for the patients to be taken off work for at least three months. There was no death from the disease during the tow and a half years.

The annual incidence of tuberculosis in the tuberculin-negative unvaccinated group was 1.94 per 1,000; in the B.C.G.-vaccinated group it was only 0.37 per 1,000; and in the vole-bacillus-vaccinated group only 0.44 per 1,000. Each vaccine therefore coferred a substantial and similar degree of protection against tuberculosis ever a period of two and a half years in adolescence, the estimated reduction to the incidence of tuberculosis being about 55 per cent. The strength of the earlier batches of vole bacillus vaccine was below the standard intended.

Complications of vaccination consisted of occasional regional adenitis and delayed healing of the local lesion. Two cases of erythema nodesum were also attributed to B.C.G. vaccine and 22 cases receiving vole bacillus vaccine developed lesions like lupus vulgaris requiring treatment.

Among the entrants with a positive reaction to 3 T.U. the annual incidence of tuberculosis was 1.75 per 1,000, compared with 0.74 per 1,000 among those positive only to 100 T.U. The annual incidence was particularly high among those with strong reactions to 3 T.U. on entry (15 mm. induration or more)—namely, 2,93 per 1,000, compared with 0.78 per 1,000 among those with 5-14 mm. induration. Thus, in this age group those highly sensitive to tuberculin appear to have a special risk of developing tuberculosis.

The implications of these interim findings for the use of vaccination in the control of tuberculosis in adolescents are discussed. The trial is still in progress, and later reports will contain more detailed analysis ever longer periods of time.

O'Grandy, Francis—**Mantoux Reaction Patterns in Active and Arrested Tuberculosis**—Birt. J. Tuberc. Dis. Chest. 50, 159-169, 1956.

The author compared the Mantoux reactions in patients with clinically active tuberculosis and those with fully healed disease, with a view to find out the differences which might reveal a definite reaction of healing or of activity. The total number of cases investigated was 132, consisting of 56 patients in the arrested group and 54 in the active group (16 untreated and 38 treated) and 22 with pleural effusion. The initial dose of O.T. was .1 ml. of 1:10,000 and the repeating dose 1:11,000 or 1:100 in the same arm. Induration was measured under three heads—definite, shallow and very shallow. Erythema was measured separately. Three types of reactions were recorded Typed I, II and III. Type I—the commonest type of response—arising after 24 hours—maximum on the 2nd or 3rd day, induration lasts for two-thirds of the period of reaction, quickly becoming very shallow before disappearance. Type II—less common than Type I, maximum reaction on 4th or 5th day and induration declines gradually. Type III—rarest of the three responses—induration well developed and almost maximal after 24 hours and declines linearly to zero after 48 hours.

According to the author the reactions could be broadly divided into two categories

—"Normal" and "Tuberculous". A "tuberculous" response is one in which definite or shallow induration lasts for 3 days or less while a "normal" response is one in which definite or shallow induration lasts for four days or more. Although there was undoubted overlapping in these reactions certain clear differences were also noticed in 51.8 per cent of active tuberculosis cases which were not noted in its absence. In case of primary pleural effusion 31.8 per cent showed typical "tuberculosis" response. Another difference noted in case of active tuberculosis is that the response could be elicited only after repeating the dose in 85.7% cases as against 48.5 per cent in healed cases and also the size of the induration was on the whole smaller in the former than in the latter cases. The author then discussed the possible significance and mechanism of this change.

Low, Eugene—**Mantoux and Heaf Multi-Puncture Tuberculin Tests :** Comparison in B.C.G. Vaccinated and unvaccinated subjects—Tubercle, 37, 102-110 1956.

The author compared the efficiency of Mantoux and Heaf multiple puncture tuberculin test in 1040 subjects, 420 B.C.G. vaccinated and 620 unvaccinated, in Saskatchewin, Canada. Each individual received a Mantoux test with 10 T.U. O.T. on the left forearm and a multiple puncture test on the right forearm. The latter test was performed with adrenalized undiluted O.T. (Heaf, 1953) and both the reactions were read in 48 hours—one operator reading the Mantoux and the other the Heaf test. Only induration of 6 m.m. and more were considered positive reaction. In judging the differences, the intensity of reaction, size of reaction and the age of the subject were taken into consideration. The preparatory work required for the Heaf test was insignificant compared with that required for the Mantoux test: The author's conclusions were as follows:

The Heaf test gave 15% more positive reactions in the vaccinated subjects and 7% in the unvaccinated. The Heaf reaction was easier to read particularly in the unvaccinated subjects. The reactioss were dissimilar in the vaccinated and unvaccinated subjects with both the tests. The 10 T.U. produced more intense reaction than the Heaf test and is less satisfactory in persons aged over 60 years. Thus the Heaf test was considered superior to 10 T.U. Mantoux test for tuberculin survey work, being simple with greater sensitivity and fewer doubtful and complicating reactions.

VENEREAL DISEASES

Daguet, G.L.—**Treponema pallidum adherence-disappearance Reaction** Bull. Wld. Hlth. Org., 14, 303-316, 1956.

The author describes a number of variants of the Treponema pallidum adherence-disappearance reaction, which is carried out in two stages: first, immune adherence of sensitized treponemes to normal red blood cells, and, secondly, disappearance of the antigen by leucocytic phagocytosis. The immune-adherence phenomenon by itself can be used for the detection of specific antibody; absorption experiments have shown that this antibody is different from the Wassermann reagin and closely allied to the immobilizing antibody of the TPI test.

An account is given of the results obtained with the adherence-disappearance reaction on 914 sera examined by three groups of research workers. Of 382 sera of proved nonsyphilitics (TPI negative), only one serum gave an adherence-disappearance reaction; while with 307 sera of untreated syphilitics (TPI positive) only 7 failed to react.

There are still numerous problems to be solved—those, for instance, of treponeme counts, spontaneous disappearance, lack of reactivity, antigen preparation, and criteria of positivity and negativity—but the reaction nevertheless presents even now certain advantages over the TPI test. Thus, it is possible to use suspensions of killed treponemes as antigen, eliminating the risks inherent in the use of the live organism; and the reaction takes place in a very brief space of time. allowing numerous sera to be examined in a few hours. The procedure, moreover, is relatively inexpensive, only 1 ml of antigen being necessary for each serum under test and 100 ml of antigen being obtainable from the irradiated testicles of a single rabbit.

Magnuson, H. J. and Portnoy, J.—**The Trepanema Pallidum Complement—Fixation test.** Am. J. Pub. Hlth. 46. 190-194, 1956.

395 serum samples from treated and untreated syphilitic patients were subjected to TPCF (Trep. Pallidum—Compl.—Fix) test and the results were compared with TPI (Trep. Pallidum Immobilisation) and STS

(lipid antigen) tests The principle of TPCF test is a follows: Virulent *T. pallidum* are obtained from infected rabbit testes. By differential centrifugation the trepanemes are acetone and ether extractions and the active protein-like antigen is collected from the dried trepanemes by a 0.2% solution of sodium desoxycholate. This antigen is employed in the conventional comp-fixation test. The STS gave 76.2%, TPI 78.7% and TPCF 82.3 per cent positives.

Inadequacies in serologic tests employing lipid antigens are wellknown. TPI test proved an important improvement upon the above tests but because of technical limitations a number of laboratories have been seeking easier test procedures that would prove equally efficient. In this respect the TPCF test is likely to be a reliable and useful procedure for the diagnosis of syphilis.

PLAGUE

AJL, S. J. Reedal, Jeanette S., Durrum, E. L. & Warren, J.—**Studies of Plague** I Purification and Properties of the Toxin of Pasteurella pestis—J. Bacteriology. 70: 158-69, 1955.

