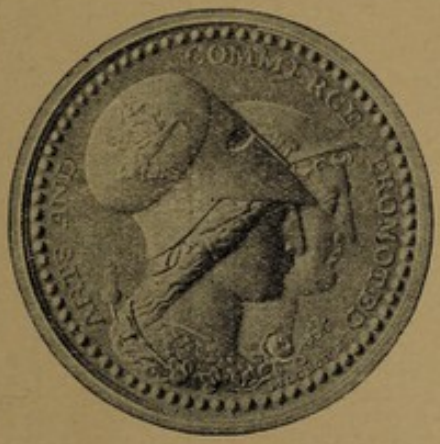
Industrial psychology and the modern world / by Charles S. Myers.

THE JOURNAL OF THE ROYAL SOCIETY OF ARTS



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NOTICE

NEXT WEEK

MONDAY, MAY 3RD, at 8 p.m. (Cantor Lecture). ELLIS K. WATERHOUSE, M.A., Sometime Librarian, British School at Rome, "Italian Baroque Painting" (Lecture III). (Illustrated by lantern slides.)

WEDNESDAY, MAY 5TH, at 8.15 p.m. (Ordinary Meeting). PROFESSOR ALFRED W. NASH, M.Sc., F.C.S., M.I.Mech.E., Professor of Petroleum Technology, University of Birmingham, "The Fuel Supplies of Great Britain." R. LESSING, Ph.D., F.I.C., F.C.S., will preside.

NOTE.—Owing to the indisposition of Vice-Admiral Sir H. Percy Douglas, K.C.B., C.M.G., the paper which he was to have read on "The Manchester Ship Canal" has been postponed until next Session.

PROCEEDINGS OF THE SOCIETY

FIFTEENTH ORDINARY MEETING

WEDNESDAY, MARCH 10TH, 1937

SIR JOHN D. SIDDELEY, C.B.E., J.P.,

Immediate Past-President, Engineering and National Employers' Federation, in the Chair

THE CHAIRMAN, in introducing the lecturer, said :—It is my privilege to take the Chair for this paper by Dr. Myers on Industrial Psychology. Industrial Psychology, I think, is rather a vague expression, but we shall know more about it as the paper proceeds. I was speaking to a really intelligent friend the other day, and when

I told him that I was taking the Chair at this meeting, he asked " What is Industrial Psychology ? " thus indicating that there is a certain amount of ignorance in regard to Industrial Psychology which I hope the paper will dispel.

The following paper was then read :—

INDUSTRIAL PSYCHOLOGY AND THE MODERN WORLD.

By Charles S. Myers, C.B.E., M.A., M.D., Sc.D., F.R.S.,
Principal, National Institute of Industrial Psychology.

I. THE ORIGIN OF INDUSTRIAL PSYCHOLOGY

Less than a century ago, Psychology was but the hand-maid of Philosophy, serving mainly to confirm the philosopher's views on metaphysical, ethical and kindred problems. Its emancipation as an independent science began with the systematic observation of mental states and processes, especially under prescribed conditions. Psychology came to be engaged in the experimental study of sensation, perception, illusion, imagery and memory, of mental and muscular work, of our experience of space, time and rhythm, and even of the processes of feeling, thought and will.

This young science soon became characterised by three special features. In the first place, it evolved a special discipline of its own, so important and fundamental that no one can be trusted to carry out a reliable psychological experiment unless he has been thoroughly grounded in what are called the " psycho-physical methods." Secondly, it stressed the importance of the joint study of internal mental states and external bodily behaviour. And in the third place, it discovered the wide extent and the enormous importance of individual mental differences. It was especially these three features which led to the establishment of Psychology as a branch of *Natural* Philosophy—more particularly as an independent Biological Science—somewhat as Physiology, by developing special aims and a specialised discipline, had earlier become differentiated from Biology, and as more recently Bio-chemistry has become to a large extent differentiated from Physiology.

There arose soon two socially important *applications* of Psychology—to education and to medicine—which have been of no small service to Industrial Psychology. Thus the present verbal and performance tests of intelligence, used by the industrial psychologist, may be traced to those early workers in Educational Psychology who were specially interested in the recognition and appropriate education of the mentally dull and defective. To the psycho-pathologists, too, the industrial psychologist owes our modern realisation of the importance of the unconscious underworld in normal mental life, of the profound influence exercised on consciousness by repressed emotional experiences and by consequent dissociated "complexes", and of the play of intellectual rationalisations as explanations of—in reality excuses for—the remarkable influence of unconscious

mental processes on normal conscious experience and conduct, both individually and socially. Thus to Educational and Medical Psychology, Industrial—and Social—Psychology, the youngest of the applied sciences of the youngest biological science, is much indebted. To them, in return, Industrial Psychology has contributed much in the course of its development.

Industrial Psychology is a misnomer. It is confined neither to Industry nor to Psychology. It is concerned not merely with industrial, but with every kind and grade of occupation, both commercial and professional; it is concerned not only with the mind, but also with such physiological processes and physical conditions as affect the worker's occupational activity. Industrial Psychology means therefore the study of the human factor throughout occupational life. It is applicable even before the start of occupational work, since by *vocational guidance* it aims at determining the most suitable career for the young person who is about to choose his life's work. And, even earlier, by *educational guidance* it helps to advise as to the kind of education—classical, modern, commercial or technical—to which the adolescent is innately best fitted. By *vocational selection* the object of Industrial Psychology is to choose the best of the applicants for a vacant occupational post.

We have now reached the stage when the novice comes to receive *training* in his future work. With this subject also Industrial Psychology is closely concerned, and when occupational life has been already started, it enters in improving *industrial relations*, *personnel management* and other planned organisations that affect the personnel, and in bettering general *working conditions*, for example, the distribution and occupation of periods of work and of rest and leisure, the reduction of accidents, fatigue, boredom and irritation, the satisfaction of interests, the introduction of appropriate incentives—all directed to ensure the happiness, health and efficiency of the " worker ", whatever be the kind and grade of his occupation.

Not only does Industrial Psychology relate to every kind of *productive* work and *worker*, it relates also to the *distribution* of goods as well as to their production, and psychological factors clearly enter here into the study of the *consumer*—into the study of the most successful form of advertisement and the most preferred design of new products and their display.

