Surgery has a fascination possessed by few occupations. By its aid diseases and injury, incurable by nature alone or aided by altering the constitution of the body fluids, can be eradicated or assisted in such a way that natural processes are enabled to bring about a cure. This work can be carried out so that its benefits are obvious to the naked eye; it is the one direct method we have to-day of combating disease which is already established in the body. Enthusiastic as we may be about operative method of treatment, we all look forward to the day when the causes of surgical diseases are known with certainty and measures can be taken to prevent their development. It is, however, only with the help of departmental knowledge, particularly those for pathological and X ray investigation, and the use that is made of them.

Surgery is synonymous with operating; this fallacy is certain to operate. The public seem to think that surgery is the art in which a surgeon% the sure technique with the power of quick decision that brings this art into play he should have a rapid and wide range of skill. The modern surgeon is not an operating machine, although if he has to undertake a difficult operation he should have a rapid and sure technique with the power of quick decision that brings this art into play. The modern surgeon is not a man well seen in the skull and in the abdomen; he is a region of the body that should be approached with a surgical mind. Many lives would be saved and much suffering avoided if this were done. How many cases of carcinoma of the stomach, to take a common example, have been told that there was nothing seriously wrong, finally to seek surgical aid when the condition was too far advanced to be benefited. How many tragedies does this not call to mind! I recently saw a gentleman with an enormous inoperable mass in the abdomen who, on retiring from business nine months previously, developed suspicious gastric symptoms. His medical attendant wished him to see a surgeon; the patient’s friends said “No—he will surely be operated on.” He was diagnosed flatulent dyspepsia—allowed to go for a trip round the world and returned inoperable. Never a month passes but I see cases of this nature.

One judges of the value of the work done by a hospital, not by the beauty of its wards or the up-to-date nature of its operating theatres, valuable as these are in treatment, but by the special departments, particularly those for pathological and X ray investigation. All our reliance must be on the one direct method of treatment—appendicitis. Un fortunately we do not get all as early as this, and it is in these late cases that often tax our skill to the utmost. The surgeon is the only individual who has the correlated knowledge of symptoms, signs, and the actual condition of parts as seen during life. This clinical knowledge cannot be possessed by the pathologist. He may have seen many cases of such a disease, but he is not familiar with the actual condition of parts as seen during life. This is the clinician; he alone knows the nature of the symptoms and realises, perhaps dimly, their meaning, and as a result of that valuable asset, clinical experience, he can determine the nature of the investigations required for diagnosis and of the special forms of treatment that may be requisite. His must be the guiding hand.

Before discussing the great value of these methods I should like to emphasise that, in the abdomen, the symptoms as given by the clinician are the most important factor in diagnosis, which would, in most cases, be impossible on pathological and X ray investigation alone. In some branches of surgery the histological investigations to be carried out, often at short notice, but bacteriological and chemical. The clinical pathologist needs to be familiar with every method of investigation.

Special Investigations in Acute Cases.

In acute abdominal emergencies no time should ever be wasted. A careful history must always be taken; this, with the symptoms and physical signs and examination of the urine, which ought never to be neglected, must be our guide. After all our reliance must be on ourselves. To await some special form of investigation while peritoneal infection or damage to intestine is possibly increasing is quite unjustifiable. In the less acute cases we may obtain much help; in the more acute cases following appendicitis. I am a whole-hearted sceptic as to the value of vaccine treatment, in acute abdominal conditions at any rate. I have never known it do good so shall not discuss it.

Absenteeism and the Value of the Work Done by a Hospital.

One judges of the value of the work done by a hospital, not by the beauty of its wards or the up-to-date nature of its operating theatres, valuable as these are in treatment, but by the special departments, particularly those for pathological and X ray investigation. All our reliance must be on the one direct method of treatment—appendicitis. Unfortunately we do not get all as early as this, and it is in these late cases that often tax our skill to the utmost. The surgeon is the only individual who has the correlated knowledge of symptoms, signs, and the actual condition of parts as seen during life. This clinical knowledge cannot be possessed by the pathologist. He may have seen many cases of such a disease, but he is not familiar with the actual condition of parts as seen during life. This is the clinician; he alone knows the nature of the symptoms and realises, perhaps dimly, their meaning, and as a result of that valuable asset, clinical experience, he can determine the nature of the investigations required for diagnosis and of the special forms of treatment that may be requisite. His must be the guiding hand.