The authors used avirulent Tjiwidej strain of *Pasteurella pestis* to obtain the endotoxin in broth culture. The bacterial cells were collected by centrifugation washed ewice with distilled water and resuspended in a small quantity of water and extracted with 4 volumes of acetone at −70.C for 1 hour and the process was repeated three times. After evaporation of acetone the toxicity of the extract was tested intraperitonially in mice. The material was then purified by extraction with 2.5% Nacl and precipitation with ammon. sulph. of 0.2-0-6 saturation followed by isoelectric precipitation at pH 4.7 to remove the envelope substance, by manganese chloride pricipitation to remove nucleic acid, by calcium phosphate gel absorption and elution for further removal of envelope substance, by precipitation with methyl alcohol to concentrate protein, and by extraction with choloroform to remove lipoid material. Finally the toxin was concentrated by isoelectric and ammon. sulphate precipitation and by continuous paper electrophoresis. The final yield fell from 4835 mgm to 115 mgm. The LD 50 for mice was reduced from initial 18.0 ugm to 2.6 ugm. Chemically the substance was free from nucleo-proteins, carbohydrate, and capsular material; it contained 14.0 per cent nitrogen, 1.9 per cent sulphur and not more than 0.2 per cent phosphorus and was antigenic producing specific antibodies.

Warren, J., Walz, Ursula, Reedal, Jeanettee S. & AJL, S. J.—**Studies of Plague II.** Immunological Properties of Purified Pasteurella pestis Toxin—J. Bacteriology, 70: 170-76, 1955.

The rabbits injected with the purified toxin described in the preceding abstract yielded serum which compared favourably with the Lederle concentrated anti-plague rabbit serum when tested by neutralisation.

The antitoxic serum showed the following properties: It did not react with envelope antigen and therefore was shown to have been effectively freed from that substance. It neutralized toxin extracted from several strains of *P. pestis* some of which were virulent and others were avirulent, so it appeared that all these toxins had similar antigenic structure. This view was confimed by that the purified toxin reacted with antisera prepared against a varity of virulent and avirulent strains of *P. pestis*. The authors suggest that it may be possible in future studies to establish whether anti-toxic immunity alone will modify the course of plague in experimental animols.

The authors also claim that this purified toxin was found specially useful in the diagnosis of human plague by the haemag glunation test, erythrocytes treated with tannic acid and sensitized with toxin were agglutinated at much higher titres than were given by the complement-fixatios test.

What the authors have probably found is a fraction of the total somatic antigen of the organism, it would be interesting to see if this antitoxin can save the plague-infected animals. As for the diagnosis of plague much simpler technique has already been found. Nevertheless, it is an interesting study even otherwise.

SMALLPOX

McClean, D.—**The Use of Smallpox Vaccine** Bull. World. Hlth. Org., 13: 437-446, 1955.

To avoid contaminating micro-orgaisms and to reduce the amount of extraneous tissue debris, the author supports the method of preparing the vaccine by cultivating the virus

in the embryonated egg and in tissue culture. This vaccine could be dried for more convenient use. As to the strain of virus to be used he does not consider it necessary to use strains which have periodically been passed through the human object.

He then discusses a trial of the stability of dried smallpox vaccine which is being conducted by the World Health Organisation and the characteristics of a dried vaccine developed at the Lister Institute of Preventive Medicine, London. Encouraging results have also been achieved there in the production and use of virus inactivated by ultraviolet irradiation, in order to decrease the risk of complications consequent upon the use of living virus vaccine.

Consideration of the duration of immunity and the protection afforded after contact with smallpox leads to the conclusion that complete protection may be expected in most cases if vaccination is carried out within 24 hours of exposure, but that if vaccination is delayed more than three days it will have little influence on the infection.

TROPICAL EOSINOPHILIA

Ganotra and Lewis—**Hetrazan in Tropica Eosinophilia.** Ind. J. Med. Sc., 9:672, 1955.

Hotrazan in a dose of 13 mg per Kg was administered for four days in 13 consecutive cases of tropical easinophilia. The results of this group are compared with these obtained in 13 consecutive cases treated with 0.26 g. of carbarsone given twice daily for 10 days. The clinical results with hetrazan compare well with these obtained with carbarsone. The fall in the total eosinophil counts was quicker with hetrazan and an early temporary exacerbation of symptoms was noted more frequently.

ENCEPHALITIS IN JAMSHEDPUR

Seal, S. C. and Ghose Chaudhury, R.N.—**Epidemiological aspects of the 1954 outbreak of Encephalitis in Jamshedpur**—J. Ind. Med. Assoc. 26:371-384, 1956.

An epidemic of encephalitis occurred in Jamshedpur between early May and the middle of September, 1954. Of the 893 cases of unknown etiology recorded within the period, 430 were suspected to be cases of virus encephalitis—114 clinically typipcal. 67 probable and 249 possible cases. Fatality rate aws 13.5 per cent (Male—11.5% and Female—18.5%). Except for 2 cases all deaths occurred among persons below 15 years, the two worst affected groups being the infants and those between 5-10 years. Of the cases 77% were Hindus, 13.7% Muslims, 5.3% Christians and 4% Sikhs.

At first the disease appeared to be confined to children only. Closer investigation revealed that there were at least three typ of cases namely (1) severe toxic or fulminating type, (2) relapsing or diphasic type and (3) abortive or mild type. The onset in the typical case was sudden, the symptoms appearing 4 to 5 hours after an apparently healthy child had gone to sleep when he woke up as if in fright crying followed by signs of chill or rigor, flushed face, congested eyes, slow pulse and temperature shooting up to 104°-105°F and even higher. Typical encephalitic symptoms followed and death was by respiratory failure. In the diaphasic type fever came in two bouts, the first lasting for 1 to 4 days and the relapse for 2 to 4 days intervened by a period of remission for 2-4 days. It usually occurred in the elderly children or adults and the symptoms though less severe led to prostration but no death. The abortive or milder type was seen among the grown-ups. The symptoms were milder lasting for 1 to 6 days but leaving the patient fairly exhauted.

Among other features there was increase in either neutrophilic or lymphocytic leucocyte count, in the majority of cases the total count varying between 10,000 and 46,000 per c.m.m. Hypoglycæmia was discovered as a clinical feature in severe cases, in some of which there was a corresponding fall in the C.S. fluid. No other significant change was noted in the C.S. fluid. In urine albumen was present in 13.7% and sugar in 5.1% of cases. Pus cells were present in 32% stool samples and r.b.c. in 10 per cent. No known pathogenic organism was isolated from the blood, stool or urine, nor the seological tests carried out against *S. typhi, S. paratyphi, Proteus* OXK, OX_2, *B. abortus* or *melitensis* was positive. Inoculation tests in animals were also negative.

The cases occurred throughout the town and even extended to suburban areas. The earliest case occurred in a young man of 18 in the Mohulbera Vasti (Ward IV) who had come from an outside place only 4 days prior to symptoms. The minimum incubation period was estimated to be 4 days. At least

367 families were affected, 37 or 10% families having multiple (2.46 per family) cases but cross infection in the hospital wards was not seen. In the families with multiple cases the average number inmates was 9.6 as against 7.0 per family in the general population. Expecting 9 individuals all were vaccinated against smallpox. Only 17.2% of patients investigated gave history of recent movements. Amongst the patients 12 were breast-fed babies.

Overcrowding was present in 25% of the households and the sanitary conditions or state of repairs were unsatisfactory in about the same numbers. Night soil was disposed of by water carriage system in the main part of the town. Some areas were provided with open bucket type of latrines and open fields were being used by the people in the suburban areas. The town is supplied with a piped filtered water which is chlorinated before distribution. The water supply in the outskirts and suburban areas was from tube-wells and wells. There was actually a diminished rainfall in Jamshedpur during the months of May, June, July and August, 1954 and humidity was also somewhat less.