In this country Industrial Psychology owes its origin largely to the unsatisfactory working conditions of munition workers during the Great War, and to the investigations set on foot by the Home Office to remedy them. These researches have since been widely extended in the psychological laboratory and in the factory and office by the Industrial Health Research Board (a branch of the Medical Research Council), first known as the Industrial Fatigue Research Board, and by the voluntary organisation soon after established, the National Institute of Industrial Psychology. Investigations in all the fields above-mentioned have been carried out by these two bodies in nearly every industry for thousands of persons, for hundreds of industrial and commercial firms and for various

Government departments. Systematic courses of instruction have been given by the staffs of these two bodies to students, teachers and managements, in universities, and for education authorities and business concerns. Institutes corresponding to the National Institute of Industrial Psychology have now been established in Australia and Canada. Other organisations under Government or private control have been formed in most European countries, in the United States and in Japan. The industrial psychologist is now to be found at work in every modern civilised country of the world. Why has this happened ?

II. THE MODERN NEED FOR INDUSTRIAL PSYCHOLOGY

The answer to this question is provided by a more detailed examination of the main fields and results of Industrial Psychology and of the modern changes in occupational life and social attitudes.

A. Educational and Vocational Guidance

Until recent years this was dependent on the opinion of the school teacher, the wishes of the parent and the interests of the boy or girl. Even to this day these are the most usual determinants, although we now have available fairly reliable tests of manual, mechanical and clerical ability which, in one educational area at least, are being given to every entrant to its junior technical and commercial schools. We have still more reliable tests of innate general intelligence which have proved of the greatest value, especially in cases where the high intelligence of a pupil may be masked by absence from school through illness, by bad educational methods or by uncongenial teachers, or, on the other hand, where it is stimulated by successful cramming for school or scholarship examinations. The use of intelligence tests has been recently recommended by the Board of Education in certain scholarship examinations.

But neither the careers master, who has of late years been installed in many public and other secondary schools, nor the juvenile employment officer usually receives as yet any training in vocational guidance ; he picks up his empirical methods as best he can. The careers master's lack of training and his restricted knowledge render him ignorant of the requirements for success in different occupations. The juvenile employment officer usually attends a terminally held school conference before which each school-leaver appears for a few minutes only ; and the advice which the pupil receives is largely based on the latter's interests and on the likelihood of finding a local vacancy in a particular occupation.

Many have thought that a young person's interests are indicative of his abilities and of his future success in the occupation he desires to enter, but experience has proved beyond question that this is far from being necessarily true. Others have held that most young people are so adaptable to different kinds of work that vocational guidance is needless. Others again have believed that a series of " trials

and errors " is really beneficial to a young person before he " settles down " to his life's work. These two views have also been definitely disproved. No doubt there is always a certain measure of adaptability in human mental and bodily activity ; but for virtually every one of us there are certain occupations in which we shall be contented and more or less successful, and there are other occupations in which, owing to their uncongeniality and utter unsuitability, we shall disastrously fail and be most unhappy. And if a young person tries one occupation after another, failing at each, not only does he waste his own and his employer's time and effort, but he loses self-confidence and comes to believe that in no occupation can he achieve some measure of happiness and success.

The new methods of vocational guidance, introduced by Industrial Psychology and now being more and more widely taught and spread, do not depend fundamentally, as is so commonly supposed, on the mere use of tests. Tests are of undeniable and considerable value, alike in determining the degree of different abilities required for success in different occupations and in ascertaining that the applicant for vocational guidance possesses the requisite abilities—in insuring, for example, that he or she does not try to enter an occupation which demands a higher, or (which is equally harmful) a lower, degree of general intelligence than he possesses. But the results of tests are often merely accessory to information obtained from other sources. Nor are abilities the sole determinant of vocational success. Temperamental and character qualities are at least of equal, probably indeed of greater, importance ; they may over-ride the estimate reached of mental abilities, and for them no satisfactory tests have yet been discovered. They have still to be determined, as of old, by personal intercourse, although the industrial psychologist has formulated a more reliable and more systematic method of their evaluation.

The striking success of the methods of the industrial psychologist in vocational guidance is especially due to the " all-round " view and the systematic procedure that he adopts. He aims at a full knowledge not only of the young person's abilities, temperamental and character qualities, physique and constitution, but of the different extents to which these are required for success in different occupations. With this aim he does not neglect scientific methods of procedure, but he regards them as his servants, not as his master. And he does not neglect the young person's interests and ambitions, or the opportunities which he may have for a post in a certain occupation or for advancement in it. But he takes a balanced " global " view of all the circumstances which finally lead him to a correct decision. He does not regard the applicant for vocational guidance as a " peg " for which a certain occupational hole can usually be found as a perfect fit. His general practice is to indicate the three or four most suitable kinds of occupation and to discourage the choice of certain other careers which appear to him wholly unsuitable. The National Institute of Industrial Psychology, the pioneer organisation in research into these methods and in developing practice and instruction in them, has recently completed the follow-up of about five

hundred cases, mainly from public and other secondary schools which had received its vocational advice. Of those which had taken its advice only 8 per cent. were found to be unhappy or unsuccessful in their occupational work; whereas of those which had entered on a career different in kind from that recommended, 43 per cent. were unhappy or unsuccessful. Equally satisfactory results have been obtained from similarly conducted vocational guidance given to elementary school children.

B. Vocational Selection

The methods until recently employed in choosing an applicant for a vacant post have been to select him at sight or after an interview, often with the help of a testimonial or some other personal recommendation. The use of these methods implies that it is possible to select a suitable employee by looking at him or by talking with him and by reading what others report of him. In practice this is too often merely a method of "hire and fire," resulting in endless waste of time in interviewing, engaging and training worthless workers, a serious wastage of material and damage to machinery used by beginners who will never become competent, an unnecessarily large labour turnover owing to the numbers leaving through dissatisfaction or discharged through incompetence, and a consequent lowering of *esprit de corps* throughout the factory or office. For no one can adjudge with certainty the suitability of an employee by merely looking at him; if an interview is given, it is apt to be unreliable unless conducted on systematic, psychological lines, while the ordinary testimonial, even if it be honestly written, is notoriously untrustworthy.

In vocational selection one can never dispense with any of these three methods. But they can be made far more reliable by determining and realising beforehand what qualities are required for success in the vacant post, by framing the questions at the interview so as to ascertain these qualities separately, and assessing them separately on a prescribed scale, by asking definite and relevant questions from those who are competent to testify to the suitability of the applicant, and, especially, by recourse to appropriate tests that will afford some measure of those abilities possessed by the applicant which are known to be necessary for success in his new work.

The time has long ago passed when raw material or new machinery was purchased by the employer without its having undergone and passed scientifically conducted tests, or received other systematic inspection. It is only within recent years that successful efforts have been made to provide and to introduce similar scientific measures in the selection of the employer's human "material." Suitable tests have now been devised by the industrial psychologist for an enormous variety of occupational work. And he is now being asked, with increasing frequency and success, to help in the selection not only of clerical, manual and other workers of similar grade, but even of the highest executives and administrators concerned in management.