Before discussing the great value of these methods I should like to emphasise that, in the abdomen, the symptoms as given by the clinician are the most important factor in diagnosis, which would, in most cases, be impossible on pathological and X ray investigation alone. In some branches of surgery the histological investigations to be carried out, often at short notice, but bacteriological and chemical. The clinical pathologist needs to be familiar with every method of investigation.

Special Investigations in Acute Cases.

In acute abdominal emergencies no time should ever be wasted. A careful history must always be taken; this, with the symptoms and physical signs and examination of the urine, which ought never to be neglected, must be our guide. After all our reliance must be on ourselves. To await some special form of investigation while peritoneal infection or damage to intestine is possibly increasing is quite unjustifiable. In the less acute cases we may obtain much help; in the more acute cases following appendicitis. I am a whole-hearted sceptic as to the value of vaccine treatment, in acute abdominal conditions at any rate. I have never known it do good so shall not discuss it.

Absenteeism and the Value of the Work Done by a Hospital.

One judges of the value of the work done by a hospital, not by the beauty of its wards or the up-to-date nature of its operating theatres, valuable as these are in treatment, but by the special departments, particularly those for pathological and X ray investigation. All our reliance must be on the one direct method of treatment—appendicitis. Unfortunately we do not get all as early as this, and it is in these late cases that often tax our skill to the utmost. The surgeon is the only individual who has the correlated knowledge of symptoms, signs, and the actual condition of parts as seen during life. This clinical knowledge cannot be possessed by the pathologist. He may have seen many cases of such a disease, but he is not familiar with the actual condition of parts as seen during life. This is the clinician; he alone knows the nature of the symptoms and realises, perhaps dimly, their meaning, and as a result of that valuable asset, clinical experience, he can determine the nature of the investigations required for diagnosis and of the special forms of treatment that may be requisite. His must be the guiding hand.

Before discussing the great value of these methods I should like to emphasise that, in the abdomen, the symptoms as given by the clinician are the most important factor in diagnosis, which would, in most cases, be impossible on pathological and X ray investigation alone. In some branches of surgery the histological investigations to be carried out, often at short notice, but bacteriological and chemical. The clinical pathologist needs to be familiar with every method of investigation.

Special Investigations in Acute Cases.

In acute abdominal emergencies no time should ever be wasted. A careful history must always be taken; this, with the symptoms and physical signs and examination of the urine, which ought never to be neglected, must be our guide. After all our reliance must be on ourselves. To await some special form of investigation while peritoneal infection or damage to intestine is possibly increasing is quite unjustifiable. In the less acute cases we may obtain much help; in the more acute cases following appendicitis. I am a whole-hearted sceptic as to the value of vaccine treatment, in acute abdominal conditions at any rate. I have never known it do good so shall not discuss it.
X-ray examination is invaluable in cases of acute right-sided pain, so often diagnosed incorrectly as appendicitis, even by experts. While the house surgeon is new I am asked to see these cases of acute pain in the right iliac fossa as appendicitis, which they certainly are not; of the numerous cases I have seen I could not recall one in which any surgical experience of the abdomen will recall cases in which the appendix was removed and a stone was later found in the ureter and had to be removed by another operator, and many more in which the appendix was removed without relief for pain confined to the right iliac fossa. X-ray investigation and careful examination of the urine will prevent these cases from being overlooked.

**Special Investigations in Chronic Cases.**

I will now pass to the type of case in which special investigations are so often necessary; in at least 90 per cent of chronic cases we should have recourse to the pathological or X-ray department at some time during the illness, either for diagnosis, prognosis, or both. Chronic abdominal diseases fall into two groups, those in which the diagnosis can be made by clinical methods—particularly careful history-taking—and those in which the symptoms and signs are not clear and do not conform to those of any named disease. It is in the latter group that special methods of investigation are so helpful, although they should never be neglected as confirmatory evidence in the former.

I should like to give two examples from the latter group to illustrate my meaning. Both were women with left-sided pain, and in both the pain was diagnosed as renal in origin. The history in neither was typical: the pain—in its site and spread—did not have all the characteristics of renal pain; neither did it have the characteristics of pain due to the disease from which the patients were found eventually to be suffering—in one case peritonitis, in the other malignant disease eroding the pancreas, in the other malignant disease of the splenic flexure of the colon. By X-ray investigation the correct diagnosis was made, which enabled me to carry out operative treatment successfully knowing beforehand the condition with which I had to deal.