Both clinically and epidemiologically the disease appeared to be arthropod-borne virus encephalitis of the type of Japanese B, Australion X, St. Louis, Equine or West Nile. But all attempts made by the workers of the Poona Virus Research Laboratory failed to isolate the virus which could be definitely incriminated. Various arthropods examined were also negative. The results of controlled insecticidal measures adopted in a part of the town yielded no conclusive evidence of any arthropod vestor being involved in the transmission of infection, but there was evidence to show that the disease was not new in the town. The isolation of Coxsackie virus group A type 4 from the stools of certain patients by the V.R.C. workers led to the suspicion of intestinal virus and later neutralising antibodies against Coxsackie B_2 virus suspected to be associated with the encephalitic symptoms was detected in four acute sera.

The author discussed the findings and did not like to entirely rule out insects as the possible vector till a definite source was discovered and in the meantime he was in favour of environmental sanitation to continue as the sheet anchor of control measures.

(One of the reasons given for the absence of cross-infection in the wards may be the absence of arthropod in the hospital wards, if the hypothesis of arthropod as its vestor is correct—Ed.).

[Abstracts prepared by—S.C.S.]

NOTES & NEWS

Need of Health Education Plan in the Rural Areas

Speaking at the inauguration of the new Maternity and Child Health Project, and a students' hostel at Singur, near Calcutta, the Union Health Minister Rajkumari Amrit Kaur, emphasised the need for an effective health education programme in the rural areas. She said, "Much of ill-health in rural areas is due to ignorance of health rules. Knowledge of this has to be imparted to the villagers making them health conscious. Progressive countries have achieved striking results through effective health education programmes."

She also said "the expansion of the Singur Health Centre will not only provide improved curative, preventive and social welfare services to the people of the area, but will also help to raise to a higher level practical field facilities for the training of students in public health. In the expansion programme high priority has rightly been given to improved maternity and child health services. In order to build up a strong and healthy nation this is most essential. The data available shows that the Singur Health Centre has so far not been able to extend proper confinement facilities to more than 25 per cent of expectant mothers in the area."

Nevertheless, the Minister added, much reduction in maternity and child mortality rates had already been achieved at Singur. She expressed the hope that the increase in the staff and other facilities at the centre would help further to reduce the mortality rates.

The number of trained dais (midwives) actually working in Singur was still very inadequate. It was necessary to have in every village in the thana at least one trained dai and to arrange for proper supervision and guidance of her work. This could only be done by intensified training and service programmes.

Continuing, the Minister said that another important aim of the centre was to serve as a practice field for the training of public health students of different categories who came from all over Inlia. The inadequacy of trained personnel for carrying out health projects had always been and still was a great drawback. The All-India Institute of Hygiene and Public Health, which was the only institute of its kind in India, had assumed the responsibility for this training and the Singur Health Centre, as the rural practice field of the Institute, could play a very useful part in this training programme.

Healthy Living and Fewer Hospitals

Clean and healthy living should be given preference over the opening of more hospitals, declared Rajkumari Amrit Kaur, Union Health Minister, in Teharpur village near Shahdara on 6-4-56 at the opening ceremony of Samaj Kalyan Kendra in the village which would provide facilities for maternity, child welfare and literacy classes. Creche has also been provided in the Kendra for the convenience of working women.

The Health Minister praised the Chinese example of killing flies and asked the village people to follow the Chinese example in order to keep their villages free of flies.

Leprosy Control Needs Hard Work

Speaking at the annual general meeting of the Hind Kusht Nivaran Sangh (Indian Leprosy Control Association) on 20-4-56 Dr. Prasad said that a nationwide problem like leprosy control could be solved only by carrying out a dynamic programme and by intensive work.

"The time has certainly come", he said, "when we cannot be satisfied with little cases of compassionate work here and there which are at best the reflection of the spirit of exceptional dedication. The spirit of dedication should spread itself so that we may sense the inspiration of it everywhere."

Successful treatment of leprosy had again created the prroblem of rehabilitating the

cured patient. "I am sure that the voluntary associations, which have always been the first to respond on such occasions, will come forward with constructive plans. They will naturally have the Government's sympathy and support is this work."

Leprosy Menace can be ended

The Executive Board of W.H.O. has decided that the time was ripe for large-scale campaigns against leprosy in every country affected by the disease. According to this Board, sulphones, synthetic drugs first tried out during World War II, bring about considerable improvement, if not complete cure, after one or two years' treatment. Because lepers are no longer treated as outcasts and because of growing confidence in the new drugs, more and more sufferers have been coming forward for treatment. A W.H.O. report has estimated the number of lepers as 10 or 12 million.

The W.H.O. Expert Committee on Leprosy declared in 1952 that it is a myth that leprosy is highly contagious. Women suffering from leprosy can give birth to perfectly healthy children and the risks of contracting leprosy are infinitely smaller than those associated with tuberculosis.

The Committee stressed the futility and even the danger of measures for the compulsory isolation of lepers. There should be segregation only in case presenting a real danger of infection.

Broadcasting of Health Problems to Masses

Dr. William W. Frye, Professor of Tropical Medicine and Dean of the Louisiana State University, U.S.A. recently visited India and being pleased to see the progress in Medical and Public Health in the country remarked "You have built new hospitals and medical institutions and have made great advances during the past few years. Your health institutions are also doing magnificent job and have some outstanding men engaged in basic work." He also felt that more American Medical men should visit India to become acquainted to the good work done in the Health Institutions in this country, particularly against malaria and tuberculosis. Now India must also persue a programme of eradication of malaria.

The most important thing which he wanted to stress was that India should adopt a programme of broadcasting health problems to impart knowledge about the disease to the masses. In America this had been tried with good results. In his University they organised health forums once in every three months to talk about diseases in popular language to the people. Men and women packed their auditorium to listen to their talks. One of their newspapers of the city took a keen interest in the health forum and published articles on the subject.

Biggest Menace to Health

An American scientist has challenged in Washington the Atomic Energy Commission's view that H-bomb tests can be continued indefinitely without endangering world health.

In an interview to the Press Dr. Ralph E. Lapp, the famous atomic scientist said, that there was real danger of world-wide increase in cancer resulting from continued tests. Reports published, said Dr. Lapp, accused the Atomic Energy Commission of "Sugar-coating bitter facts about atomic fall-outs" and of "double-talk with regard to long-term hazards from nuclear detention.

A member of the Commission, Dr. Willard Libby, is reported to be in agreement with Dr. Lapp that the chief long-term threat comes from radioactive stontium, one of the elements produced when uranium atom splits. The element, it is said, is similar to calcium and tends to cause cancer by concentrating in bone structure. Dr. Lapp, however, admitted that so far this element had not over-loaded the atmosphere with the hazardous strontium.

WHO wants to see Malaria Gone ?

A committee of the ninth World Health Assembly urged the necessity of programmes to eradicate malaria and not merely to keep it in check. The committee found that schemes for total eradicatios would be cheaper in the long run. In addition the potential danger of mosquitoes developing resistance to insecticides would be avoided.

A vote of 50 in favour, none against and four obstestions, backed the committee's stand for eradication as the only means of relieving millions of sufferers from malaria. The Director-General of the W.H.O., Dr. M. G. Candau, was authorised to invite contributions to the world malaria fund set up at the 1955 Health Assembly from governments, non-goversmental organisations and private

sources. Governments which have contributed so far to the fund are those of Brunei, Nationalist China, West Germany, Iraq and Lebanon.

Inspect Resistance to D.D.T.

