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Some Experiences with Protamine and Protamine Zinc Insulin*

By J. L. MACARTHUR, '37

THE discovery of insulin in 1922, by Banting and Best,[1] ushered in a new era in the treatment of diabetes mellitus. In the past, the cause of death had been diabetic coma, and the prognosis in any case was poor. Since the introduction of insulin, however, there has been a remarkable change. Today, death from coma is uncommon; the prognosis is exceedingly better, especially in the younger and middle-aged groups of patients, and the life span of the diabetic approaches and, in some cases, surpasses that of the non-diabetic individual. Nevertheless, the outlook is not quite as optimistic as it may appear. At present, arteriosclerosis and all its implications, heads the list as the greatest contributing factor causing death among diabetics; and infection is always a serious complication.

The subcutaneous injection of insulin cannot compensate wholly for the physiological secretion of the islets of Langerhans. Its action is rapid, powerful and transient; and is likely to be accompanied by marked fluctuations in the concentration of the blood sugar. Consequently, sudden and frequent demands are made upon the suprarenal glands when hypoglycaemia ensues. It has been stated[2] that in a moderately severe diabetic, even when the disease is controlled as well as possible, that during one-quarter to one-half of the time the blood sugar is abnormal. This means that during a period of 20 years, hyperglycaemia with its ill effects has been present for from five to ten years.

To more closely simulate the physiological secretion, there should be a slower, steadier flow of insulin into the blood stream. With standard insulin, frequent, repeated, small injections act much more efficiently than when the total quantity is given as one dose. A prolongation of the insulin effect has been attempted in two principle ways: (1) By the purification of the insulin to heighten its effects, and (2) by the addition of some substance with which the insulin would combine to form a fairly insoluble compound which, when injected subcutaneously, would break down and liberate insulin to the blood gradually.

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The first effort in this direction was in 1923 when Burgess et al.[3] endeavoured to use insulin with gum arabic. In 1929, Leyton[4] utilized a suspension of insulin in oil. Also, attempts have been made to employ combinations of insulin with lecithin, and vasoconstrictor substances such as adrenalin and pituitrin. None of these methods added materially to the effectiveness of the insulin.

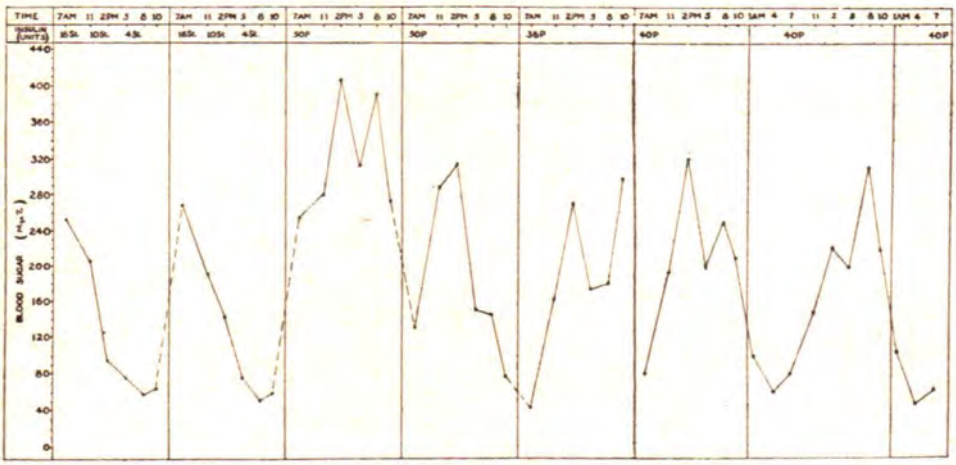
Recently, more encouraging results have been obtained by the use of crystalline insulin and various combinations of protamine and insulin.

PROTAMINE INSULIN

Protamine insulin was developed by Hagedorn and his associates[5] in Denmark. It consisted of standard insulin mixed with a protamine prepared from the sperm of a fish, Salmo Iridius, and buffered to a reaction of Ph. 7.3. This compound was found to be relatively insoluble, quite stable, painless on injection and not followed by protein shock.

Protamine insulin was first investigated clinically by Hagedorn, who recommended the administration of standard insulin in the morning to meet the heavier and more sudden demands due to food absorption,

CHART I



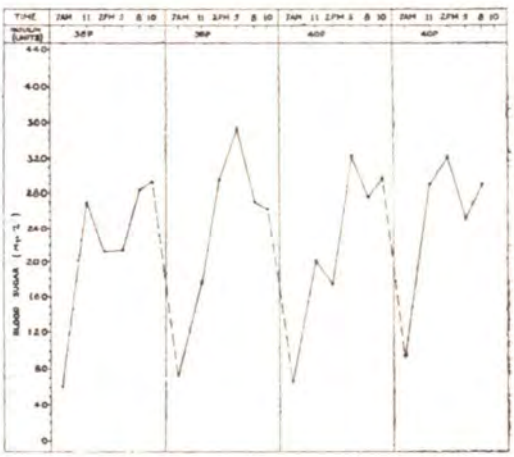
and protamine insulin in the evening to regulate the lighter, but more prolonged demand at night. He concluded that protamine insulin would depress the blood sugar for much longer periods than standard insulin; that hypoglycaemic reactions were less frequent, more easily recognized and less severe; and that fewer injections of the preparation were required than with regular insulin alone. He believed that the new product was rather unstable and should be made up fresh every few days and be administered by a cool, dry syringe. Sprague et al.,[6] Rabinowitch[7] and others have since shown, however, that the compound will remain unchanged for as long as six months at least and that precautions regarding syringes and needles are unnecessary.

The clinical observations of Hagedorn have been confirmed by Root,[8] Kerr,[9] Lawrence,[10] Sprague,[6] Joslin[11] and others. The majority of the

patients treated were known diabetics of all ages and severity, who had been fairly well controlled previously by standard insulin. In some cases there was an early evening rise in the blood sugar unless the carbohydrate given with the evening meal was curtailed. The immediate blood sugar reducing effect of protamine insulin was less than that of standard insulin. When protamine insulin was used alone, increased glycosuria was the rule for a few days following its institution, but under proper dosage this gradually disappeared and a normal blood sugar could be maintained after four to six days. Control could be obtained in a shorter period by supplementing the protamine insulin with small doses of standard insulin.