**Value of X Rays in Abdominal Diagnosis.**

In speaking of the value of X-ray work in abdominal diagnosis one naturally starts with its earliest victory—that of revealing calculi in the urinary passages; this is of itself of the greatest value not only in those elusive cases of right-sided pain, but also in many left-sided. Disease of the stomach, gall-bladder, and the appendix may all give rise to pain in the left iliac fossa, and a suspicion of uric acid calculi is raised, to be settled by this method of examination. The left-sided pain in chronic posterior gastric ulcer and in diseases of the gall-bladder is more common than is generally realised. It is unfortunate that so far X-ray examination has not been used in all cases of gall-stones as accurately as they do stones in the urinary tract. The frequency, however, with which they are demonstrated is yearly increasing with greater knowledge and improved technique. While from time to time we are able to get positive results, the constitution and size of gall-stones differ so much that no reliance should be placed on negative reports; and we must always bear in mind that the causes of biliary colic are numerous and that a typical attack is not necessarily diagnostic of gall-stones. We have, therefore, to rely on our history, symptoms, and physical signs; and we must make our diagnosis of biliary colic from history and symptoms, and occasionally are able, from symptoms and signs, to determine, definitely, its cause. If the diagnosis of biliary colic is to be correct, we must realise that pain may be due to a condition in the bladder region, but is epigastric or right round the waist as a band, in the back, and occasionally the left side.

The introduction of X-ray investigation of the alimentary tract after an opaque meal has advanced our knowledge of abdominal anatomy and physiology, and, in certain cases, is a great aid in diagnosis. It helps also to settle the somewhat elusive condition in which the shadow of the viscera can be depicted in a photograph that may be presented to the patient showing the dropped stomach or the dropped colon, whichever it happens to be the fashion to treat. The whole subject of visceroptosis is so complex and bound up with the well-being of the abdominal autonomic nervous system that it is very difficult to believe that any form of operation fixing plexus of this description is likely to be of great advantage. X-ray investigations are so helpful, although not infrequently overlooked in these patients, as it probably would not have been had an opaque meal been given.

**Routine X-ray Examination in a Gastric Case.**

The opaque meal should be given six hours before the patient is to be examined. The first point of note is the rate of passage of the meal through the alimentary canal, much more important above than below; normally the whole of it should have left the stomach in five hours. In cases of five hours the meal should be half-way across the transverse colon. Any residue in the stomach is evidence of gastric stasis and denotes some organic lesion, the nature of which may be at once apparent by definite signs indicating the presence of carcinoma, or at least will be diagnostic of disease without stasis; in this case a residue may sometimes be seen in the crater of an ulcer. The actual time taken for the material to leave the body is not important; there are such wide variations in individuals of normal health. It is important, however, that there should be no undue delay in the small intestine; such delay is, however, rare. The question of intestinal stasis and not only stasis but also the cause of stasis is a controversial character that I could not profitably discuss it briefly. I would, however, remark that I believe it is rarely necessary to operate, and that the failures of operative treatment far exceed the successes.

After these points have been noted, if the diagnosis is not clear the patient is again given a meal, and the opaque in the stomach is evidence of gastric stasis and denotes some organic lesion, the nature of which may be at once apparent by definite signs indicating the presence of carcinoma, or at least will be diagnostic of disease without stasis; in this case a residue may sometimes be seen in the crater of an ulcer. The actual time taken for the material to leave the body is not important; there are such wide variations in individuals of normal health. It is important, however, that there should be no undue delay in the small intestine; such delay is, however, rare. The question of intestinal stasis and not only stasis but also the cause of stasis is a controversial character that I could not profitably discuss it briefly. I would, however, remark that I believe it is rarely necessary to operate, and that the failures of operative treatment far exceed the successes.
I have very briefly sketched out what should be looked for in the routine X ray examination of a gastric case. Before dealing with its value in diagnosis in the various gastric lesions I must speak shortly of its utility in diseases of the colon.

VALUE OF X RAY INVESTIGATION IN DISEASES OF THE COLON.

Except in the usual cases in which we wish to estimate the stay of intestinal contents in this part of the alimentary canal, the opaque material is usually and, in my opinion, better administered by enema. We avoid such complications as over-inflation, and the changes caused by diverticulitis, all of the utmost importance. In the diagnosis of carcinoma it may be of the greatest help. Every suspicious case should be so investigated by X rays as a routine. Here, again, I would warn against accepting a negative finding if it does not agree with the clinical diagnosis. The possibility of carcinoma of the lower bowel should never be dismissed until examination with the sigmoidoscope has been carried out.