The development of resistance by disease-bearing insects to insecticides has become a public health problem of the greatest importance, according to a resolution adopted by the executive board of the World Health Organization which met in Geneva on January 31.

Dr. M. B. Candau, Director-General of the organizations, said that 32 countries had reported insect resistance to D.D.T. and other new insecticides. Various types of malaria-bearing mosquito, body lice which spread typhus, fleas responsible for plague, and a strain of mosquito from Trinidad which spread yellow fever had all shown themselves to be extremely resistant to insecticides.

"Should the degree of resistance, in vectors of diseases such as malaria, yellow fever, plague, and typhus reach the point where control by available insecticides is no longer possible, disastrous results from a health view-point will inevitably occur in many parts of the world", Dr. Candau said. The resolution adopted said that a determined effort must be made to avoid what might well become a catastrophe for world health, and that the world must assume responsibility for co-ordinating and stimulating research to combat this new danger.

UNICEF'S Plan for Aid to India

A million dollars for development of rural health services throughout India will be recommended by the executive director of the UNICEF. India will also get part of the $855,000 towards her emergency feeding programme. She is sharing this allotment with Korea. UNICEF sources paid in allocation of $25,000 for fellowships at a Calcutta training centre will enable ten non-Indian doctors to take postgraduate study in maternal and child health. Both in India and Pakistan vaccination programmes to prevent tuberculosis will be supplemented by domicillary treatment of active cases with drugs contributed by the fund.

In all, allocations totalling nearly $8.50 million for child aid programmes in 47 countries and territories were recommended at the spring session of the fund s executive board.

XV International Congress of History of Medicine

The 15th International Congress of History of Medicine will be held in Madrid and Salamanca, in the latter half of September, 1956.

International Congress of History of Science

The 8th International Congress of History of Science will be held in Florence and Milan, in the first week of September, 1956.

University Centenaries in 1957

Established in 1857, the year of the first war of independence in India, Calcutta University—the oldest in this country—will celebrate its centenary from January 19 to January 24 next year. The University authorities desire to make the centenary a national celebration and expect that the alumni, wherever they are, will think of their Alma Mater on this occasion and give their help and co-operation. A week later, Madras Univtrsity, and in early February Bombay University will also celebrate their centenary.

There would be a nuumber of functions in celebration of the Calcutta University centenary ending on January 24 with a special convocation for distinguished guests. Among others, many eminent people from different parts of this country and abroad who would be attending the Indian Science Congress session in Calcutta at the time would be invited to take part in the celebration. A board of editors has been appointed to write a history of the University.

POPULATION AND BIRTH CONTROL

The mid-year 1954 World population released in a quarterly publication by the U.N.O. Statistical Office is estimated to be 2,655 million, i.e., 255 million more than the 1950 figure of 2,400 million. The big jump is partly due to the adoption of 1953 population figure of 582,503,000 released in Red China, which has pushed the revised estimate by more than 100 million. The corrected estimate according to the *U.N. Demographic Year Book* for 1953 is however, 2,504 million for 1950 and 2,652 million for 1954, showing an increase of 148 million, i.e., average 37

million or 1.5% annual increase which is higher than the previous estimate of 1.25 per cent per annum. This four years' rise splitted up by continents stands as follows: Asia—83 million, Africa and U.S.S.R.—12 million each, North America, South America and Europe—11 million each, Middle America—5 million and Oceana—14 million. The average annual rate in Latin America is **2 per cent** and that of Europe less than 1 per cent.

Family Planning Programmes:

The Family Planning Programmes and Research Committee of the Government of India have requested about Rs. 100,000,000 for an expanded family planning programme. The First Five Year Plan allocated Rs. 6,500,000 for the project. The programme is divided as follows:

(1) Subsidies to State government, local authorities and voluntary organizations for the opening of clinics.

(2) Training programme for required personnel.

(3) Education for family planning.

(4) Research programme (medical and demographic).

(5) Central orgasization (administrative).

One of the foremost voluntary organizations which has received government money is the FPASC India which embraces both the scientific and social aspects of the work. Since the Association began is 1949, four distinguished conferences have aroused national and international interest: two All-India conferences; the Third Conference of the International Planned Parenthood Federation; the recent Scientific Seminar on Family Planning. The colossal tasks of trying to reach some of India's farflung villages is being tackled.

Lack of trained personnel in the entire health field is a major handicap. Nevertheless, according to the figures of Health Minister Rajkumari Amrit Kaur published in WHO (Jan. 1956), India has made great strides.

	1945	1954
Mortality rate ...	21.8 per 1000	13.4
Infantile mortality rate	158.0 per 1000	116.0 (1952)
Expectation of life ...	27 years	32

Health Planning in the Second Five Year Plan

The Planning of health in the second five-year plan should be of interest to all medical and public health workers. Below we publish the relevant portion of Chapter XXV of the Second Five Year Plan—

The objective of health programmes is to improve the general level of health by expanding the basic health services and bringing them within the reach of the people. More specifically, the aims which the Second Five Year Plan empasises are:

(1) Control of communicable diseases which affect large sections of the community;

(2) Improvement of environmental hygiene;

(3) Provision of adequate institutional facilities to serve as a base for organising health services;

(4) Provision of facilities for the training of medical and health personnel; and

(5) Family planning.

As against Rs. 131 crores provided in the first plan for health prpogrammes, the second plan provides Rs. 267 crores.

During the Second Five-year plan it is intended to provide for larger hospital accommodation and to improve the services in hospitals, including staff, accommodation equipment and supplies. For this purpose the plan provides about Rs. 43 crores. It is estimated that in 1951 there were 8,600 medical institutions in the country with about 1,13,000 beds; in 1955-56 the number of institutions is estimated to be about 10,000 with about 1,25,000 beds. These figures represent an increase during the first plan, of 16 per cent in institutions and of 10 per cent in beds. At the end of the second plan the number of medical institutions is likely to be 12,600 and the number of beds about 1,55,000 so that the increase expected is about 26 per cent in institutions and about 24 per cent in hospital beds.

The provision of rural medical and health care is the central problem in health planning. This object is to be achieved through the setting up of 'health units' in national extension and community projects. During the first plan, in all 725 health units were expected to have been set up. while in the second plan it is proposed to establish over 3,000 health units in community project. national extension and other areas. State Governments also propose to convert 131 of the existing dispensaries into primary health units and to set up a number of secondary health units. The plan provides about Rs. 23 crores for this programme.

Personnel Requirements.

The key to the extension of health services and their efficient operation is the availability of trained personnel of all categories. Training programmes have, however, to be linked with employment opportunities which are likely to become available. As against 59,300 registered medical practitioners at the end of 1950, it is estimated that by the end of the first plan their number would be about 70,000. At the rate of one doctor for every 5,000 population at the end of the second plan about 80,000 doctors will be needed. Allowing for supervisory posts, the number of doctors needed will be about 90,000. That is to say, each year 4,000 more doctors are required.

The number of medical colleges has increased from 30 in 1950-51 to 42 in 1955-56 and the number of annual admissions from 2,500 to about 3,500 providing at present for a net annual out-turn of about 2,000 doctors State plans provide for the expansion of about 28 medical colleges and attached hospitals. The Central Government will assist the setting up of 6 new medical colleges and the establishment of full-time teaching units and of Preventive Medicine and Psychiatric Department in medical colleges. Provision has also been made for completing the All-India Institute of Medical Sciences and upgrading certain departments of medical colleges for post-graduate training and research.

Shortages in personnel other than doctors have been more marked and are likely to persist longer than in the case of doctors. As norms to aim at there should be one hospital bed for 1,000 population, one nurse and one midwife for every 5,000 population and one health visitor and one sanitary inspector for 20,000 population. Figures in the last column in the table below illustrate character of the present shortages of doctors and other personnel and the need for accelerated and sustained action if even elementary services are to reach the mass of the people in any adequate degree.