Where he can devise tests, their value is first determined by applying them to employees already at work and by ascertaining the degree to which high or (more especially) low scores at the tests, combined ultimately with temperament and character ratings, correlate with high or low efficiency at occupational work, as assessed independently by the management. These psychological methods of vocational selection are only applied to the selection of novices after a high correlation is thus reached between assessment of efficiency by their means and independent assessment of efficiency by the management. Their value has been recognised by companies of high repute and of vast organisation. For example, Imperial Chemical Industries have found the selection methods recently devised for them by the National Institute of Psychology so useful that they have extended their use to other branches of the special group of industries for which they were devised, and they have shown their appreciation of the value of the work by making an exceptionally generous contribution towards the Institute's present appeal in aid of research and its other unpaid, national work. Again, Imperial Airways, for which the Institute devised methods for the choice of men best fitted to fill ground posts in their stations abroad, have found the selection so effective that they have now far fewer vacancies every year to fill and hence far fewer applicants to consider; they, too, have signified their appreciation of the Institute's work for them by a contribution towards its appeal fund.

C. Vocational Training

This is the plank in the platform, the other two being vocational guidance and vocational selection, which the First World Economic Conference, held in Geneva in 1927, urged as essential for maintaining the efficiency and contentment of the workers in these days of increasing vast-scale organisation and mechanisation of industrial and commercial businesses. The old method—or lack of method—of training the novice is rapidly dying, whereby the young worker was cast into his totally new environment without any introduction to the history, reputation and general policy of the firm, and left to pick up his methods of work either without any training whatever or by instruction from a relative or from some other senior comrade who, however expert, wholly lacked the necessary qualifications for being an efficient instructor.

Here, once again, in the modern world of industry and commerce, Industrial Psychology has come to play an important part (i) in the selection of suitable teachers, (ii) in the determination of the best movements and other methods of work which should be taught, and (iii) in the best ways of giving such instruction. The industrial psychologist is especially concerned in preventing the acquisition of bad habits of work. He observes the methods of efficient and inefficient workers, and by movement and time studies he establishes certain broad principles. But he realises that there is no *one* best method of work suitable for *every* worker

in a particular occupation, each individual (as in golf or in violin-playing) having his own style best suited to his own constitution.

A research has been recently conducted at the Institute, which corroborates the conclusion previously reached by the Industrial Health Research Board and by others that workers who have improved by routine practice at a certain manual operation cannot appreciably transfer the practice thus gained when they are asked to perform a different kind of manual operation. But the Institute's research went further ; it clearly demonstrated that such transfer of practice effects readily occurs if the worker, instead of acquiring expertness merely by the routine practice of an operation, is at the same time systematically instructed in the basic principles that govern the efficient performance of that operation. In other words, this research demonstrates the importance of an explanation of general principles underlying the best methods of work if the effects of training are to be transferable to other kinds of work. Man is not to be treated as an animal, trained mechanically to perform one particular trick. Under modern industrial conditions processes are continually changing, and unless the worker has been instructed in the general principles underlying his work, he cannot be expected to face changed conditions of his work without initially wasting mis-directed effort and thus incurring needless fatigue. The need for the most effective methods of training has never been more urgent than at the present day when, with reviving trade and the priority claims of armament manufacturers, such a dearth is experienced in the supply of skilled workmen.

There is a widespread fallacy that under modern conditions, in which machinery is replacing so much of former handicraft, the need for skilled workers is fast disappearing, and that only the routine labour of machine feeders will soon be needed. The contrary has proved to be the case. With the increasing introduction of machines in a factory or office, the number of relatively unskilled workers engaged in manual or clerical work diminishes in proportion to the number of highly skilled workers needed to " run " and to adjust the machines, to safeguard them from breakdown by inspection, and to repair them when necessary. High manual skill is being largely replaced by high mechanical skill, but the number both of mechanicians and of fresh fields for skill is increasing with the development of new " luxury " industries, *e.g.*, the wireless, the film and the motor car industries, to meet the demands of the better paid workers for mass-produced articles. Every year, therefore, and in every new and old industry a greater proportion of skilled workers is demanded, and consequently more and more stress must be laid on efficient training, which must inevitably be conducted in accordance with psychological principles. It is, of course, at the same time true that under recent conditions many unskilled workers have been needed, and that as machine-feeding itself comes to be performed in a larger measure merely by machinery, a serious problem may sooner or later have to be faced in regard to the future occupation of those of our community whose special abilities and general intelligence are so low that they are only fitted for unskilled and routine manual work.

D. Working Conditions

These may be classified as psychological, physiological and physical. The study of the physiological and physical environment might be considered to be the province rather of physiology and engineering than of psychology. But physiology is only interested in *mental* processes so far as they throw light on or affect living *bodily* processes ; it is concerned predominantly with the responses of living matter to *material* stimuli, and, so far as *mental* processes are concerned, with their localisation in the cerebral hemispheres or in other regions of the nervous system. The psychologist, on the contrary, is not *primarily* concerned with the structure or functions of the brain, spinal cord, nerves, sense organs or muscles, nor with the responses of small, experimentally isolated parts of the whole organism. He studies such problems as mental work, fatigue and boredom, the acquisition of skill, the causes of accidents, and the provision of appropriate incentives to work, regarding them as mental problems of the intact organism and disregarding our complete impotence at the present time to assign to them any material, structural, physiological basis. The relations of optimal occupational efficiency to lighting, ventilation and temperature, to noise and vibration, to food and to periods of sleep and rest, the determination of the best mental as well as physical and physiological conditions for work-a-day life, and also for the use of leisure, thus fall within the province of Industrial Psychology.

Industrial Psychology is concerned not only with the study of the best movements of the worker and of the best posture and the best arrangement of the material and tools which he employes, but also with the forms of tools and arrangements of machinery best adapted to human needs. The engineer in designing a machine is only too apt to neglect the convenience of the operator who will have to use it ; the industrial psychologist frequently finds levers or pedals so placed that they involve a needlessly wide stretch, a cramped, distorted posture or harmful vibration. Into the illumination problems of the engineer not only the merely physical conditions of candle-power enter, but also such psychological factors as contrast, shadows, glitter and glare. Into his ventilation problems the subjective factor of comfort must likewise enter. The general aim of the industrial psychologist is, by co-operation both with the physiologist and the engineer, to remove all obstacles, all sources of friction, whether physical, physiological or mental, that tend to prevent the worker from giving his best, and to introduce incentives—not merely the purely selfish and often dangerous incentives of payment, but also and especially the more social incentives of knowledge, pride, interest and loyalty—which will most effectively and permanently stimulate, but not over-drive, the worker.