Although Joslin and his associates[11] have allowed many of their patients to continue the use of protamine insulin in their homes and claimed no untoward effects from such usage, other investigators,

CHART II



namely Kerr[9] and Sprague,[6] felt that the compound was entirely in the experimental stage and not without danger. They believed that further experience must be acquired before general rules for its use could be formulated. Allen[12] maintained that when used in the home with the same freedom as standard insulin, very severe reactions were liable to occur and that the fluctuations in the blood sugar level were more marked. Such results, if met with generally, must indeed lead to discouragement. It is probably true that there are many problems yet to be solved before protamine insulin is ready, if ever, for general use by the medical profession.

CRYSTALLINE INSULIN

A crystalline, pure form of insulin has been developed recently by Sahyun, of Detroit, and studied clinically by Freund and Adler,[13] Mains and McMullen[14] and by Altshuler and Leiser.[15] They concluded that it was perfectly stable at room temperature; that its action was more

prolonged than standard insulin but not quite as prolonged as protamine insulin; that severe infections and acidosis seemed to favour more rapid absorption and that delayed absorption prevented reactions following large doses. We have had no experience with the use of crystalline insulin.

PROTAMINE ZINC INSULIN

It was shown by Scott and Fisher[16] that the action of insulin was augmented by the presence of certain metals, notably zinc. Further, crystalline insulin in its purest state still contains a certain proportion of zinc. Kerr and his associates[9] have shown that insulin to which zinc had been added resembled protamine insulin by prolonging its action. The fact that zinc is present in definite amounts in the pancreas tends to suggest that it may be a factor in aiding the effect of insulin and is actually a constituent of it. Working on this hypothesis, Scott and his co-workers[16] produced a complex combination of protamine, zinc and insulin which was tested clinically to see if it was more efficient than protamine insulin.

TABLE I.

Mrs. A. K., aged 70—Hospital No. 4526, 1936

Date (1936)	Urine			Blood Sugar (Mgm. %)		Insulin (units)		Diet		
	Sugar	Aceto-acetic acid	Acetone	AC	PC	S	P	Prot.	Fat	CHO.
June 12	++++	neg.	trace	370			30	70	70	80
June 13	++++	neg.	neg.	274			26			
June 14	+++	neg.	neg.				26			
June 15	++++	neg.	neg.	229	289		26			
June 16	+	neg.	neg.			12	32			
June 17	+	neg.	neg.			12	32			
June 18	neg.	neg.	neg.	198	117	12	32			
June 19	neg.	neg.	neg.			10	28			
June 20	ft. trace	neg.	neg.			10	28			
June 21	trace	neg.	neg.			10	20	75	90	100
June 22	trace	neg.	neg.	222	220	10	20			

S — Standard insulin.
P — Protamine insulin.
AC — Morning fasting blood sugar.
PC — 4 hours after morning insulin.

Using protamine zinc insulin prepared by Scott, Rabinowitch[17, 18] observed its effect upon diabetics who had been previously very difficult to control with standard insulin and were still unsatisfactorily handled with protamine insulin. He concluded that, although protamine insulin was more efficient than standard insulin, the protamine zinc compound worked even better, much less of the mixture being needed to control the blood sugar level. He found that in a series of diabetics, in whom control was impossible with standard insulin and of whom only 25 per cent could be well controlled with protamine insulin, 75 per cent were controlled by protamine zinc insulin. The action of the latter was more prolonged than protamine insulin and, further, the patients seemed to have become sensitized to insulin by the zinc, so that post-prandial hyperglycaemia was lessened.

FURTHER INVESTIGATIONS

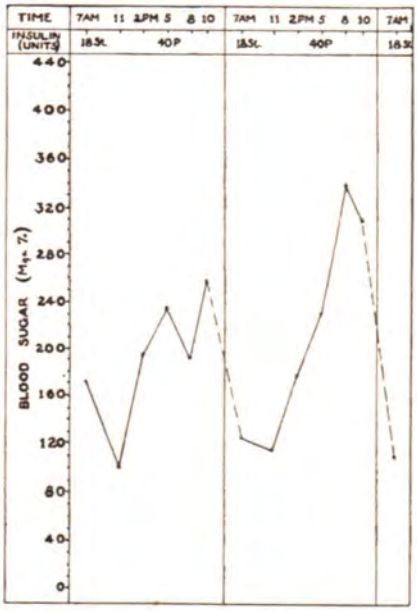
Observations of diabetics who were treated with protamine insulin

and protamine zinc insulin have been carried out at the Victoria Hospital, London, Ontario, in association with Dr. E. M. Watson. The results are presented below.

The products used for the investigations were supplied by the Connaught Laboratories, Toronto. Nearly all the patients had been treated with standard insulin previously. The majority were severely diabetic, receiving three or four injections daily of the standard insulin. A few were children. All were observed in the hospital, where they could be watched carefully.

PROTAMINE INSULIN: The methods of investigation were similar to those employed by Hagedorn.[5] For two or three days before beginning the protamine insulin, blood sugar estimations were made at 7 a.m., 11 a.m., 2 p.m., 5 p.m., 8 p.m. and 10 p.m., and the resulting blood sugar curves plotted. These were used for comparison with those obtained later, after the use of the newer compound. The urine was

CHART III



collected every two hours, and on each sample, qualitative tests for sugar and acetone were performed and a quantitative estimation of the 24-hour output of sugar was made.

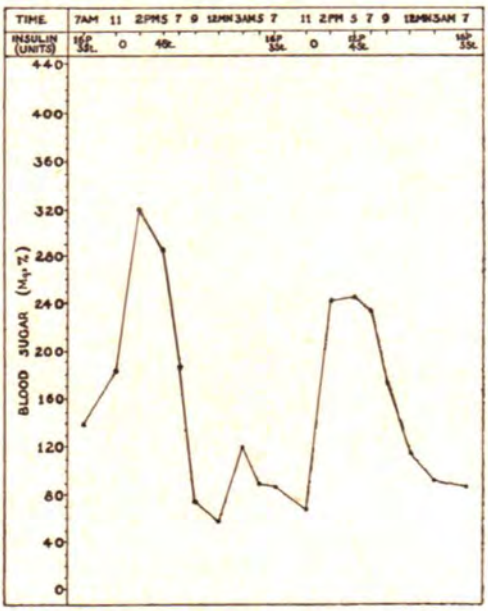
Some patients were started on one massive dose a day, while others were given the protamine insulin along with a complementary injection of standard insulin.