Malignant disease of the colon is very amenable to surgical treatment and the prognosis is good; yet how seldom do we see cases of left-sided, or, what are really operable, not because the condition does not produce symptoms, either pain or diarrhoea, but because so little attention was paid to them. Every complaint of the bowels must be seriously investigated, and X ray examination should never be neglected.

The early symptoms of carcinoma of the colon are usually irregularity of the bowels or painless diarrhoea. Sometimes there is colicky pain—general, or it may be due to disease of the appendix. These symptoms caused many errors in diagnosis; for example, I was asked to operate on a patient for intestinal obstruction on his landing from New York, after a recent operation in Canada, for "appendicitis." On seeing the patient I found that the appendix had been removed for pain confined to the right iliac fossa, due to carcinoma of the pelvic colon. This is by no means uncommon. Much more generally renal disease causes symptoms similar to the symptoms of carcinoma of the cecum and a mass due to disease of the appendix. In both there may have been attacks of colicky pain in the mid-line. I have known mistakes made in both directions. Usually X ray examination is sufficient to enable the diagnosis to be made; X ray examination after an opaque enema usually clinches it at once, revealing in the one the irregular filling defect, in the other the narrowing of the cecum from external pressure.

Left-sided pain is rarely a symptom of carcinoma of the pelvic colon; it is much more common in disease of the gall-bladder and stomach. I have known several patients with gall-stones sent to me as carcinoma of sigmoid. Adult patients with looseness of the bowels must be seriously investigated, and X ray examination is one of the most valuable methods and should never be neglected.

The help given by the investigation of the stools, not only in inflammatory disease of the colon but in pancreatic and obstructive jaundice, is often the greatest in use in diagnosis and treatment.

PATHOLOGICAL CHEMISTRY OF THE STOMACH.

It is an exaggeration to say that without access to a pathological and clinical staff, abdominal surgery is impossible. In dealing with diseases of the stomach chemical pathology is of great assistance. I attach importance to the examination of the gastric contents after total removal. In diagnostic cases I have been in the habit of employing the Ewald test breakfast. With regard to the fractional test-meal much work is still being done and valuable physiological information obtained, but for surgical work it has, at present, no advantage over the simpler method of examining the gastric contents one hour after the meal. Some years may elapse before such observations packed by operative investigations, have given data to render it so satisfactory a guide.

Certain precautions are necessary; the meal must be brought in the same laboratory under the same staff. All mine have been done by Dr. P. N. Panton in the manner which he described with Dr. H. L. Tidy. It has its greatest use in diagnosis, in chronic duodenal ulceration and certain cases of carcinoma, in prognosis, after gastric operations.

Considerable discussion has taken place with regard to the action of gastro-jejuno-stomy in bringing about the healing of an ulcer and in preventing the formation of other chronic ulcers elsewhere. I have shown by numerous specimens, obtained post-mortem, and by examination at operations performed for other conditions up to 11 years after, that chronic ulcers of the stomach and duodenum if they are "free" will heal and remain healed after a gastro-jejuno-stomy, correctly performed. Also that the formation of ulcers in the region of the anastomosis is dependent upon gastric acidity. The operation is dependent upon gastric acidity, and the change it produces in the chemistry of the stomach is of great importance. By the new opening it allows rapid emptying of the stomach and counteracts pyloric spasm, but pain is long for some time continued by the pylorus with no ill-effect. It should immediately abolish the free HCl and diminish by half to two-thirds the total gastric acidity. This it does in at least 90 per cent. of cases, and in these success is certain: no fresh ulceration can take place under these circumstances unless unabsorbable material has been used. This lowered acidity is permanent; at least I have known it persist for 11 years after gastro-jejuno-stomy.

There are many interesting details with regard to what prevents, in some few cases, lowered gastric acidity after gastro-jejuno-stomy. There is one very fertile cause that I must mention—pyloric exclusion. No attempt should ever be made to bring this about. If ulcers in the pyloric region have to be directly dealt with it should be in such a manner that the pylorus is enlarged and not excluded. Every patient upon whom gastro-jejuno-stomy has been carried out for the cure of ulcer should have a second test-meal 14 days after operation, and if gastric acidity is not lowered, although the original ulcer will heal, fresh ulceration in the region of the anastomosis will be certain unless medical measures can be found which will bring about the desired change. Test-meals are, therefore, of great importance in prognosis.

BLOOD EXAMINATION.