With the increasing introduction of machinery, physical *fatigue* is becoming less important than mental *boredom*. The Industrial Health Research Board has in recent years carried out a series of investigations with the object of alleviating boredom in occupational work, and valuable light has also been thrown on this problem in the course of the investigations of the National Institute of Industrial

Psychology. Moreover, with the increasing use of machinery, heavy manual labour is being largely replaced by the lighter but more delicate and exacting work of assembly, adjustment and inspection, in which mental rather than muscular fatigue demands attention.

A further change in conditions, as the Institute has recently pointed out, has arisen from the now far more numerous problems of business organisation and administration, and from the far larger number of persons engaged in this work than heretofore. The conditions affecting such administrators are very different from those affecting the mere operative. Their problems do not necessarily cease to confront them outside working hours; they may persist in presenting themselves in the train, over the lunch hour and at night. Thus administrative ability is apt to be seriously disturbed by over-concentration and resulting mental fatigue, and to express itself by feelings of impotence or irritability, by transfer of the blame for failure on to others, and in other symptomatic ways well recognised by the psychologist. In these directions, as the result of modern conditions, important new fields are opening for Industrial Psychology.

E. Industrial Relations and Personnel Organisation

A century or more ago these problems needed little attention from the psychologist, even if he had then had sufficient knowledge to offer help towards their solution. In those days the manufacture of an article was generally completed by the hands of a single workman; the modern vast aggregations of employees within a factory, each engaged in machine work and in making some small part of an article, were unknown. The employer then knew all his workmen personally, often, too, their parents and other relatives who may have also worked for him, so that there was little occasion for the team or herd spirit, little chance of technical and other higher education for the rank-and-file of operatives, and relatively few opportunities for their rising in the social scale. At the present time this "feudal" atmosphere has virtually disappeared; ampler and more varied facilities are provided both for education and for leisure, while different ideals of citizenship and a more democratic spirit prevail.

The individual employer in a huge concern cannot hope any longer to know each of his innumerable employees; indeed, often he has ceased to exist, being replaced by a managing director or by a general manager—a salaried employee of a company of countless shareholders who is in control of a large staff of departmental managers, foremen and others concerned in management. The operative is no longer content with the slow, dependent and relatively servile life led by his forbears. He is dominated by an often excessive desire for release from various seemingly out-worn social restrictions, but at the same time is usually willing to accept regulations and restrictions which are conducive to a satisfactory collective life—or, if not, he needs the education, now lacking, to appreciate the necessity for such acceptance. He refuses to become a mere robot in his occupational life, to lose his individuality and his interest and pride in his work—the

inevitable results of modern business mechanisation and rationalisation so long as the human factor fails to receive systematic and expert consideration. He evinces an increasing desire to be satisfied not merely with the conditions, but with the worth-whileness, of his work, and in his conduct he shows more and more the influence of friendship and loyalty towards his occupational group and of satisfaction with his leader.

Management, too, has come to realise the enormous importance of developing and maintaining loyalty to and interest in the business on the part of every grade of worker within it, and Industrial Psychology has been able to give invaluable help in developing and maintaining this necessary *esprit de corps*. Just as, on the introduction of machinery, management recognised at once the necessity for its smooth running, the removal of needless mechanical friction, and the introduction of all other measures designed to insure its durability and its freedom from breakdowns so, too, in modern times management is fast extending a corresponding recognition to the human material which it employs.

Industrial Psychology has studied the individual needs of the workers ; it has stressed the necessity of recognising individual mental differences and the hopelessness of administratively preparing plans from the armchair or of adopting a fixed, theoretical scheme of business organisation, regardless of the particular mental constitutions of those persons who will be required to work it or who will be otherwise affected by it. Industrial Psychology has carried out work to show the enormous importance of listening to the grievances of workers, of removing by explanation those grievances which result from exaggeration and misunderstanding or are based on mere rumour or ignorance, and of remedying those which prove to be fully justified ; these troubles, which so profoundly affect their work, may relate to domestic, as well as to working conditions. It has also stressed the psychological, apart from the economic, value of welcoming suggestions from operatives that relate to improvements in working conditions and even to wider policy.

Industrial Psychology has applied the modern teachings of Medical Psychology to reduce the absenteeism due to sickness, a vast and indeed predominant portion of which has recently been traced to psychological causes. We now know that the condition medically known as " psychoneurosis," so frequently characterized by the quite unconscious action of " complexes " previously repressed from consciousness, may be evinced not only by *mental* disturbances, *e.g.*, by diffidence, irritability, suspicions, fears, anxieties, obsessions and more serious nervous breakdown, but also by such *bodily* disorders as gastritis, anæmia, asthma, cardiac troubles, dysmenorrhœa, headaches and general debility. We know, too, largely as a result of the work of the Industrial Health Research Board, that there are vast differences in the sickness rates of similar business concerns, which can only be ascribed to differences in the frequency of psychoneurotic manifestations dependent on uncongenial conditions of work, particularly on such as arise from needlessly rigid discipline, from the unsuitability of the managers,

foremen or workers for their respective work, and from the hopelessness of opportunities for promotion.

In improving industrial relations and personnel organisation, the visiting industrial psychologist is at a considerable advantage compared with permanent members of the staff. He approaches his subject with a wide experience derived from other business organisations. He can regard the situation from a new angle, different from that adopted by those who have so long " held their noses to the grindstone." He is not hampered by inter-departmental jealousies and by such obstructive, traditional etiquette as must usually be observed by one of the permanent staff. At the same time he can also render valuable help by instructing the managerial staff in the general principles of industrial psychology so that, without becoming experts in the subject, they can nevertheless avoid many future pitfalls and often work effectively under the visiting expert's supervision.

III. CONCLUSION

Enough has now been said to indicate the value and the place of Industrial Psychology in modern work-a-day life. Like Medicine, it is not an exact science ; each is an art based on scientific principles and knowledge. In having this more secure foundation it possesses an inestimable advantage over, and presents a striking contrast to, the purely empirical character of certain other professed aids that claim to have similar or even greater value in improving efficiency under present conditions of industrial and commercial life. Moreover, it offers services ideally suitable to the future development of a dictator-free democratic civilisation like ours, in which every citizen is allowed the liberty and initiative to determine his particular rôle in the community, and is expected to feel responsible for his personal contribution towards it. In this connexion it is interesting to note that, as in the case of the early applications of Chemistry and Physics to industry, Great Britain is foremost in this applied study of Psychology.