Observations: Protamine insulin alone, it was found, did not give a satisfactory control of the diabetes. The first few injections were given at 6.30 a.m. daily but it was found that when this was done, there was an evening hyperglycaemia, followed by a hypoglycaemia with the

lowest blood sugar level occurring about 3 or 4 a.m.; that is, about 21 to 22 hours after the injection, providing moderately large doses were used (Chart I.). The time of injection was then advanced four hours, giving it at 10.30 or 11 a.m., in the hope that the hypoglycaemia occuring 20 hours later might be counteracted by the carbohydrate of the breakfast. By this method, it was hoped that larger injections might be given to overcome the evening rise of the blood sugar. Morning hypoglycaemia was not less marked under these conditions and the control was definitely unsatisfactory with severe diabetics (Chart II.). The long night interval of fasting apparently determined the time of the hypoglycaemia, rather than the time of the injection.

Much better control could be accomplished by injecting regular insulin before breakfast and protamine insulin in the evening but with any method of injection, glycosuria was marked for three or four days (Table I.). A gradual fall in the blood sugar occurred subsequently, however, so much so that the doses of protamine insulin had to be

CHART IV



greatly decreased. The fluctuations in the blood sugar level still were greater than had been hoped for (Chart III.).

To overcome the excessive early evening rise and the gradual night fall in the blood sugar concentration, multiple meals were tried, in which the total daily carbohydrate allowance was divided and given as follows: 1/10 at breakfast, 1/10 at 10 a.m., 1/5 at noon, 1/10 at 2 p.m., 1/5 with the evening meal, 1/10 at 8 p.m. and 1/5 at bedtime (Chart IV.). Under this regime along with protamine insulin, it was possible to decrease the fluctuations in the blood sugar concentration.

Reactions and Exercise: Because of the reserve supply of protamine

insulin at the site of injection, the blood sugar was readily converted into glycogen. Indeed, there seemed to be an excessive conversion perhaps due to an increased blood supply in muscles during exercise, and a coincidentally increased release of insulin. During the course of our investigations, two severe hypoglycaemic reactions occurred. In one case, the blood sugar dropped to 29 mgm. per cent before the symptoms became manifest. This is explainable probably on the ground that the slow rate of decline of the blood sugar allowed adrenalin to be released and counteract the insulin effect to some extent. This reaction was sudden and moderately severe, requiring the total glucose equivalent of the breakfast, also the repeated ingestion of orange juice for two hours, to prevent its recurrence. In the other case, a boy aged 14, the reaction occurred during the night. He had been allowed out in the afternoon and he had walked for three hours. The reaction occurred about nine hours after the exercise, showing the slow rate of decline of the blood sugar level. It was impossible to arouse him and 15 cc. of 50 per cent glucose were injected intravenously, before he became conscious enough to take fluids by mouth. It was necessary to follow this injection by 30 gm. of dextrose in orange juice orally over a period of two hours to prevent the recurrence of the hypoglycaemic symptoms. Even then, when left alone for one and one-half hours, it was found that he again was on the verge of reaction, with a blood sugar of 48 mgm. per cent just before breakfast.

Exercise, it seems, presents a serious problem to the users of protamine insulin. Once injected, the compound is not readily controllable. This alone suggests the danger of permitting its use at present, generally, by patients in their homes.

PROTAMINE ZINC INSULIN: Following the investigation of protamine insulin, an opportunity was provided for studying the effects of protamine zinc insulin. In this, an endeavour was made to follow the same methods of procedure as used with protamine insulin, in order to make a comparison of the efficacy of the two preparations. In a few instances, patients who had been controlled poorly with protamine insulin were switched to the newer compound and observations made to see if there was, as Rabinowitch claimed, an easier and better control of the blood sugar level with it.

In order to compare protamine zinc insulin with protamine insulin, one daily injection was given to some patients and to others one injection along with one or more injections of standard insulin. In all these investigations, the diets were kept constant. The type of diet employed was that known as the moderately high carbohydrate, moderately low fat diet.

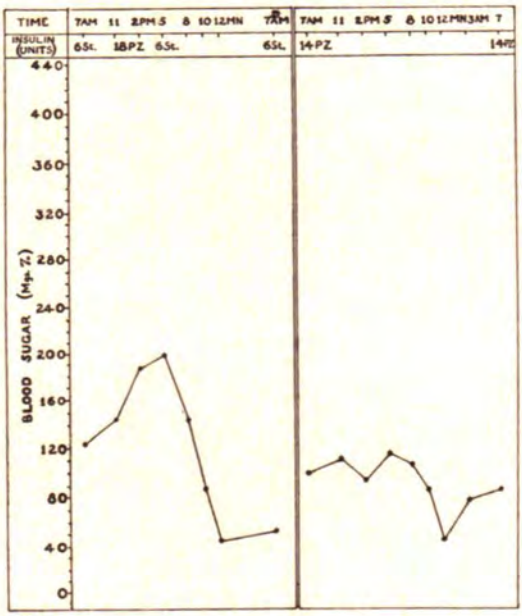
Observations: The addition of zinc to protamine insulin seemed to have sensitized it in some way. It was possible to control in many instances moderately severe diabetics with but one daily injection. With the severe cases, it was possible to keep the blood sugar concentration

more even than with either standard insulin or protamine insulin, and to do so with fewer injections per day.

By using patients who had received protamine insulin with only fair control at best, it has been possible to roughly compare protamine zinc insulin with the protamine variety. Chart V. shows patient R. M., aged 25, whose blood sugar could not be maintained perfectly with protamine insulin alone or in conjunction with standard insulin (see Chart I.). At present, both protamine zinc insulin and standard insulin are being injected and control is satisfacotry, so long as the exercise factor is looked after. It is interesting to note, also, that satisfactory maintenance is being obtained with a total of 38 units daily as compared with 50 units of protamine insulin and standard insulin.