Personnel:	1950-51	1955-56	1960-61	No. needed
Doctors ...	59,000	70,000	82,500	90,000
Nurses (including auxiliary nurse-midwives) ...	17,000	22,000	31,000	80,000
Midwives ...	18,000	26,000	32,000	80,000
Health Visitors	600	800	2,500	20,000
Nurse-dais and dais ...	4,000	6,000	41,000	80,000
Health Assistant and Sanitary Inspectors	3,500	4,000	7,000	20,000

During the second plan, an attempt is being made to achieve substantial advance in the provision of training facilities for different classes of personnel. Arrangements are being made for the training of nurses, midwives, pharmacists, sanitary inspectors and other technicians at medical colleges and at the larger hospitals which are not in use as teaching hospitals. There are at present 6 dental colleges in the country and they need to be more adequately staffed, equipped and housed. It is proposed to establish 4 new dental colleges and expand two existing colleges. The plan provides about Rs. 40 crores for various training programmes.

Control of Communicable Diseases.

During the first five-year plan an effective beginning was made in the attack on communicable diseases. The principal diseases in this group are malaria, filariasis, tuberculosis, leprosy and venereal diseases. As compared to Rs. 22 crores allotted in the first plan for the control of communisable diseases, the second plan provides about Rs. 58 crores. The malaria control programme for which alone Rs. 28 crores have been allotted under the second plan envisages the institution of 200 units as against 162 units set up during the first plan. Each unit will protect a million persons through indoor spraying with DDT and treatment of malaria cases with anti-malarials. For filariasis control, 65 control units are to be set up in addition to the 13 control units and 22 survey units established during the first plan. Rs. 9 crores have been allotted for the control of filariasis.

In tuberculosis control, the primary emphasis is on prevention. This is to be achieved by extensive B.C.G. vaccination carried out by 130 B.C.G. teams, establishment of clinics, organisation of domiciliary treatment, demonstration and training centres and to a limited extent provision for isolation and rehabilitation. During the first plan 166 clinics have been set up, and this would be increased to about 340 in the second plan. It is proposed to set up 10 training and demonstration centres and 10 after-care colonies and rehabilitation centres in the 2nd Five Year Plan. About Rs. 14 crores have been provided for tuberculosis control.

Leprosy Control.

The programme of leprosy control is to set up held control units which would survey

and determine the extent of incidence of the disease and also provide domiciliary treatment to the cases as well as to contacts. During the first plan period 35 centres have been set up; in the second plan it is proposed to provide 88 additional control units. The Central Government has set up a Central Leprosy Teaching and Research Institute. The total provision in the plan for leprosy control exceeds Rs.4 crores.

In some parts of the country venereal diseases are a large and urgent problem. With the recent advances in diagnosis and cure of this group of diseases, it is possible to reduce the incidence of infection if certain public health techniques are integrated in the prgoramme of venereal diseases control. Proposals in the plans of States for the control of venereal diseases need to be reviewed from this aspect.

Nutrition.

The most important single factor in the maintenance of health is nutrition. With the improvement in the production of cereals in the first plan, there will be greater stress now on increasing the production of protective foods such as milk, eggs, fish, meat fruits and green vegetables. Priority in improving nutrition is to be given to vulnerable groups such as expectant and nursing mothers, infants, toddlers, pre-school children and children of school-going age. The resources available for development are still too limited to permit more than a small beginning in these directions.

The Indian Council of Medical Research has selected the following projects as deserving of high priority for implementation during the second plan:

(1) Survey and prevention of protein malnutrition;

(2) growth and physical development of Indian children;

(3) control of dietary and nutritional diseases like lathyrism, endemic fluorosis, etc;

(4) clinical nutrition research;

(5) food technology (par-boiling of rice);

(6) mid-day meals for school children;

(7) studies on the evaluation of nutritional status and studies into certain aspects of energy metabolism and protein, vitamin and mineral metabolism;

(8) expansion of nutrition research laboratories.

Environmental Hygiene.

Water supply and sanitation programmes have a high priority in the development of health services. The first plan provided for these programmes—Rs. 24 crores for urban areas and Rs. 18 crores for rural areas. The plans of States included 168 urban water supply schemes and the Central Government approved or took preliminary action in respect of about 150 urban water supply schemes. For the second plan, State plans have provided about Rs. 28 crores for rural water supply schemes and Rs. 10 crores for urban water supply. A provision of Rs. 50 lakhs has been made for training of public health engineers, overseers, sanitary inspectors etc. in the Second Plan.

Indigenous System of Medicine.

Plans of State have provided over Rs. 5 crores in support of indigenous systems of medicine, which continue to cater to the needs of large numbers of persons in urban and rural areas. During the second plan improvements will be effected in 13 Ayurvedic colleges and 225 dispensaries and 5 new colleges and about 1,100 dispensaries will be set up. The Central Government has provided for research and higher education in indigenous systems.

Maternal and Child Welfare.

Maternal and child health programme are proposed to be integrated with the primary health unit services. The plans of States provide for the setting up of a about 2,100 maternity and child health services. It is therefore proposed to start five regional training centres in pediatrics to give adequate training for medical as well as associated personnel in preventive and curative pediatrics.

Family Planning.

The programme of family planning which was started during the first plan will be con-

ANNOUNCEMENT

Colonel Amir Chand Trust prizes for Medical Research.

Indian Council of Medical Research—

Lieut.-Colonel Amir Chand, ex-Principal, Lady Hardinge Medical College, New Delhi, has made a donation of Rs. 50,000/- to the Indian Council of Medical Research for the purpose of awarding prizes for the best published research work in the field of medical sciences. The Governing Body of the Council has constituted a Trust called the "Colonel Amir Chand Trust" for the administration and management of the Fund.

Six prizes, of almost equal value, of which some may be in the form of medals, are awarded annually on an All-India basis for the best published research work in any subject pertaining to all fields of medical sciences in general including clinical research. The term, "Clinical Research" will imply research into the mechanism and causation of diseases, including its prevention and cure. It covers not only work in patients in hospitals, but also fields studies in epidemiology and social medicine and observations in general practice.

THREE of the Prizes are known as "BASANTI DEVI AMIR CHAND PRIZE" and the other THREE "SHAKUNTALA DEVI AMIR CHAND PRIZE".

Two out of the six prizes shall be awarded to graduates of not more than ten years standing. counting from the date of graduation, provided that the work for which the prizes are to be awarded is of approved merit.

The Competitors for the prizes may be MEDICAL or NON-MEDICAL graduates.

The selection of candidates for the award of the prizes will be made by a Selection Board appointed for the purpose.

In a Joint Publication the prize shall be divided between the joint workers in such proportion as the Selection Board may recommend.

It has been decided to award during 1956 six prizes of the value of Rs. 300/- each for the best research papers in medical science published by workers during the year 1955 (1st January to the 31st December, 1955).

The award of the prizes will be announced at the annual meetings of the Scientific Advisory Board and the Advisory Committees of the Indian Council of Medical Research, to be held at Mysore in November/December, 1956.

The CANDIDATES are required to submit 10 REPRINTS of their papers published during 1955. These should be sent to the DIRECTOR, INDIAN COUNCIL OF MEDICAL RESEARCH, "P" BLOCK, RAISINA ROAD, NEW DELHI, so as to reach him NOT LATER THAN THE 1st AUGUST, 1956.

The Papers should be accompapnied by a short biographical sketch and two copies of PASSPORT SIZE PHOTOGRAPHS of the worker or workers concerned.