Finally, Industrial Psychology is helping to meet the modern altered conditions which result from the rapidly growing social importance of occupational life and of the business organisation in which it is spent. As T. N. Whitehead has recently pointed out in his book, *Leadership in a Free Society*, the social influences once exercised by the country squire, by the Church, and even by the family have now considerably diminished ; he believes that they will be largely replaced by the influence of the business administrator both within and outside occupational life both as a business and as a social worker. Clearly the concern of the employer is limited no longer to the mere output of work by his employees; it extends now to the ways and conditions in which that output is obtained, and those conditions depend not only on occupational conditions, but are also inextricably interwoven with home and family circumstances, with social environment and with social group influences. The British workman will, of course, resent any surreptitious spying

on the part of his employer into his private life, yet neither mental life nor mental health can be divided into and treated as though it consisted of two isolated, water-tight compartments—one functioning during and one outside working hours. We are approaching the time when it will be recognised that the one half of our waking life which is spent in vocational work can no more be divorced from the other half spent in recreation and family surroundings than our religious thought and church attendance on Sunday can ever be divorced from our ethical conduct during the rest of the week. To meet such coming changes in attitude, industry must actively help in matters affecting social progress and social integration, as work and leisure and culture after, and in relation or in contrast to, working hours become more and more the central pivot of social life. And it is in satisfying these present-day and future tendencies, I have attempted to show, that Industrial Psychology must play an ever-increasing part in the life of the community.

DISCUSSION

MR. W. L. WAND said :—There are one or two points on which I should like some further information. The first is in regard to the vocational tests. I should like to know whether any allowance is made for temperamental difficulties on the part of the person being tested. For instance, a self-conscious person would probably give results which are below his innate ability. Is any allowance made in such cases ?

With regard to the " Follow-ups " of those who were given vocational guidance, it would be interesting to know the actual numbers, apart from percentages, who accepted or refused the advice given. In the case of those who refused, were any reasons obtained as to why they left their original work ? I imagine, for instance, that some of those who refused must have been of an independent temperament, and perhaps that same independence caused them to give up a particular situation apart from any dissatisfaction with the work itself.

Finally, I should like to know whether removing all difficulties from the path of the individual in relation to his work will in time tend to weaken the moral fibre of the nation as a whole ?

THE LECTURER replied :—Certainly allowance would be made, and I think that those who are continually doing this work can generally tell whether a person is conducting himself normally. Not infrequently one gets a certain result and realises that the person is not doing himself justice. As a matter of fact, the majority of people would much rather do a test with their hands than face an interview.

The reasons for people not taking up an occupation are, of course, very varied, and it is impossible to analyse them here. Undoubtedly there is that kind of person who is independent and perhaps of the neurotic character, and the negativist type apt to be independent and nervy, who act contrary to advices and have a number of changes of occupation. Sometimes it is the parent who insists on being blind to the best kind of occupation, and wants his son or daughter put to the occupation which he thinks desirable. Or again, the element of snobbishness sometimes comes in, and they want him to go in for a higher kind of occupation than those considered suitable by the adviser.

MR. J. CLIFFORD ROWE, J.P., said :—I have known a few cases of young people,

chiefly boys, who have been to the Institute. The majority have, by the report and diagnosis which the Institute has made, been apparently cases which the Institute has—I hesitate to use the term " given up "—but at any rate in which it has failed to make any definite recommendation except that the Institute has confirmed, in two cases in a most striking manner, the effect of the answers given by the parents or guardians with regard to their opinion of the youths. I am not saying this in any carping or critical spirit, but I should like to quote the case of an engineer who is a highly intelligent and experienced parent, and who endeavoured to help the Institute by doing that very difficult paper which it sets and which in my experience can take anything up to four hours, especially if the parents aim so high as to get agreement on every answer they give. The engineer's son in question was one of those cases on which the report of the Institute did not go much further than to confirm what the parents had thought. The father's observation was this : that the paper set to the parents and guardians was of such a searching and valuable character that the arrival at the concensus of opinion of the father and mother, and in this instance of the other children also, was alone worth the time given to it, not to mention the fee which was naturally the Institute's reward.

The question I should like to ask is, has the Institute, in its far more important, and I imagine more difficult, work of endeavouring to prescribe for large employers of labour, ever come across an institution which by luck or design or merely developed benevolence, left them little to prescribe ? In other words, have they ever found a system in which plant, material, personnel, buildings, lay out, physical conditions, etc., with all of which, I think, the Institute is concerned, left them little to suggest in the way of improvement ? It would be of interest to know that.

THE LECTURER replied :—We have been over a good many works in which there seemed to be nothing of a nature which the employer would be likely to consider doing, and therefore we have said that there was nothing that we could do there ; but I think you will admit that nothing is ever perfect in this world, and certainly often there is a great deal that could be done, but which for some reason is not likely to be done.

I had no idea that so much time as four hours could be spent on the form to which you refer, but I can quite understand a husband and wife disputing as to the real characteristics of their children. I think a much truer result would have been reached if two forms had been sent and the parents had written separate reports on the children. We do that in the case of public schools. The boys' masters in classics, mathematics, etc., each write out a report ; these are sent in independently, and one gets striking differences as to the way a boy reacts to different masters.

It is very seldom that the Institute " fails to make a definite recommendation " to its applicants for vocational guidance.

MR. J. T. BRADLEY, B.A., Ph.D., said :—May I suggest that this question of reaction to personalities, to which the lecturer has just referred, does make it rather difficult to be quite sure that the statistics we get from vocational or intelligence tests are really reliable ? When we give individuals such tests, we tend to regard those individuals objectively, but when they are afterwards in jobs they become personalities. They react in diverse ways, and they may fail to succeed for reasons other than the psychological factors which are tested, so that failure after a success in a scholarship examination or failure after success in a test of mechanical ability may actually occur for reasons other than those tested by the psychologist. This, I think, is the really great difficulty that psychologists have to combat ; we have

not any adequate tests of temperamental reaction. When we give intelligence tests we have to leave very largely in the background emotional tests, character tests and temperamental tests, and this may really render our figures about failures invalid.

THE LECTURER replied :—Vocational tests are not given objectively. Much can be learnt of the personality of the subject while they are being given. If you take the work done in Birmingham on the effect of selecting lads by tests instead of as previously on success in examination in English, arithmetic and geography, it is striking how closely the results of those tests agree with the opinions of the masters at the technical colleges. That is still being followed up, and the results are promising.

MR. CHARLES A. SHEEHAN, A.R.W.A., said :—I have a good deal to do with young people, and I should like to know if I am correct in understanding that interest, in your opinion, does not show necessarily an aptitude for a vocation. Am I right in thinking that ?