The outstanding benefit attributable to protamine zinc insulin is

CHARTS V and VI



the reduction of the number of daily injections necessary for adequate control of the diabetes. In some cases, this is accompanied by a diminution of the total number of units per day, as compared with the requirement of standard insulin. This is due, in part, to the continuous action of protamine zinc insulin throughout the night. With standard insulin a high morning fasting blood sugar is present following a gradual night rise. With protamine zinc insulin, the fasting morning blood sugar is low, so that the patient begins the day with a normal or subnormal concentration. The massive dose of insulin previously necessary at this time is therefore eliminated. For example, H. P., aged 12, with diabetes of two years' duration, was receiving 15-15-15 units of standard insulin daily. Subsequently, he was able on the same diet to remain sugar-free

throughout the 24 hours of the day with 14 units of protamine zinc insulin each morning. Miss D. A., aged 20, was known to have had diabetes for 12 years. She has taken insulin for 11 years and for four years she received a total of 74 units of standard insulin daily divided in four doses, with imperfect control of her diabetes. She is receiving now six units of standard insulin in the morning and four units in the evening with 36 units of protamine zinc insulin at noon, and the diabetes is under better control than it had been for several years previously. These examples could be multiplied many times.

TABLE II.

Mrs. C. D., aged 59—Hospital No. 2619, 1937

Date (1937)	Urine			Blood Sugar (Mgm. %)		Insulin (units)	Diet		
	Sugar	Aceto-acetic acid	Acetone	AC	PC	PZ	Prot.	Fat	CHO.
Feb. 28	++++	neg.	neg.				70	70	80
Mar. 1	++++	neg.	neg.	176	289				
Mar. 2	trace	neg.	neg.	171	230	60			
Mar. 3	neg.	neg.	neg.			60			
Mar. 4	neg.	neg.	neg.	58	84	40			
Mar. 5	neg.	neg.	neg.			20	75	90	100
Mar. 6	neg.	neg.	neg.		227	20			
Mar. 7	++++	neg.	trace			20			
Mar. 8	+	neg.	neg.	100	220	20			
Mar. 9	++	neg.	neg.			20			
Mar. 10	+	neg.	neg.			20			
Mar. 11	trace	neg.	neg.	111	164	20			
Mar. 12	++	neg.	neg.			20			
Mar. 13	+	neg.	neg.			20			
Mar. 14	++	neg.	neg.			20			
Mar. 15	+	neg.	neg.	115	169	20			
Mar. 16	neg.	neg.	neg.			20			
Mar. 17	neg.	neg.	neg.			20			
Mar. 18	neg.	neg.	neg.	131	100	20			
Mar. 19	neg.	neg.	neg.			18			
Mar. 20	neg.	neg.	neg.			18			
Mar. 21	neg.	neg.	neg.			18			
Mar. 22	neg.	neg.	neg.	105	89	18			
Mar. 23	+	neg.	neg.			14			
Mar. 24	neg.	neg.	neg.			14			
Mar. 25	neg.	neg.	neg.	85		14			
Mar. 26	neg.	neg.	neg.			12	75	90	130
Mar. 27	neg.	neg.	neg.			12			
Mar. 28	neg.	neg.	neg.			12			
Mar. 29	neg.	neg.	neg.	95	103	12			
Mar. 30	neg.	neg.	neg.			10			
Mar. 31	neg.	neg.	neg.			10			
Apr. 1	neg.	neg.	neg.	78	90	10			
Apr. 2	neg.	neg.	neg.			8			
Apr. 3	neg.	neg.	neg.			8			
Apr. 4	neg.	neg.	neg.			8			
Apr. 5	neg.	neg.	neg.	117	140	8			
Apr. 6	neg.	neg.	neg.			8			

PZ — Protamine zinc insulin.

Young diabetics generally are more difficult to control consistently than those who are older. Himsworth[20] has pointed out the necessity of treating each patient as an individual, keeping in mind the psychic effects produced by necessary restrictions in their normal activities. When frequent injections have to be given and there is a constant fear of reactions, children and young adults are prone to adopt a melancholy

attitude toward life. It is heartening to notice the change in outlook which many of our younger diabetics have assumed when given protamine zinc insulin with its fewer injections and markedly better control. Florence, aged 12 years, has had diabetes for 5 years. She was taking 10-10-8-4 units of standard insulin daily with but imperfect control and frequent reactions. During the past year, she changed to protamine insulin but with only slightly better results. Reactions were still all too frequent. When she was changed again to protamine zinc insulin, a marked improvement soon became evident. She has had no reactions, has gained weight and, best of all, has assumed a brighter outlook on life and entirely lost her former depression. Her improvement, physically and mentally, can only be attributed to the new compound with fewer injections, less frequent reactions and better control of her condition. Such personality changes have been the rule.

This manner of control also provides a remarkable peace of mind to parents of diabetic children. When exercise is controlled, the infrequency of reactions and the freedom from injecting insulin in the middle

TABLE III.

Mrs. E. B., aged 68—Hospital No. 2258, 1937

Date (1937)	Urine			Blood Sugar (Mgm. %)		Insulin (units)		Diet		
	Sugar	Aceto-acetic acid	Acetone	AC	PC	S	PZ	Prot.	Fat	CHO.
Feb. 10	++++	++	++++	357	—	30–20		70	70	80
Feb. 11	++++	neg.	neg.	204	210	16				
Feb. 12	++++	neg.	neg.				60			
Feb. 13	trace	neg.	neg.				60			
Feb. 14	neg.	neg.	neg.				60	75	90	90
Feb. 15	neg.	neg.	neg.	50	66		50			
Feb. 16	neg.	neg.	neg.				30	75	90	100
Feb. 17	+	neg.	neg.				30			
Feb. 18	neg.	neg.	neg.	105	113		20			
Feb. 19	neg.	neg.	neg.				18	75	90	120
Feb. 20	neg.	neg.	neg.				18			
Feb. 21	neg.	neg.	neg.				18			
Feb. 22	trace	neg.	neg.	66	124		18			
Feb. 23	neg.	neg.	neg.				16	75	90	140
Feb. 24	neg.	neg.	neg.	72	100		16			

of the night contribute greatly to the optimism being shown by them toward the new compound.