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tinued on a substantially increased scale. The porgramme includes—

(1) Grants to State Governments, local authorities and voluntary organisations for opening family planning clinics,

(2) Training of personnel,

(3) Public education on family planning and population problems,

(4) Research in human fertility and in the means of regulating it, and

(5) Demographic research, inlcuding the study of inter-relationships between social, economic and population changes, reproductive patterns and attitudes and motivation, affecting the size of the family and suitable procedures for the rapid education of the people.

About Rs. 5 crores have been provided for the family planning programme. It is expected that about 300 urban and 2,000 rural clinics will be set up during the second plan.

Health Education.

The provision of medical and public health facilities will achieve the objective of promotion of positive health in the measure in which the people take full advantage of these facilities and change their health practices and attitudes. This calls for a special effort towards general health education. About Rs. 75 lakhs has been provided for health education programmes in the second five-year plan.

[Notes & News prepared by—S.C.S.]

REPORTS & REVIEWS

SEWAGE DISPOSAL, RURAL AND URBAN

Appreciating the prime importance of environmental sanitation in the control of preventable diseases arising from inadequate methods of sewage and excreta disposal, and recognizing the very high incidences of such diseases, which sap energies and stamina of the people, and thus interfere with the raising of social and economic standards, a seminar on sewage disposal, rural and urban, was organised by the Regional Office for South East Asia of the World Health Organisation at Kandy, Ceylon on 15-27 August, 1955.

Six countries of the South East Asia, *e.g.* Afghanisthan, Burma, Ceylon, India, Indonesia and Thailand and five from the Western Pacific, *e.g.* Federation of Malaya, Japan, Philippines, Sarawak and Singapore participated. The delegations were technical personnel actively engaged in various fields of sanitation, who discussed the following problems in five subcommittees, four of which were presided over by the Indian engineers.

(1) In Asian conditions, what methods of excreta disposal for rural areas satisfy the following criteria: public health, simplicity, economy and acceptability?

(2) How can recommended methods for the disposal of excreta in rural areas of Asia be implemented to ensure their widespread and continued usage with consequent improvement of the general standard of sanitation?

(3) What can be done in the unsewered urban areas to minimise the hazards of environmental diseases?

(4) What climatological, cultural or other factors must be taken into consideration when designing waterborne sewage systems based on the experience of non-Asian countries in research and design? How do they affect the operation and maintenance of this system?

(5) What criteria should be used to justify treatment or non-treatment of water-borne sewage in urban communities of Asia?

The purposes of the above discussion was to elicit principles which could guide WHO in its regional programme and at the sametime to disseminate instructions about the design, construction and operation of sanitary disposal of sewage and human wastes, to demonstrate the relationship between good sewage disposal and public health and to provide for a forum for exchange of information and experience for the better understanding and tackling of the problem by the representative members in their respective fields.

WHO had deputed experts to help the delibrations of the discussion regarding the planning and organisation for rural sanitation is given below:

The problem of rural sanitation in Asiatic countries is colossal. Failure to make adequate progress in rural sanitation is due to the non-acceptance of the sanitary conveniences by the people, the deficiencies in the educational approach and absence of co-ordination among various types of workers now engaged in rural sanitation work. It was agreed that the planning of rural latrines should be done on the basis of co-operative action through some village organization and that the latrine construction should be carried out simultaneously with improvements of water supply. It was also agreed that the work on rural sanitation scheme should be initiated at health and medical establishments where the methods can be fully demonstrated, and next at schools, before the programme is introduced among the villagers. A follow-up until the people themselves insist on following sanitary excreta disposal habits.

The committee then discussed the basic designs for rural latrines, *e.g.* (1) Earth-Pit latrine, (2) Water-seal latrine and (3) Overhanging latrines.

1. *Eath-Pit latrine :*

It was concluded that the simple earthpit latrine with openhole squatting slab was applicable for use in most of the rural areas of Asia. It is the simplest and the cheapest sanitary facility for this purpose. Its disadvantages such as, bad odours and fly breeding, were recognized but it was felt that even with these limitations it could play a major role in the prevention of filth-borne diseases. It was specially recommended for these areas where water-seal types are not practicable due to lack of flushing water.

2. *Water-seal latrines :*

There is an increased interest in the water-seal type latrine in Asian countries and the water-seal principle appears to be more easily accepted by the rural people of the region. It blends well into the customs and religious patterns and has public health advantages over the elementary types of latrines; these are:

(1) It can be installed near or inside the house;
(2) It encourages a higher standard of maintenance;
(3) It minimizes contact with flies and insects;
(4) The door nuisance is kept to a minimum;
(5) It is entirely safe for children;
(6) The digestion and compaction of waste are more rapid;
(8) The service life of the pit is longer;
(8) It can be used in a wide range of soil types;
(8) It is applicable to high ground-water conditions;
(10) It can function with personal cleansing materials of water, paper and leaves.

The disadvantages are:

(1) It can be used only in areas where water is easy to obtain the year round;
(2) It requires a period of intensive education in its proper use and cleaning;
(3) Slightly greater cost than for pit types is involved in constructing it;
(4) It requires more supervision in construction;
(5) In some areas it will require a change in customary cleaning material currently in use, such as sticks, stones or mud balls;
(6) It may require outfalls in imperable soil types.

3. *Overhanging latrines:*

People who inhabit certain areas which are frequently or periodically covered or flooded with water are forced to use the overhanging latrines. The health hazards under such conditions are difficult to evaluate, especially in the light of the existing knowledge. It was felt that in such cases a carefully located "overhanging" or "drop" latrine might be the only measure to be applied. Such a latrine was thought to be acceptable, provided the following general conditions are met:

(1) The receiving water is of sufficient year-round salinity to prevent human consumption.
(2) The latrine is installed over such water depth that the bottom is never exposed during low tide or the dry season.
(3) Every effort is made to select a site that will provide for carrying floating solids away from the village and will provide dilution.
(4) There is a stream flow of 0.5 cubic feet per second per family for adequate dilution.
(5) The walkway, piers, squating openings and superstructure are made structurally safe for adults and children.

There was reluctance to give support to this technique, however, the reluctance was based on:

(*a*) the relatively long survival rates of pathogenic organisms in fresh and brackish tropical waters;
(*b*) the universal habit of prolonged contact with water in bathing and fishing; and
(*c*) the possibility that the practice of making this type of latrine would become established upstream, where it would empty into smaller and fresh-water courses.

It was agreed that such latrines should be considered only in places where the conventional terrestial type could not be located. It was also stressed that the practice of drinking from any surface stream in the populated areas of Asia is not safe at present and that the surface waters are expected to become progressively more contaminated as cities and towns become more highly developed and populated.

FIRST CONFERENCE OF THE STATE PUBLIC HEALTH ENGINEERS AND NATIONAL SANITATION PROGRAMME

Immediately after the W.H.O. Sominar on Sewage disposal at Kandy, Ceylon, the first conference of of the State Public Health Engineers called by the Government of India was held at Delhi in September 1956. Mr. O. C. Hopkins, Advisor in Public Health Engineering, Government of India spoke on the National sanitation programme, the text of which is given below:

Water supply and sanitation programs have a priority in development of health services as outlined in the Second Five Year Plan. We may well be proud of our accomplishments in general but dissatisfied with our progress in certain specific areas. During the First Five Year Plan there were provided Rs. 26 crores for urban water supply and sanitation projects and Rs. 22 crores for rural projects. Of these amounts there were provided for the National Water Supply and Sanitation Program Rs. 12.76 crores for loans to Municipalities and Rs. 6 crores for grants for 50% of the cost of schemes in the rural areas. In addition to funds for these projects the Community Projects Administration has operated three orientation centres for health personnel including sanitary inspectors. The All India Institute of Hygiene and Public Health has carried on research on industrial wastes and septic tanks with funds provided by the Indian Council of Medical Research. The State public health engineers held their first conference in New Delhi in September 1955. Public Health engineering organization has been established in the Centre and in most of the States. In practically all instances the existing public health engineering organisations have been strengthened.