I must deal briefly with one other side of pathological work—blood examination. The abdominal crises of tabes have led many surgeons astray, and many gastro-jejuno-stomies were done for this condition when the indications for its performance were less sure than now. Still, it does present puzzling features and the only rule is always to suspect the cerebral circulation. Examination of the cerebro-spinal fluid may be necessary to confirm our suspicions. Again, we are sometimes puzzled, and have opened an abdomen for a mass in the gall-bladder region, with symptoms suspicious of gall-stones, proved to be a gummata, when the diagnosis could have been determined by a few ounces of this condition and had a Wassermann done.

Syphilitic disease of the stomach should be borne in mind. Last summer a patient came to England from abroad to consult me with regard to the possi-
the left epididymis, associated with a large hydrocele which I considered was syphilitic. There was no hint of his disease and he had a perfectly healthy family. The X-ray examination seemed to confirm the suspicion of carcinoma, but there was a positive Wassermann, and on anti-syphilitic treatment the two symptoms disappeared completely in three weeks.

The surgery of the spleen is now becoming one of the commonplace of life in the work of an abdominal surgeon. Many of its diseases are curable by operative means. Without blood examination we should be helpless in splenic anemia, with its leukopenia with relative increase in lymphocytes, the enlarged spleen can be removed at slight risk with the prospect of cure. The patient is saved from gradually increasing chlorhydria and hunger pain. In doubtful cases I have recently operated on two patients in one family. Both had normal gall-bladders drained elsewhere and the ulcer overlooked. It is, unfortunately, only about 75 per cent. of cases have been in good gastric health, must be looked upon with suspicion. The first thorough examination will find a change in the blood after splenectomy is rapid and striking; within a few weeks the white cell count has returned to normal. The blood changes in splenomegaly jaundice are typical before operation, and equally striking is its post-operative recovery.

By our blood examination we are warned away from the enlarged spleen of splenomegaly jaundice with marked anemia, blood examination at once tells us that it is not "pernicious" and hence should raise the suspicion of carcinoma.

Post-Operative Investigations.

I have dealt only with some of the more recent methods; of the less important examination of fluids and solid materials removed at operation you are all as familiar as I. As reminders I mention that the discovery of typhoid bacilli when the biliary passages are drained, or in stones removed at operation enables us to take precautions against infection. The report on the fluid evacuated from the cyst confirms our diagnosis of its pancreatic origin, and the finding of malignant cells in a portion of tissue removed at an operation gives us the indication for correct treatment.

Special Lesions.

Chronic Gastric Ulcer.

Of all simple gastric diseases amenable to surgical treatment chronic duodenal ulcer is the most common; fortunately it is also the most easily diagnosed and has the best prognosis. Ninety per cent. at least are cured by gastro-jejunostomy, and less than 2 per cent. are failures. In this disease hyperchlorhydria is the rule, and the later development of ulceration may be diagnosed and more valuable time wasted until the suspicion of carcinoma, but there was a positive Wassermann, and on anti-syphilitic treatment the two symptoms disappeared completely in three weeks.

The right-sided pain may suggest renal colic. Several patients have come under my care with this diagnosis, who proved on investigation and operation to be suffering from chronic duodenal ulcer. The X-ray examination after an opaque meal adds nothing to our certainty of diagnosis in the majority of cases and is therefore not infrequently misleading. The X-ray examination is a great increase of gastric acidity; to know this should be sufficient.
I have never had an opportunity of seeing the result of X ray examination in an early case; at the time I most often see the patient the diagnosis is so obvious that it is usually a waste of time to have this done. It has been stated that X ray examination is so obvious that it is usually a waste of time to have this done. I have several times known cases of simple chronic ulcer to be mistaken for cancer, with the definite diagnosis of inoperable malignant growth, and cases of carcinoma with the report "no evidence of any gastric lesion." A case should only be judged inoperable before opening the abdomen if enlarged glands are present above the left clavicle, or if rectal examination, which should be a routine in every abdominal case, reveals secondary deposits in the pelvis.

In the more common type of carcinoma, that following a many years history of chronic ulcer, the test-meal is of no value; the result is the same as that found in chronic ulcer without this complication. If the opaque meal was followed by heartburn, simply showing the crater of an ulcer or being returned as negative. This is as we should expect when we consider the difficulty even after the abdomen has been opened, the muscle is so some time after the X ray examination that the diagnosis is made. It is the history that usually makes one suspicious that this complication may have occurred. After a period of years in which the patient has had attacks of pain at a regular hour after food, lasting meal or day after meal, day after day for weeks, with or without occasional vomiting, interspersed with periods of perfect or almost perfect digestive health lasting for times which, instead of passing away in the usual time, continues, or the symptoms alter, the pain becoming constant. Change in the nature of the symptoms, or their continuance, points to some complication having occurred, either adhesion to and erosion of neighbouring organs, particularly the pancreas, or the development of a stricture, hour-glass stomach, or the onset of carcinoma. X ray examination may help, but symptoms such as these mean that a long delayed and long necessary operation must be done.