THE LECTURER answered :—They may be interested in something, but it does not follow that that is a suitable occupation for them to enter.

MR. SHEEHAN continued :—Suppose you get a lot of boys drafted into a room, and they say they want to be artists and craftsmen. It is perfectly obvious that if, after a few weeks, you find them slacking, dodging about and talking, you can in a short time correct them and find out if they have any vocation ; if that same group of boys goes into a factory, it is evident that if they waste their time and do not take an interest in their jobs they should be cleared out at once. It is not a case of resting in between. Can they see the years being spent in that kind of an occupation ? My test of a boy would be to find out if he does any homework, or if he always has to be supervised. If a boy always has to be watched he would be no good in a factory. Rest and the grading do not matter nearly so much as whether they are interested in their jobs.

THE LECTURER replied :—I agree with you that interest is the most important driving force, but you do get people wanting to take up jobs in which they are interested but which they know very little about, and for which they are quite unfitted. For instance, when a most diffident boy came along and wanted to become a travelling salesman, his interest turned out to be in travelling. He would have been an absolute failure as a commercial traveller because he had no persuasion ability or forcefulness whatever. He certainly could have done the travelling very well ! Then you might get a girl who wants to become a nurse, partly perhaps from a humanitarian interest. That is not enough if she has not the required physique, accuracy and patience. We find that interest alone is insufficient to warrant a person taking on a job. Anyone who wants to go in for teaching, for example, must be capable of keeping discipline, or their life would be a torture to them. It is not merely because a person is interested in a certain occupation that that is the one to take up.

MR. H. ERNEST HUNT said :—The Institute concerns itself, and very rightly, with vocational guidance and with conditions of work and methods, but does not Dr. Myers consider there is a tremendous field which is as yet comparatively unexplored in connection with the development of the psychology of the worker himself ? We get very little of it in schools, but after school it is either picked up

or not. Does not he consider there is a field into which the Institute might venture by lectures or other means for the working hand ?

THE LECTURER replied :—The Institute has not infrequently thought of starting courses of that kind for what you might call the self-advancement of the worker or the manager.

THE CHAIRMAN said :—I am sure we are all deeply indebted to Dr. Myers for his interesting address, and for the knowledge he has imparted to us on this, as it is termed, abstruse subject. You will remember Dr. Myers stated that he thought the term " industrial psychology " was a misnomer. As an ordinary, plain industrialist, I think that if the work they are doing was described in a simpler sort of way, it would have a greater appeal to the industrialist. The word " psychology " sounds somewhat mysterious to the man in the street, and Dr. Myers himself is I think, at pains to explain to you that they are dealing with something of almost a more practical nature, such as the state of mind of the people with whom they come into contact. We all know that the state of mind of any individual, be he the greatest of us or the most unimportant person in the country, is of vast importance. I think that is evidenced before us in certain very objectional directions all the time, and at the same time I think it is to be appreciated that much good work is being done by the Institute. I am sure that the public generally, and industry in particular, will in the course of time take more notice of the work being carried out by this Institute, and I am sure we are all deeply indebted to Dr. Myers for his able address.

I have, therefore, great pleasure in moving a hearty vote of thanks to Dr. Myers for his paper.

The motion was seconded by MR. P. M. EVANS, C.B.E., and carried unanimously.

THE LECTURER, in acknowledging the vote, said :—Sir John has opened up in a few words by his most profound and wise remarks matters which are difficult to touch on at this late hour. I can assure him that the words " industrial psychology " have been objected to by others, including myself, but it is difficult to get a term covering the work carried out. Perhaps the only alternative is " human efficiency," with the accent on the human.

A vote of thanks was then passed to the Chairman, and the meeting terminated.

CORRESPONDENCE

LUMINESCENCE

With great interest I read the lecture on " Luminescence and its Applications " given to your Society by Mr. Randall on January 27th. On page 376 he is so kind as to mention our firm as manufacturers of a series of fluorescent glasses which were recently developed by me. The luminous tubes made from this glass, the trade name of which is " Lumophor-glass," are filled at present with a mixture of rare gas and mercury vapour, which has proved most suitable for exciting the luminescence of these types of glass.

On page 373 Mr. Randall points out that luminous tubes coated with zinc silicate and filled with mercury vapour lose during life a good deal of their brightness owing to the formation of a deposit on the powder, which absorbs the activating ultra-violet light. He is, however, under a misapprehension if he concludes that such

a deposit is also formed as a rule on the inside surface of " Lumophor " luminous tubes. It is true that such deposits have been observed, especially shortly after we had first issued these new types of glass, when the neon sign manufacturers lacked the necessary experience in handling the glass. But now it has been realized rather generally that such blackenings need not occur, if a careful pumping process is adopted and if electrodes of a material resistant to mercury are used.

A certain decrease in the luminescence of the glass takes place within the first two hours. Luminescence falls during this period to 75 or 70 per cent. of its original degree and then remains constant for more than 3,000 hours. That means that a luminous tube of Lumophor glass having undergone the pumping and ageing process in the factory does not lose in brightness during the normal time of running.

A. FISCHER.

EXTRACTS FROM THE SOCIETY'S RECORDS

A LETTER TO THE EDITORS OF *Museum Rusticum et Commerciale** FROM A MEMBER OF THE SOCIETY OF ARTS, CONTAINING HINTS AND DESIDERATA IN THE ART OF DYING.

Gentlemen,

Dying may be esteemed, especially in England, a very considerable branch of commerce, as most of our woollen goods are indebted to it for the preparation they receive before they are in a condition elegant enough to be exported. Surely it must be allowed that this art of dying is capable of great improvements ; and can there be a more certain method of bringing it to perfection than a communication of knowledge ?

Almost every dyer has his little secret, which, for want of being communicated to somebody capable of improving on the hint, remains useless on his hands ; and he had rather it should do so, than that any other should benefit by his thought. But is not this a narrow way of thinking ; and would not the man, who had the least public spirit, be content to share with others the benefit of that hint which he was not himself capable of improving ? The misfortune is, that many men who follow this business are mere machines : they have been taught, during their apprenticeships, that such and such ingredients, combined and managed in particular modes, will have such various effects : they take all upon credit, they know nothing of the doctrine of causes, and are quite ignorant of what is meant by the theory of an art.