The above are some of our accomplishments under the First Five Year Plan and the ones, I think, we may be exceptionally proud of are: (1) the large number of water supply and sanitation schemes which have been started and many of them completed in the First Plan period; (2) establishment of public health engineering organisations and strengthening of these organizations in the States; and (3) the conference of public health engineers which was unusually constructive.

However, we should be quite dissatisfied at the rate of progress in using funds provided for the National Water Supply and Sanitation Program. The Health Minister has stated: "In the urban program only about 50 per cent of the sanctioned amount of Rs. 12.72 crores has been so far utilized. In respect of rural schemes less than one-third (Rs. 153.77 lakhs) of the sanctioned amount of Rs. 6 crores had been spent." This has been due, in part, to the following: (1) Lateness of approval of programs; (2) Lack of dequate organizations; (3) shortage of materials and personnel; and (4) lack of specific organization for carrying on rural water supply and sanisation programs. Most of these deficiencies can be overcome in the Second Five Year Plan, but the development of a satisfactory rural sanitation program is still in the future. Much depends on adequate research.

For the Second Five Year Plan, state plans have provided about Rs. 23 crores for urban water supply and Rs. 27 crores for rural water supply schemes of which 50 per cent will be a grant from the Centre. At the Center an amount of Rs. 25 crores being provided for urban water supply and sanitation schemes and provision is being made to the extent supply and saniation schmes and provision is being made to the extent of about Rs. 10 crores for assistance to Municipal Corporations mainly towards their water supply and sanitation programme. In addition Rs. 50 lakhs have been provided for training public health engineers, overseers, sanitary inspectors, water and sewage plant operators in public health and water supply and sanitation. The programe has been tentatively approved and it is hoped that we able to train an adequate number of personnel to carry on our public health engineering program satisfactorily.

It is unanimously agreed that one of our great needs is research in public health engineering in order that the answer to some of our environmental hygiene problems may be found within the limits of our indigenous resources. The first conference of public health engineers recommended that there should be a Public Health Engineering Institute in the Ministry of Health and it should be created during the Second Five Year Plan period by expanding the present engineering research activities at the All India Institute of Hygiene and Public Health. As recommended plans have been developed for expanding the research activities on industrial wastes.

and septic tanks and carrying on new research projects in rural sanitation. The Council of Scientific and Industrial Research also realizing the need for public health engineering research has appointed a Committee to assist them in developing such research. The Ford Foundation and World Health Organization likewise are co-operating with the Ministry of Health in some action-cum-research projects in rural sanitation.

In accordance with the recommendations of the first conference of health engineers, the Director General of Health Services has recommended to the Ministry that two official committees be established, one on Public Health, Engineering Practices and the other on Water supply and Standard Methods of Water and Sewage Analysis. In addition the chairman of the Conference has appointed a committee to draw up constitution and bye-laws for the guidance of future Conference.

From the above it is evident that National Water Supply and Sanitation Programs does indeed have a very high priority in the developing accomplishments are inadequate. Our biggest problems lie in developing adequate organizations to carry on our rural sanitation schemes and research programs, lack of trained personnal to staff these organizations, and shortages of the materials to construct our schemes. With your help these problems will be solved.

Discussion :

A large number of Public Health Engineers from different states took part in the discussion and made various comments and suggestions which are sumarised below:

Some of the difficulties in the execution of the project mentioned were (1) lack of suitable Public Health Engineers, (2) lack of necessary data for design, (3) lack of funds and red tapism, (4) non-availability of lands and (5) scarcity of material.

To overcome the above difficulties the various suggestions putforward were: (1) help from centre is necessary (2) education should be organised for rural sanitation (3) community project work should be handled by qualified engineers (4) every state should have a Public Health Engineering Department with provision for expansion (5) in certain states geophysical investigations are necessary (6) long term loans at small interest should be raised for sanitation work (7) to overcome the shortage of personnel, scholarship should be given, the number of institutes for training increased and the graduateship in technology should be further subdivided as B.E. (struct), B.E. (P.H.), B.E. (H.I.) and so on. (8) Public Health Engineering Branch of the Directorate of Health Services should encourage research in public health engineering.

New developments in Environmental Sanitation.

1. The Indian Council of Medical Research has started a subcommittee for carrying out research work in the field of environmental sanitation.

2. The Council of Scientific and Industrial Research has also made a provision for starting a Research Institute in the field of environmental sanitation, which will provide for postgraduate training.

3. News has come from Madras that a postgraduate Public Health Engineering College is being started at Guindy. This will be the second institute of its kind in India, the first being the All India Institute of Hygiene and Public Health, Calcutta.

Mortality from cancer of digestive organs.

Next to heart diseases, cancer is the largest cause of death in the mojority of highly developed countries. Highest on the list of cancer deaths—from

In the mortality from all cancers of digestive organs :

Countries	Stomach cancer represents		Large intestine cancer represents		Rectum cancer represents	
	M	F	M	F	M	F
Canada	39.9%	28.2%	21.2%	34.1%	13.1%	10.1%
United States	31.5%	22.6%	23.2%	34.4%	13.0%	12.1%
Japan	70.3%	66.0%	2.0%	4.2%	4.2%	5.0%
Germany, Fed. Republic ...	54.6%	46.3%	7.9%	8.9%	10.2%	7.2%
Italy	57.4%	50.2%	7.9%	12.0%	5.9%	5.8%
Netherlands	53.0%	42.1%	12.7%	19.1%	11.0%	8.7%
Scotland	39.0%	33.9%	25.3%	31.7%	13.7%	10.6%
United Kingdom	40.0%	34.2%	20.6%	29.9%	17.0%	13.5%
Australia	42.0%	34.0%	22.3%	34.3%	11.3%	8.7%

39 to 73 per cent of the total, according to countries —are those caused by cancer of the digestive organs (oesophagus, stomach, small intestine including duodenum, large intestine, rectum, biliary passages, liver, pancreas and peritoneum).

Important factors concerning cancer in these various sites are to be found in the statistical publication made by the World Health Organization (WHO) on

Countries		Population over 65 in per cent	Deaths in per cent: from senility and unknown cause	of malignant neoplasms all sites	digestive organs and peritoneum
		Male			
France	1901	7.6			
	1953	9.5	21.1	13.1	7.5
Italy	1901	6.1	22.6	3.3	...
	1951	7.6	14.2	10.3	6.8
Norway	1901	10.2	41.8	11.2	8.0
	1953	13.1	8.6	17.5	10.8
Netherlands	1903	5.6	29.5	11.5	8.7
	1953	7.8	5.9	18.6	11.0
England & Wales	1901	4.2	21.7	6.9	4.4
	1953	9.5	1.7	15.1	7.8
Scotland	1902	4.1	19.1	6.4	3.9
	1953	8.8	3.3	15.5	8.4
Sweden	1901	7.6	...	...	...
	1953	9.9	6.7	14.6	8.8
Switzerland	1901	8.7	15.4	12.4	9.8
	1953	12.7	1.9	19.6	11.6
		Female			
France	1901	8.7	...	...	...
	1953	14.1	23.4	11.8	6.7
Italy	1901	6.1	26.3	3.5	...
	1951	8.7	16.4	9.3	5.8
Norway	1901	11.2	49.3	9.3	5.6
	1953	11.4	9.9	13.9	8.5
Netherlands	1903	6.4	32.9	10.1	7.4
	1953	8.5	5.9	15.9	9.9
England & Wales	1901	5.1	24.5	8.4	4.6
	1953	13.0	2.7	12.9	7.1
Scotland	1902	5.6	24.5	7.5	4.3
	1953	11.3	3.8	13.1	7.7
Sweden	1901	19.1	...	...	...
	1953	11.3	7.9	13.0	7.4
Switzerland	1901	9.9	16.8	10.7	7.2
	1953	15.5	2.8	16.2	9.0

mortality from malignant neoplasms of digestive organs and peritoneum in 26 countries since the beginning of the century.