Following the preliminary investigations concerning the effects of protamine zinc insulin on patients who had been receiving formerly only standard insulin, several new patients have been treated successfully from the beginning with protamine zinc insulin. The record of Mrs. C. D., aged 59, is shown in Table II. The interesting feature about this case is that she had a major surgical operation performed (vulvectomy for carcinoma of the vulva), with little upset in her sugar metabolism and without the necessity of resorting to standard insulin. The fluctuations in her blood sugar for 24 hours on March 24, 1937, are shown in Chart VI.

Mrs. E. B., aged 68, was given standard insulin on admission, in order to combat severe ketosis rapidly and was changed to protamine

zinc insulin on the second day of her stay in hospital. Her satisfactory progress with one daily injection is shown in Table III.

Probably one contraindication for the employment of protamine zinc insulin is diabetic coma, on account of the slow action of this type of insulin. Rabinowitch,[18] however, has reported successful results with the preparation in cases of pre-coma. Nevertheless, it is doubtless unwise to depend upon protamine zinc insulin entirely in the treatment of actual diabetic coma. That simple ketosis is not a contraindication for its use is indicated by the case of Mrs. A. H. (Table IV.).

Reactions: Rabinowitch[18] states that reactions are infrequent with protamine zinc insulin. It is true that they have not occurred as often with protamine zinc insulin as with standard insulin or protamine insulin at this clinic, but it is equally true that those which have occurred have come on suddenly and have been severe.

I. B., a juvenile diabetic, had a reaction which began about 8.30 a.m. In spite of constant watching and repeated administration of dextrose and orange juice along with intravenous glucose, she remained stuporous

TABLE IV.

Mrs. A. H., aged 55—Hospital No. 3027, 1937

Date (1937)	Urine			Blood Sugar (Mgm. %)		Insulin (units)	Diet		
	Sugar	Aceto-acetic acid	Acetone	AC	PC	PZ	Prot.	Fat	CHO.
Mar. 22	++++	++++	++++	277	—		70	70	80
Mar. 23	++++	trace	++	232	274	20			
Mar. 24	++++	+	++			20			
Mar. 25	+	+	++	253	182	20			
Mar. 26	++	neg.	trace			24			
Mar. 27	+++	+	++			24			
Mar. 28	trace	neg.	neg.			24			
Mar. 29	neg.	neg.	neg.	196	190	24			
Mar. 30	neg.	neg.	neg.			30			
Mar. 31	neg.	neg.	neg.			30			
Apr. 1	neg.	neg.	neg.	90	110	30			
Apr. 2	neg.	neg.	neg.			20	75	90	100
Apr. 3	neg.	neg.	neg.			20			
Apr. 4	neg.	neg.	neg.			20			
Apr. 5	neg.	neg.	neg.	105	117	20			

for over nine hours. During this time there was a marked tendency for hypoglycaemia to recur.

R. M. was allowed out for a walk one afternoon. The same evening at 8 o'clock, without warning, he lost consciousness and had a convulsion. Over a period of four hours he received intravenous glucose and, when possible, dextrose by mouth. At midnight, even though the blood sugar was 200 mgm. per cent, he was still hard to arouse. The next morning his blood sugar was 135 mgm. per cent.

The usual warning symptoms were absent in both of these cases, due apparently to the slow fall in blood sugar level. Subjective symptoms may not appear but when the blood sugar becomes low enough sudden convulsions occur.

These observations confirm those of Lawrence and Archer[19] who

warn that protamine zinc insulin is a dangerous drug in inexperienced hands.

SUMMARY

1. Protamine insulin and protamine zinc insulin, by decreasing the rate of absorption of the insulin, prolong its activity.

2. Protamine insulin, either alone or in combination with standard insulin, is not as effective as protamine zinc insulin in controlling the blood sugar of diabetic patients.

3. It is possible to control the blood sugar of moderately severe diabetics with one daily injection of protamine zinc insulin and, in more severe cases, to maintain the blood sugar at a fairly normal level by various combinations of protamine zinc insulin and standard insulin.

4. The principle advantage of protamine zinc insulin, as compared with standard insulin, is the fewer injections necessary for adequate control of the diabetes. This benefit is frequently accompanied by a reduction of the total number of units required per day.

5. Reactions are less frequent with protamine zinc insulin than with standard insulin, but they are prone to come on without warning and to be very severe when they do occur. There is a tendency to hypoglycaemia during the early hours of the morning.

6. Exercise is an important factor, which must be stabilized if good control of the blood sugar is to be maintained.

7. The general well-being of diabetics is enhanced by the use of protamine zinc insulin.

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(Continued on Page 151)

The History of Lead Poisoning*

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ONE of the most interesting fields in medicine is that of occupational diseases, those disturbances to which an individual is liable as a result of certain environmental conditions under which he lives and works. Those environmental factors may be physical, chemical, or organic in nature and they are many in number. The majority of them are by no means well-defined, and their differentiation is usually very difficult and often impossible. They are constantly increasing in importance as industry develops, so that a working knowledge of them is becoming a necessity for even the average practitioner.

Lead poisoning is probably the most interesting of the occupational diseases and one whose history is easy to follow, because unlike most of these conditions, it has very definite clinical features which are easily recognized. According to Cecil, chronic lead-poisoning is a disease acquired by the accumulation of lead salts in the body, and characterized in its fully developed stages by abdominal colic, paralysis affecting mainly the upper extremities, ocular disturbances, encephalopathy, and secondary anemia, with characteristic punctate basophilic stippling of the erythrocytes.

This disease is one of those which has been known since the time of the ancients. The first mention of it is found in a verse by Nikander, a Greek physician of the second century B. C. who fancied himself a poet. One of his attempts, which goes under the name of Alexipharmaca, deals with poisons and their antidotes and one section gives a vivid picture of lead poisoning with its colic, paralysis and ocular disturbances. I quote now from an English translation of a Latin translation of his poem:

"He belches so much and his belly does swell,
His sluggish eyes sway, then he totters to bed,
Complains that so dizzy and heavy his head,
Fantastic forms flit now in front of his eyes,
While deep from his breast there soon issue sad cries,
Meanwhile there comes a stuporous chill,
His feeble limbs droop and all motion is still.
His strength is now spent and unless one soon aids,
The sick man descends to the Stygian shades."

