

**The helpfulness of physiological experiments to the general practitioner /
by James Mackenzie.**

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THE HELPFULNESS OF PHYSIOLOGICAL EXPERIMENTS TO THE GENERAL PRACTITIONER

By JAMES MACKENZIE, M.D., LL.D.

IN these pages I give the notes of the evidence I had intended to lay before the Royal Commission on Vivisection, had I been called as a witness, as illustrating the help that a general practitioner derives from Physiological experiment.

Shortly after I entered into general practice, in 1880, I attended a woman, aged thirty-five years, suffering from valvular disease of the heart, produced in all likelihood during an attack of rheumatic fever many years before. She married and left the town, but returned to her father's house, a year later, pregnant and in bad health. Towards the end of her pregnancy failure of the heart set in, so that she became very dropsical. When I saw her at the beginning of her labour she was greatly swollen and unable to lie down in bed on account of her bad breathing. We were unable to render her any assistance, because the slightest disturbance, as changing her position, increased the distress of breathing. The suffocation feeling produced by the attempt to give chloroform was so great that the patient begged to be left alone. In spite of our attempts to relieve her after thirty-six hours of great suffering her strength gave way and she died undelivered.

I was much distressed by my inability to give any effective aid to the patient, and I resolved to see what one could do to protect patients similarly affected from such great suffering. I carefully studied the experiences of others and found that there was much that was obscure in regard to the effects of pregnancy upon the heart, and our knowledge of the subject was so limited that no reliable indications to distinguish the cases where pregnancy would be dangerous could be given. I therefore determined to note the effects of pregnancy upon healthy as well as upon diseased hearts.

For a great many years after this experience I kept making observations, but the advance was slow. I noted all the circulatory changes in normal, healthy women and their modification during pregnancy. I ultimately found out that there were a number of changes whose meaning and significance had never been elucidated. It seemed that if the meaning of these changes were understood some advance might be made in the solution of the problem I had set myself. Two of these changes, in particular, seemed worthy of further investigation, namely the pulsation in the veins of the neck, which sometimes became very large during certain periods of the pregnancy, and irregular action of the heart, which occurred frequently in the pregnant state. The meaning of these symptoms had never been clearly understood.

It was soon evident that no advance could be made in the study of these questions, unless more accurate information of these changes could be obtained by other methods than those usually employed in the investigation of the heart and vessels. I therefore

applied the methods evolved by physiologists in their experiments on animals, modifying them to suit my purpose. I was thus able to get the vessels and the heart to record their own movements. When I attempted to analyse and to understand the meaning of the movements that had thus been registered I failed completely until I had recourse to the study of the physiological experiments in which the movements of the heart, and the alterations of the pressure within the heart chambers, had been recorded. For this purpose I studied the experimental work of Marey, Chaveau, Roy, Porter, Frey, and others. In this way I was able to understand the somewhat complicated series of waves that appeared in the jugular pulse. The knowledge of the venous pulse thus obtained I applied to the interpretation of the irregularities in the heart's action. I found that heart irregularity is very common not only in pregnancy but in many conditions of life from youth to old age. I also found that there were many forms of irregularity, some of which were of grave significance, while others were of very slight significance. I was enabled to separate and recognise the meaning of a certain number of these irregularities, but my knowledge of their manner of production was too limited to enable me to carry the matter beyond a certain stage. At the time I was carrying out these observations others were working independently at the same subject. Thus Professor Cushny had been producing, experimentally in dogs, different forms of irregularity, and had called attention to the fact that identical forms of irregularity could be recognised in the human subject. When I applied the explanation given by Cushny of his experiments to my own observations, I was greatly

helped in the recognition of certain irregularities. In 1903 Wenckebach, Professor of Medicine in Groningen, Holland, published a book on the irregular action of the heart as evidence of functional changes in the heart, and this work was of the greatest help to me and all other workers in the field. Wenckebach informs me that his interest in the subject was aroused in the following way. From 1901 to 1906 he was a medical practitioner in Utrecht. During a part of this time Engelmann was Professor of Physiology in Utrecht, and was at that time carrying out a series of experiments on the functions inherent in the heart muscle. Wenckebach visited Engelmann's laboratory frequently, and watched the experiments in progress. He felt convinced that irregularities similar to those produced by Engelmann occurred in the human subject, and he obtained apparatus similar to that used in physiological experiments, and proceeded to get records from the heart and pulse of his patients. He found a distinct resemblance between experimental irregularities and those arising spontaneously and as a result of disease in the human subject, and he was able to explain the meaning of many obscure actions of the heart, while his studies have thrown a flood of light on many of the heart's functions.

The outcome of these researches, as well as those of a great number of other observers, has been to elucidate the nature and meaning of a great number of abnormal conditions of the heart. It might be said with truth that, whereas a few years ago irregular action of the heart was one of the most obscure symptoms in clinical medicine, it is now one of the best understood. It is needless to repeat that this advance would have been absolutely impossible without

the knowledge gained by experiment. While all this work has been of use in improving our physiological knowledge, it has at the same time been of no little use to suffering humanity. No one who is called upon to treat patients, and who recognises his limitations, but will admit that any advances in Physiology that can throw light upon the working of the organism, helps materially in revealing the processes of disease, and that the more we know about these processes the more competent do we become to combat them. So far as the original project with which I started this investigation is concerned, much direct benefit has accrued. We can now distinguish certain cases where the incidence of pregnancy would be attended with very grave consequences. Recognising the danger, precautionary measures can be taken, and suitable treatment can be given when danger threatens. In the wider field of general medicine the benefit has been direct and important. We can recognise and appreciate the significance of symptoms that before were overlooked or misunderstood. We can differentiate irregularities in the heart's action so that we can tell those that are of grave significance, and those that are of little importance. In the matter of remedies the same reliable information can be obtained. The action of such a drug as digitalis, which has long been of the greatest service, is now better appreciated, as the evidences of its action can be studied with greater precision. The cases suitable for its application are now better recognised, and the extent to which it can be given can be regulated. The outcome of all this work is at the present day enabling clinicians to prosecute the study of the action of remedies with a precision hitherto unattainable.

In conclusion, as one who has never performed a physiological experiment, but whose work has been spent in the observation of disease, and in the attempt to withstand its progress and to alleviate the suffering it produces, I cannot too highly appraise the assistance I have derived from the study of the experimental results obtained by Physiologists.