It is not from such men we are to expect improvements in the art of dying ; they are content to jog on in the old routine ; and if they lose not any part of their knowledge, thus by rote acquired, they think they have acted well their part in life. Others indeed are more ingenious ; they make use of their reason, and are curious to search into the latent causes of the effects they every day see produced : they may perhaps in part discover these causes, and, by various experiments of different combinations of substances, may, by chance, produce an effect which to them appears new : their next thought is, to turn this as much as possible to their own particular advantage, and it is seldom they get much by it ; whereas, were they to communicate generously to the public this their boasted secret, it might either turn out no new discovery, or, if new, might be capable of great improvement, which the experiments that would soon in course be made would soon effect. All the honour of the discovery would rest with the person who had first given the hint, and he would have his share in the profit resulting from the practice of his method. But I should do great

* February, 1764.

injustice to the dyers, did I not confess that there are among them men remarkably intelligent, who have studied nature, are masters of the principles of their art, and know how to improve on accidental circumstances.

To these is the nation much indebted for many important discoveries, which I am willing to think they would communicate for the benefit of their country, did they know of any proper method of doing it. Doubtless, as you, Gentlemen, have afforded them a fair opportunity of proving their public spirit, they will not miss the occasion ; but I shall hope soon to see some valuable pieces in your collection on this subject.

I mean this letter as a hint to the ingenious to communicate their hitherto self-reserved knowledge, and am not without hope, that I shall soon see some difficulties, which occur in the noble art of dying, removed by means of some of your correspondents' letters ; and in this hope I beg leave to subscribe myself,

Gentlemen, Your most obedient servant,

A Member of the Society of Arts, &c.,

and a Lover of Useful Improvement.

NOTES ON BOOKS

Annual Reports on the Progress of Applied Chemistry, 1936. Vol. XXI. pp. 870. Issued by the Society of Chemical Industry. Price 12*s.* 6*d.*

These reports continue to increase in length and in value both to the expert and the general reader ; the latter appreciates them the more as they are made more readable and less a collection of facts expressed in abbreviated technical jargon. In this respect the volume for 1936 shows improvement ; it is divided into twenty-six divisions written by an imposing list of experts.

It is becoming an unpleasant habit to exhibit the chemist as an individual chiefly occupied in the application of his discoveries for use in war, or in discovering lethal substances. It would be difficult to discover a single paragraph in these reports bearing out such an accusation ; the immense and invaluable amount of progress and invention reported is wholly for pacific purposes tending to the normal betterment of the lot of man. Even under the heading of Explosives, it is stated that in Britain recent developments have been largely in the direction of increasing the safety of blasting explosives for use in fiery mines, and that the output of sheathed explosives has increased enormously during the period, whilst in America a new type of explosive which has been introduced is extremely safe to handle.

One of the most important fields of application of chemistry is to sanitation and water purification, subjects in which renewed interest is being taken partly as the result of the periods of drought from 1933–35.

During the dry period the improved condition of rivers and streams was remarkable, and this has directed renewed attention to the question of their pollution by untreated sewage and trade waste. The solution of the sewage problem, which requires the harmonious co-operation of biology, chemistry and engineering, is developing only slowly, particularly as public opinion concentrates upon a compromise between what is desirable and what is readily attainable at reasonable cost. Chemical treatment of sewage is coming once again into favour, chlorine being applied in increasing quantities to effect quite a number of desiderata.

The fact that the large cities have already appropriated the most accessible sources of water supply has made a comprehensive survey of all the water resources of the country, both surface and underground, a matter of urgency, and a Government Committee is now at work which has issued its first Annual Report. The world over safe water for potable and other purposes is becoming available in increasing quantity.

Photography might be regarded as a fully established industry, yet the amount of new work which is still taking place in it may be gauged from the fact that during 1936 over 1,100 patents and 600 research papers have appeared. The industrial use of photography is steadily expanding, and the use of special ray and high-speed photography and kinematography for the examination of materials and processes is almost commonplace. Though there has been progress in colour photography, no new processes or outstanding achievements are to be recorded.

The opportunities for the chemist to help agriculture are almost unlimited ; it is only slowly that he is feeling his way into many of the more complex problems. There is a new science of the soil, and much progress in this was made as the result of an international congress at Oxford in July, 1935. Most important publications on the soil surveys of the United States have been made by C. F. Marbut and by C. E. Kellog. Russia has an approach of its own to the problems of soil genesis and geography, and is paying great attention to the subject. Their leader, Polinov, regards soil formation as a natural process of the continuous motion and transformation of matter, from which the very possibility of a state of equilibrium is excluded. It is clear there is much to learn in connection with soil composition and behaviour. For example, the poor growth of the seedlings of forest trees, especially pine which is associated with defective mycorrhiza, may be corrected by incorporating various organic composts and inorganic nutrients which stimulate root production prior to the usual stimulation by mycorrhiza.

So far we have dealt with outside subjects with the purpose of illustrating the magnitude of the field covered by applied chemical science. The reports likewise chronicle the progress made in the manufacture of chemicals proper and their use in the great allied industries such as textiles, fermentation, ceramics, glass and metallurgy.

A debt of gratitude is owed to the Society and those who contribute to its funds for making a volume so stocked with information available to a wide public at a modest price. E.F.A.

LIVERPOOL AND HER POTTERS. By H. Boswell Lancaster. Liverpool : W. B. Jones & Co., Ltd. 5*s*.

Mr. H. Boswell Lancaster has been successful in collating a mass of scattered information from old records and extracts from earlier writers into his book about the old potters of Liverpool.

The earliest dated piece of Liverpool is the Crosby, delft plaque, 1716, but during excavations a quantity of broken pottery was found in the silt of a dried stream—some few pieces glazed and decorated, but the greater part unglazed. This discovery seems to indicate that decorated delft was made earlier than the dated plaque, as this stream was filled and built over about 1700. The first portion of the book deals with the history of the potteries, where mention is made of the industry of John Sadler, who discovered the art of transfer printing on pottery from copper plates.

The next section gives an alphabetical list of names known to have been

connected with the art in Liverpool. The third part is called " Classification and Examples," and the book ends with some hints as to patterns and peculiarities which will assist in identification. This small volume should prove of use to the collector of pottery, and also to the student of local history, and the numerous illustrations add to its value.

MEETINGS OF OTHER SOCIETIES DURING THE ENSUING WEEK

MONDAY, MAY 3..Engineers, Society of, at the Geological Society, Burlington House, W. 6 p.m. J. E. Newman, **" Grass Drying."**

Farmers' Club, at the Royal Empire Society, Craven Street, W.C. 4 p.m. A. Hurd, **" Agricultural Policy in the Empire."**

Geographical Society, Royal, Kensington Gore, S.W. 8.30 p.m. Miss I. Hutchison, **" Plant-Hunting in the Aleutian and Pribilof Islands."**

University of London, at the Imperial College of Science and Technology (Huxley Building), Exhibition Road, S.W. Prof. H. H. Plaskett, **" Problems in Astrophysics." Lecture I—Observable Properties of the Stars.**

At the London School of Economics, Houghton Street, W.C. 5 p.m. Prof. Dr. L. H. Jenks, **" Some Aspects of the Migration of British Capital. Lecture I—Introductory."**

At University College, Gower Street, W.C. 5 p.m. Prof. Dr. H. Rein, **" Some Economising Mechanisms as a Condition of the Body's Adaptation to Increased Activity."** (Lecture I.)