Mortality from cancer of the digestive organs is higher in men than in women. Stomach cancer is responsible for the majority of cancer deaths in both sexes, immediately followed by cancer of the large intestine and the rectum.

The WHO study further shows that mortality from these malignant neoplasms increases from the age of 40 onward and becomes very important after 60.

Cancers of the digestive organs kill more people than all other cancers

According to the WHO study, in England in 1953, 44.6 per cent of all cancer deaths were caused by cancer of the digestive organs; in Scotland 46.5%, in Denmark 48.4%, in Spain 48.9%, in Finland 56.2%, in France 50.1%, in Ireland 51.7%, in Italy 54.6%, in Norway 51%, in the Netherlands 50.5%, in Sweden 52.7%, in Switzerland 50.6%, in the Union of South-Africa, 45.7%, in Canada 46.7%, in Chile 62.6%, in the United States of America, 39%, in Uruguay 54.6%, in Japan 73.9%, in Australia 45.3%, in New Zealand 46.3%.

More people live long enough to get cancer

A remarkable increase in cancer deaths since the beginning of the Twentieth Century is clearly shown in the statistical tables of the WHO report. Among the many possible causes of this rise the aging of the population should be mentioned. Because cancer starts mainly around middle age, the fact that people live longer means that more of them may be struck by this disease. Furthermore, in the past 50 years other causes of death such as the infectious diseases have lost much of their importance, thus increasing the proportion of some other conditions, as cancer for instance, as cause of death.

In England in 1901 mortality from all cancers represented 4.4 per cent of all deaths, in 1920, 9.4 per cent, in 1947, 15.1 per cent and in 1953, 16.9 per cent:

in	1901 %	1920 %	1947 %	1953 %
Scotland ...	5.6	8.5	13.7	16.7
Denmark ...		10.5	16.2	19.6
Spain ...	1.5	2.5	5.9	8.6
Finland ...		4.5	10.1	14.9
France ...	3.5	4.7	11.9	13.4
Ireland ...	3.4	5.7	9.0	12.5
Italy ...	2.4	3.7	8.5	11.5
Norway ...	6.4	8.6	15.3	17.6
Netherlands ...	5.4	9.4	16.4	18.9
Sweden ...	7.6	8.6	13.0	15.6
Switzerland ...	7.1	9.3	15.7	17.9
Union of South Africa ...	4.5	5.3	12.5	14.5
Canada		7.1	13.3	14.5
Chile ...	1.0	1.3	4.8	6.6
USA ...	4.1	6.4	13.1	14.6
Uruguay ...	4.0	5.2	14.8	17.5
Japan ...	2.4	2.9	4.7	8.9
Australia ...	5.2	8.0	12.9	13.6
New Zealand ...	6.8	8.5	14.6	15.5

Better diagnosis

Finally, diagnosis has improved considerably during the past 50 years. Thus the proportion of deaths attributed to "senility" or to "unknown cause" has greatly decreased in most countries, resulting in an increase of the number of deaths from well-diagnosed causes.

[Reports & Reviews prepared by—S. C. S.]

ASSOCIATION NEWS

The inauguration of the Indian Public Health Association will be performed by Hon'ble Rajkumari Amrit Kaur, Union Health Minister at the All India Institute of Hygiene and Public Health, 110, Chittaranjan Avenue, Calcutta on the 28th September, 1956. The entire session will continue for successive three days.

In this connection, a health exhibition on all India basis will be organised and and a Souvenir volume will be published giving facts and figures of the past and the recent health and welfare activities in this country as well as the history and trends of Health Services, Medical Education and Research, Public Health Laws, Five Year Plans, Community Project Administration and collaborative International Health Programmes, etc.

A scientific session dealing particularly with the various aspects of health problems in the rural areas and their solutions will be held in joint collaboration with the members of the Alumni Association of the All India Institute of Hygiene and Public Health, Calcutta.

The tentative programme of the entire inaugural session is given below:

FRIDAY, 28TH SEPTEMBER, 1956

Inaugural Meeting
Opening of Exhibition
Tea
Entertainments
Subscription Dinner

SATURDAY, 29TH SEPTEMBER, 1956

Scientific Session :

MORNING: 9 A.M.—12-30 P.M.

Subject—Public Health Man Power and Training of Personnel.

Chairman—Dr. B. C. Dasgupta.

AFTERNOON: 2-30 P.M.—5 P.M.

Subject—Continuation of the morning session.

Tea.

Entertainments.

Exhibition will remain open 9 a.m.—7 p.m.

SUNDAY, 30TH SEPTEMBER, 1956

Scientific Session :

MORNING: 9 A.M.—12-30 P.M.

Subject—Environmental Sanitation.

Chairman—Sri P. C. Bose.

AFTERNOON: 2-30 P.M.—5 P.M.

Business Meeting of the Indian Public Health Association.

Chairman's address
Report of the Secretary.
Memorandum & Rules and Regulations.
Budget.
Election of Office Bearers.
Selection of next venue of Annual Session.
Tea.

Entertainment.

Exhibition will remain open 9 a.m.—7 p.m.

MONDAY, 1ST OCTOBER, 1956

Scientific Session :

MORNING: 9 A.M.—12-30 P.M.

Subject—Health Education.

Chairman—Dr. M. R. Fields.

AFTERNOON: 2-30 P.M.—5 P.M.

Subject—Health Organisation in Rural Areas including Community Project Areas.

Chairman—Col. Barkatnarain.

Tea.

Entertainments.

Exhibition will remain open 9 a.m.—7 p.m.

TUESDAY, 2ND OCTOBER, 1956

CONDUCTED TOURS AND SIGHT SEEING.

Members intending to attend the ceremony from outside Calcutta and to participate in the Scientific Session and other functions should intimate the Honorary Secretary sufficiently ahead of the date, if any arrangement for their accommodation is required.

According to the recent Railway Circular the outside members and delegates attending the session may avail of the Railway Concession at $1\frac{1}{2}$ fare for return journeys.

INDIAN PUBLIC HEALTH ASSOCIATION

110, Chittaranjan Avenue, Calcutta-12.

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Mailing address

Present position

Experience

Place and date of birth

Education (Degree if any)

Professional Society Membership

Section affiliation desired (choose only one by a Cross mark)

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Health Officer	Public Health Education	Public Health Administration
Laboratory	Public Health Nursing	Unaffiliated
Statistics	Epidemiology	Proposed by
Engineering	School health	Address
Industrial Health	Dental health	Seconded by
Food & Nutrition	Medical care	Address

Branch affiliation—Local/State (if already set up).

Proposer and seconder of this application must be an ordinary (including Life) Member of the Indian Public Health Association.

Annual dues—Ordinary membership—Rs. 12/-; foreign Rs. 18/- or $4.00 (£1-7s.).

Membership year—January-December. Members enlisting in July and afterwards may pay for the half year but he must pay for the whole year if he wants all the issues of the journal in the year. Money to be sent by M.O. or Postal order. If crossed cheque is issued extra charges of Re. 1/- for collection should be included.

Date..... *Signature*.....

INDIAN JOURNAL OF PUBLIC HEALTH

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