For 900 years after the time of Nikander, we find only fragmentary mention of the subject. Dioscorides saw the dangers to workers in lead and some of the clinical results; he even described certain hygienic measures to prevent them. Galen and some other lay and medical writers of the same period recognized the dangers from drinking water conducted through lead pipes. However, the next account of any length

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which comes to notice is in the works of Paul of Aegina, a prominent Greek physician of the Alexandrian school who wrote toward the middle of the seventh century. He is most noted for his works of surgery, which show a stage of development surprising to us of the present day; he describes such operations as lithatomy, trephining, tonsillatomy and amputations of the breast. With respect to lead-poisoning, he describes an epidemic of colic followed by paralysis which, from the account, is obviously due to lead. Paul, however, had no conception of the true cause of the condition, believing it to be due to a collection of humors.

After the time of Paul, medical literature is once more silent, this time for a period of almost a thousand years. Then in 1616, a French physician, Francois Citois (1572-1652), published a widely read account of Poitier's colic "Colica Pictorum." Citois was a very prominent medical man, being personal physician to the great Cardinal Richelieu and, later in life, Dean of the Medical Faculty at Poitiers. In 1616, Citois published a paper entitled "A Discussion of the New and Common Painful Bilious Colic at Poitiers." In a preface to his account, he enumerates all the epidemics which had swept over Western Europe during the previous century, and indicates clearly the ravages of disease in medieval Europe. In his paper, he gives an accurate clinical description of plumbism, although he has no suspicion of its cause, and gives us no hint as to the source of the lead which must have been responsible. His belief was that it was due to an abnormality of bile, but now we are of the opinion that lead salts added to the Poitiers wine for purposes of preservation were really the cause.

Then, in 1700, was published the first text book of occupational diseases, a small volume entitled "Diseases of Tradesmen" by Bernardino Ramazzini (1633-1714). Ramazzini himself was a well-known Italian physician and scholar, who was the first principal of the University of Modena. In his publication under the section entitled "Diseases of Potters" we find the following:

> "Potters make use of burnt and calcined lead for glazing their ware. They receive by the mouth and nostrils and all the pores of the body all the virulent parts of the lead. They seldom have recourse to physicians till the use of their limbs has been taken from them and their viscera grown hard."

The next mention of lead poisoning which we find is in the writings of John Huxham (1692-1768), a famous English physician of the eighteenth century. Born in Devonshire and educated on the continent, he set up practise in his home country and first became known for his "Essay on Fevers," which brought him royal patronage. He is, however, best known for his volume entitled "Method of Preserving the Health of Seamen in Long Cruises and Voyages," in which he recommended the use of vegetables and fruit juices as a preventive of scurvy, which was then so prevalent in the British navy and merchant marine. With regard to lead-poisoning, in 1759 he published a classic account of

Devonshire colic which called attention to the frequency of the disease in England. From his essay we find that the condition was epidemic in England at that time, especially in the county of Devon and was a constant occurrence, from autumn until spring. His dissertation gives a very vivid account of the disease and I quote a few excerpts from it:

> "This disease began its attack by an excessively tormenting pain in the stomach and epigastric region, with unequal weak pulse and coldish sweats . . . An enormous vomiting followed, for the most part, exceeding green, bile. Things continuing in this state for a day or two, the belly became extremely bound, neither answering to the most drastic purges or sharpest clysters, the latter coming off without wind or stool, the former being soon vomited."

He goes on to describe the onset of paralysis and neuritis and comments on the alternation of rheumatism and colic. However, at no time does he make any serious attempt to state its cause.

Following the further history of lead-poisoning, interest crosses the Channel to Holland, where we meet with the name of Theodore Tronchin (1709-1781). Born of a Calvinist family who fled from France after the massacre of St. Bartholomew's Day, educated in England and Holland, he became an outstanding medical man in Amsterdam and later in Geneva. His best-known work is his essay "De Colica Pictorum," published in Geneva in 1757. He first mentions a case of poisoning occurring in an arthritic patient who was being treated with powdered lead, and then he discusses those trades or localities in which a similar condition arose. He tells of its prevalence among potters, who fashion earthen vessels with leaden glass, in patients being treated with compounds of lead, and finally he devotes the greater part of his account to an explanation of the prevalence of plumbism among the inhabitants of Amsterdam, whose drinking water was impregnated with lead. At the time, the people of Amsterdam received most of their drinking water from rainwater which was drained from the roofs of their houses into large cisterns. Unfortunately, most of the houses were roofed with lead, and it was inevitable that the water draining down should pick up sufficient lead to result finally in chronic lead poisoning among those who drank the polluted water.

The first definite proof that this clinical entity of colic, paralysis and ocular disturbances was caused by lead, was brought forth by Sir George Baker (1722-1809), a brilliant English physician, who was not only famous for his medical achievements (physician to the Royal Household, and nine times President of the Royal College of Physicians), but was also a profound and learned scholar with an inexhaustible knowledge of medical history. In 1767, he published his famous paper, "Inquiry Concerning the Cause of Endemial Colic of Devonshire." Born in Devonshire, he was well-acquainted with the famed Devonshire colic, acquired by drinking Devonshire cider, and, strangely

enough, not experienced on drinking cider from any of the surrounding counties. Baker noticed that the colic was very common in Devon, yet very rare in the next county of Hereford. Obtaining samples of ciders from both counties, he carried out a series of chemical tests, by which he proved that the Devonshire cider contained lead, while that of Hereford contained none. Further investigation revealed that only in Devon was the cider made in lead-lined cider presses, and the final link in the chain evidence was complete. Baker's essay aroused a furore and he was attacked fiercely by his farmer neighbors. However, the farmers, in spite of their disbelief, removed the lead linings from their cider presses and Devonshire colic disappeared.

During the first part of the nineteenth century, French scientists were the chief contributors to the literature of lead-poisoning. Tanquerel des Planches, in 1838, published the result of ten years study, including more than 1,200 cases; this is by far the most profound and important work ever devoted to the subject. His associate, Duchenne, working in the same period, first studied thoroughly, by modern methods, the nervous disorders produced by lead.