Gall-stones. Little help can be obtained in the diagnosis of gall-stones from X ray or pathological investigations. It may be possible in the future to say as the result of X ray examination that no stones are present, but this, although of value, would not exclude serious disease producing biliary colic. Many anomalous symptoms owe their origin to cholelithiasis; I have already mentioned attacks of pain in the left iliac fossa. I have published several cases in which the symptoms of carcinoma of the stomach were mimicked with exactitude; in gall-stones low gastric acidity is the rule and absence of free HCl common. Occasionally the regularity of the pulse is such that the disease is chronic gastric or duodenal ulcer. We remember how frequently gall-stones are found complicating other abdominal diseases, the problem becomes more difficult. It holds a lesson for us all—never be content with the lesion found; if the condition of the patient will permit the whole abdomen must be examined. This warning is particularly necessary in dealing with disease of the appendix. No term has been used more abused than the term appendicitis; it has been made to cover many sins other than its own. Appendicular dyspepsia is a very real condition—diagnosable usually only by exclusion—and none of its symptoms can be explained on the lesion itself. I teach at hospital that it is legitimate to diagnose appendix dyspepsia but not to act upon it. By this I mean that one should not in these cases remove the appendix through a small incision in the right iliac fossa; the whole abdomen should be explored through a right paramedian incision in which the rectus is pulled out. By this method the size of the incision, if not entirely, is at least reduced, and the abdominal wall after operation; the muscle falls back into its place and ventral hernia is impossible.

CONCLUSION. I am afraid my remarks have been rambling, and for this I must apologise. I hope I have been able to point out a few of the great advantages of such departments as I have opened up in the small branch of surgery. Their utility, not only to the hospital, but to the whole district served is so great as to be inestimable.

The Milroy Lectures on RESPIRATORY EFFICIENCY IN RELATION TO HEALTH AND DISEASE. Delivered before the Royal College of Physicians of London.

BY MARTIN FLACK, C.B.E., M.B., B.Ch. Oxon., WING COMMANDER, ROYAL AIR FORCE MEDICAL SERVICE.

LECTURE III.—(Concluded).*

SPECIAL ROUTINE TESTS.

The Endurance or + Fatigue" Test.

This test is sustaining 40 mm. of mercury with the breath held arose out of an endeavour to see if any noticeable fatigue could be elicited by getting the subject to blow every few seconds the mercury as high as possible, thereby getting a fatigue curve. This proved to be too tiresome, so the idea came to hold the mercury at a given height as long as possible. The height of 40 mm. was fixed upon, partly because certain subjects could not blow the mercury much above this height, but also because it was thought that this pressure, besides throwing a certain amount of work upon the expiratory musculature, would also cause a distinct but not unbearable or dangerous resistance to the circulatory through the lungs, thereby possibly giving value to the test as throwing light upon the circulatory condition of the subject. The idea of counting the pulse arose from this point of view, and it has proved to be a valuable adjunct to the test. The subject has no control over his own pulse, and it has been found that the fit man differs very greatly from the unfit man in this respect. In the fit man the rate of the pulse every five seconds is not materially affected during the time that the mercury is sustained; in the slightly less fit the pulse rises gradually in rate until just before the end. The average time for the fit individual is 50 to 60 seconds. In a man probably unfit for flying, on the other hand, the pulse is immediately increased in rate and may stay so, with variations due mainly to error in counting by five seconds, as, for example, from seven per second before the test to 10, 11, 10, 11, 9, 10 in five-second periods during the test. This type of response, however, is certainly not so definitely an expression of unfitness as one in which, after a transitory period of quickening, the pulse rapidly falls to the initial rate or even below. This type of response has been found to be associated with the most marked cases of flying strain. The length of time during which the mercury is supported is short, 15 to 25 seconds, and in that time the pulse-rate, in five-second periods, may vary from 90 to 110, or 115 per minute to 130 per minute, to again to 72. Such cardio-motor instability is very rare.

* Lecture I. and the first part of Lecture II. were published in THE LANCET of Sept. 17th and 24th respectively. Lecture III. will appear in a coming issue.