Victoria Institute, at the Central Hall, S.W. 5 p.m. Rev. Dr. D. M. McIntyre, **" The Gospel of St. John 'in situ '."**

TUESDAY, MAY 4..Petroleum Technologists, Institution of, at the Royal Society of Arts. 4 p.m. Conference on **" Deep Drilling Problems."**

University of London, at the New Buildings of the University, Montague Place, W.C. 5.30 p.m. Dr. P. Wittek, **" The Rise of the Ottoman Empire. Lecture I—Criticism of the Tradition and Exposition of the Problem."**

At University College, Gower Street, W.C. 5 p.m. Prof. Dr. H. Rein, **" Some Economising Mechanisms as a Condition of the Body's Adaptation to Increased Activity."** (Lecture II.)

WEDNESDAY, MAY 5..Electrical Engineers, Institution of Savoy Place, W.C. 6 p.m. L. B. Turner, **" Constant Temperature : a Study of Principles in Thermostat Design ; and a Mains-operated Isothermal Chamber constant to One-Thousandth of a Degree Centigrade."**

Fuel, Institute of, at the Royal Society of Arts. 6 p.m. R. J. Sarjant, **" Fuel Economy in Melting and Re-Heating Furnaces for Steel Works."**

Metals, Institute of, at the Institution of Mechanical Engineers, Storey's Gate, S.W. 8 p.m. Prof. Dr. E. N. da C. Andrade, **" The Flow of Metals."**

Public Analysts, Society of, at the Chemical Society, Burlington House, W. 8 p.m.

University of London, at King's College, Strand, W.C. 5.30 p.m. Dr. A. de Hegedus, **" Three Hungarians of the Nineteenth Century. Lecture I—Maurice Jokai, the Dumas of Hungary."**

At the London School of Economics, Houghton Street, W.C. 5 p.m. J. Cliff, **" Some Experiments in Public Administration in Great Britain. Lecture II—The London Passenger Transport Board."**

At the New Buildings of the University, Montague Place, W.C. 5.30 p.m. Dr. P. Wittek, **" The Rise of the Ottoman Empire. Lecture II—Turkish Asia Minor up to the Asmanlis."**

THURSDAY, MAY 6..Central Asian Society, Royal, at the Royal Society of Arts. 8.45 p.m. Dr. G. Montell, **" Mongol Life and a Journey to Etsin-gol."**

Chemical Society, Burlington House, W. 8 p.m.

Electrical Engineers, Institution of, Savoy Place, W.C. 6 p.m. R. S. Whipple, **" Electricity in the Hospital."**

Imperial Institute, South Kensington, S.W. 2.30 p.m. G. E. Janson-Smith, **" The Life of African Boys and Girls."**

University of London, at the London School of Economics, Houghton Street, W.C. 5 p.m. Prof. Dr. H. A. Smith, **" International Law and the Spanish Civil War."**

At the New Buildings of the University, Montague Place, W.C. 5.30 p.m. Dr. P. Wittek, **" The Rise of the Ottoman Empire. Lecture III—From the Emirate of March-Warriors to the Empire."**

At University College, Gower Street, W.C. 5 p.m. Prof. Dr. H. Rein, **" Some Economising Mechanisms as a Condition of the Body's Adaptation to Increased Activity."** (Lecture III.)

5.30 p.m. Prof. T. Borenius, **" Giotto : in Commemoration of the Sixth Centenary of his Death."**

FRIDAY, MAY 7..Electrical Engineers, Institution of, Savoy Place, W.C. 7 p.m. Sir T. E. Smith, **" Fundamental Electrical Measurements."**

Geologists' Association, at University College, Gower Street, W.C. 7.30 p.m. N. E. Odell, **" Nanda Devi, Central Himalaya."**

Mechanical Engineers, Institution of, Storey's Gate, S.W. 6.30 p.m. J. Rogers, **" Through America with the World Power Conference."**

Sanitary Engineers, Institution of, at Caxton Hall, S.W. 6 p.m. Discussion on **" Storm Water in Sewage Disposal Works."**

Sanitary Institute, Royal, at Rolls Hall, **Monmouth.** 5 p.m. (1) Dr. W. R. Nash and Dr. W. Panes, **" Immunization in Diphtheria."** (2) Dr. J. J. Evans, **" The Public Health Acts and their Implications in Rural Areas."**

University of London, at the London School of Economics, Houghton Street, W.C. 5 p.m. Prof. Dr. P. Vaucher, **" Recent Aspects of Trade Unionism in France."**

At Trinity College of Music, Mandeville Place, W. 5.30 p.m. G. D. Cunningham, **" The History and Development of Organ Music. Lecture I—Organ Music before Bach."**

EXHIBITIONS DURING THE ENSUING WEEK

MONDAY, MAY 3 (TO AUGUST 7)..**Royal Academy Summer Exhibition.**

(TO MAY 25)..**R.I.B.A. Civic Centres Exhibition, Warrington.**

TUESDAY, MAY 4 (TO MAY 14)..**L.N.E.R. Poster Art Exhibition,** New Burlington Galleries.

SOME CANTOR AND OTHER LECTURES

RECENTLY DELIVERED BEFORE THE ROYAL SOCIETY OF ARTS

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Geological Aspects of Underground Water Supplies. Three Lectures. By BERNARD SMITH, M.A., Sc.D., F.R.S., F.G.S. (1935.) Price 2s. 6d.

Nutrition and National Health. Three Lectures. By Major-General SIR ROBERT MCCARRISON. (1936.) Price 2s. 6d.

Lettering and Its Uses To-day. Three Lectures. By PERCY SMITH. (1936.) Price 2s.

(Peter le Neve Foster Lectures.) **Problems of Road Research.** Three Lectures. By REGINALD E. STRADLING, C.B., M.C., D.Sc., Ph.D., M.Inst.C.E. (1936.) Price 2s. 6d.

Copies of the above lectures can be obtained from the Secretary, Royal Society of Arts

Royal Society for the Encouragement of Arts, Manufactures and Commerce

PATRON—HIS MAJESTY THE KING

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