In spite of all the investigations carried on previously by the men whom we have noted, many of whom were outstanding physicians and far-famed clinicians, it was not until 1840 that first mention was made of a clinical sign which we now regard as practically pathognomic of lead-poisoning. In that year Henry Burton, F.R.C.P. and Physician to St. Thomas' Hospital, read a paper entitled "On a Remarkable Effect upon the Human Gums Produced by the Absorption of Lead." He commented on the fact that, as far as he could ascertain, this phenomenon had not hitherto been recorded. His description of the now well-known lead line is one which stands to the present day and shows him to be a most careful and accurate observer. He says:

> "The edges of the gums attached to the necks of two or more teeth of either jaw, were distinctly bordered by a narrow leaden-blue line, about the one-twentieth part of an inch in width, while the substance of the gum apparently retained its ordinary color and condition. There was no invariable tumefaction, softening or tenderness about them; neither was there any peculiar factor to the breath; nor increased salivary discharge."

Since the middle of the nineteenth century, although there are no outstanding names associated with its history, there has been a vast amount of investigation and research on this subject. More and more the realization has come that it is a most prevalent condition, and one which can be prevented if adequate measures are used. Of late years we have been led to believe that lead-poisoning may cause many other conditions aside from the classical picture, most of which had been unrecognized until recently. Boyd tells of a chronic form of nephritis, due to lead-poisoning, occurring mainly in Queensland, Australia. The

much higher incidence of nephritis in Queensland over all the other Australian states has been a subject of conjecture for many years. It is now attributed to the high lead content of the Queensland paint, which in that hot, dry climate becomes rapidly cracked and powdered and contaminates the food, water and the hands of the children. Occurring mostly in children, this form of nephritis often does not become evident until adolescence, although the growth of the children is often stunted. In many cases, whole families are affected and altogether it is a very serious problem. This serves only as an illustration of the many and devious ways in which lead may be introduced into the body. There are undoubtedly many places where plumbism is similarly responsible for some strange local condition, which has not as yet been recognized for what it really is.

Today, in spite of hundreds of years of familiarity with it, lead remains the chief industrial poison. One factor responsible for its prevalence is the fact that practically all forms of lead are poisoning, even the metal itself. Plumbism is by no means confined to industry, but occurs quite generally in the population at large. Epidemics of lead-poisoning may result from impregnation of drinking water or beer or other beverages. Babies contract lead-poisoning from gnawing lead paint from toys and cribs. Face powder, cosmetics, a bullet in the body, or even bullets carried in the pocket, have caused lead poisoning.

In many industries, lead remains a serious menace, particularly in lead mining and smelting, working in white lead and lead colors, manufacture of pottery and earthenware, making storage batteries and many such processes in which the use of lead is involved. For that reason, it has many times engaged the attention of the governments of various countries, particularly in England, France and the United States. In England, as far back as 1895, the Home Office had made special rules for workshops and work people, with the object of minimizing or preventing the occurrence of lead poisoning. These include such measures as, compulsory notification of cases, regular medical examinations, provision for keeping the air about the workmen free from lead dust or fumes, the maintenance of cleanliness of the body, clothing and surroundings. Similar laws have been passed in France and the United States and recently France has ruled that zinc paints are to be used as a substitute for lead colors in all indoor work.

And so, although more than two thousand years have elapsed since the first case of lead-poisoning was recorded, it still remains a serious menace. What progress will be made in the future we cannot predict, but with the increasing complexity of industry it is probable that its occurrence will in no way be diminished.

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Hysteria Major in General Practice

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IT has been said that hysteria, like chlorosis, is a disappearing disease. This proposition cannot be argued, because there are no figures to support the premise, but if it were more frequent in the past than at present, general practitioners must have had a lively time. Hysteria occurs at all ages and in both sexes, and because of the frequency with which it is encountered in practice, we record our opinions and some illustrative cases picked at random from the files.

Before going further, it is necessary to digress a little into psychopathological considerations. Time and space will be saved if we state that after study and practice of many of the systems of psychopathology, including those of Freud, Jung, and Ross, we have found that of Alfred Adler to work best in general practice, provided that in dealing with major hysteria the treatment is modified from the tenets laid down by Adler.

Briefly stated, Adler submits that aberrations in behaviour can be best understood by assuming that the patient is getting something out of the manner in which he acts. The behaviour is purposive, but much discussion has been waged, as to whether or not the purpose is present to the conscious mind. In our experience, it is best for success in treatment to assume that the purpose is conscious. Adler further submits that, in common with the victims of neurosis, the hysteric has had some upset in the realms of Sex, Society, or Subsistence. As a result of such an upset the patient seeks Sympathy, Security, or Support. The phenomena of hysteria, therefore, can be understood if the physician asks himself a few questions.

On encountering a case of major hysteria, the first question for the physician to ask himself is "Why does this patient act AS IF these symptoms were organic in origin." Note the important words "AS IF," because they put the case on its proper footing. The nature of the symptoms, the information gleaned from the patient and the relatives will give the answer; the answer will be that the patient is seeking Sympathy, Security, or Support, or a combination of these. The next question the physician asks himself is "Why does this patient need Sympathy, Security, or Support?" and the answer, when found, will invariably show that there has been a disturbance in the fields of Sex, Society, or Subsistence.

Some case histories will illustrate these points:

CASE 1. A man, 38, married 12 years, no children, was seen because

of paralysis of both legs of six weeks duration. On asking him to stand, he showed the typical phenomena of astasia abasia. There was anaesthesia to pain, touch, and temperature, from the toes to the upper borders of both patellae, at which point there was a sharp line of demarcation between sensation and its loss. Muscle, joint, and tendon sense was absent in the same distribution. There was loss of motor power from both knees to toes. Knee jerks were present, moderately exaggerated and equal; ankle jerks present, and the plantar reflexes were flexor. Beevor's sign was negative. (When a patient with organic paralysis is asked to fold his arms and raise himself from the supine to the sitting position the paralyzed limb is raised from the bed; the functionally paralytic limb is dug into the bed for support.) He could not adduct nor abduct the things, but antagonistic muscles were seen and felt to contract. Cremasteric and abdominal reflexes were present, and the testicles were sensitive to pressure.

He had operated a combined grocery and filling station on a lease for years, and had recently bought the business. To extend his business, he had extended much credit to poor risks, and two weeks before the onset of paralysis had found himself unable to meet his obligations or to collect from his debtors. The paralysis offered a way out of his difficulties, because, IF he were paralyzed, he obviously could not be expected to interview his debtors and collect from them; he so excited his wife's love and sympathy that she forgot the financial mess he had got into. All explanations failed to remove the phenomena, because there was nothing to offer in the way of Sympathy, Security (his wife had gone to work), and Support. Due to a long history of psychoneurosis it was easy to convince his wife of the hysterical nature of the symptoms.

CASE 2. A female, aged 37, unmarried and likely to remain so because of an unprepossessing appearance, was seen in a hysterical trance, with complete body rigidity. The trance had lasted six hours, and was the third she had had in a year. A hypodermic of apomorphine brought the trance to a sudden end. No explanations were given at that time. Six months later, she was seen in exactly the same condition as the patient described in Case 1. Questioning showed that marriage, a home, and children had been her dream for years, and the same years brought the fear that the dream would never be realized. The facts were carefully explained to her and she was shown that she could be of service in other ways than by marriage. She went into business, operating a small hotel, and has remained well for some years.

CASE 3. A man, aged 35, married, no children, was seen complaining of severe pain in the epigastrium, vomiting, and loss of 35 pounds in weight during the seven weeks since the onset of symptoms. The pain was most severe at night, and he often vomited food eaten 24 hours previously. Five years before, he had a similar attack which was diagnosed as gall stones. He was operated upon, and the gall bladder drained, but no stones were found.

On examination weakness and emaciation were obvious. Physical examination revealed no other abnormalities. X-rays after a barium meal showed a grossly dilated stomach with fifty per cent retention after 24 hours, and a small residue after 48 hours. There was no vomiting after giving the barium meal and this aroused suspicion. There were no abnormalities beyond dilatation in the stomach; the duodenum and passage of the meal through the bowel were normal.

Questioning revealed that the symptoms began after an intravenous injection of neoarsphenamine had leaked into the arm, caused great pain and swelling, and fear of losing the arm. The wife did not know that he was having injections. It was explained to him that the disease could be cured, and that future injections should not cause any trouble. The symptoms ceased at once and he rapidly regained his normal appetite, weight, and strength. It was ascertained that the onset of symptoms five years before coincided with a depression in business, which for weeks caused him to lose money at the rate of one hundred dollars a day.

Many cases of pernicious vomiting of pregnancy are hysterical in nature. The patient is protesting against an unwanted pregnancy; the Support desired is an abortion. But other manifestations occur in pregnancy.

CASE 4. A woman, 22, married for six months to a man twice her age was seen one night because she was shaking violently all over and screaming almost incessantly. (It is a curious fact that most hysterics in major attacks come under observation at night.) She complained between screams of "terrible pains" in the abdomen and back. Examination revealed nothing abnormal beyond a slightly enlarged uterus, and questioning elicited a history of two months amenorrhoea. She had spent the day visiting her mother who lived at a distance, and during the visit, the mother had informed the patient that she was probably pregnant. A jug of cold water terminated the seizure and forceful explanation brought about a cure.

The above case reports are sufficient to indicate the protean nature of the symptoms. Though it has been said that hysteria can simulate any disease except prostatism in a woman it is rare for the diagnosis to be difficult. A thorough examination should be made, and as soon as the physician is satisfied of the nature of the symptoms, the treatment is ready to begin.

Treatment for the hysteric should be swift and usually disagreeable. It is easier for the physician who administers the correct treatment, if other physicians have not temporized with the patient in previous attacks. Only too often, the patient has had pseudo-diagnoses made, either through ignorance, or through disinclination boldly to utter the correct words. Some of the fairy tales that patients and relatives tell concerning what has been diagnosed previously are enough to make one writhe. The appendix and the gall bladder are favourite victims of mis-diagnosis. "Dropped stomachs" and "dropped colons" are often blamed, and it is amazing to find that there are many physicians who

do not know that the positions of the stomach and colon within the abdomen are as individual as the shape of the patient's nose!

In treatment, the relatives and bystanders must be told in no uncertain terms just what the condition is. Fortified by the questions the physician has asked himself and the patient, and further fortified by knowledge of the purpose the attack is serving, the physician can forcefully explain the origin, the nature, and the treatment of the symptoms. Such an explanation is often so humiliating to the patient, and so disagreeable, that the attack ceases. In cases where the attention of the patient cannot be secured, a jug of cold water, a hypodermic of apomorphine, or the application to the skin of a little chloroform under a watch glass are sufficient to secure the effect desired. If the patient does not wish to give up the symptoms, the physician should lose no time or opportunity of emphatically stating what he knows to be the truth—that the patient does not wish to get well at the moment, but that the symptoms will disappear when the patient achieves the object desired; gives up the idea of attaining it; or makes a concession by getting well through some outlandish remedy or bizarre religion.

During the explanation, it is not unusual to have a few of the relatives and many of the patients get angry. It is easy to point out that if the explanation is accepted, the patient will get well, and if the explanation is not accepted, it is proof that well-being is not desired because it will not fit the purpose of the patient. The physician can further point out that if his treatment be followed, he certainly cannot be accused of angling for a fee! If some sympathetic relative is not convinced by the physician's statement, the task of cure is made far more difficult, because the proper atmosphere will not surround the patient; fortunately for us, not all the relatives are easily deceived by hysterical patients. The average hysteric has a long history of neuroticism which makes it easier for the relatives to accept the explanation. In fact, it is almost a truism, that while all neurotics are not hysterical all hysterics are neurotic.

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THE MORNING VISIT

A sick man's chamber, though it often boast
The grateful presence of a liberal toast,
Can hardly claim amidst its varied wealth
The right, unchallenged, to propose a health.

Yet, though its tenant is denied the feast,
Friendship must launch his sentiment at least,
As 'prisoned damsels locked from lover's lips
Toss them a kiss from off their finger tips:

The morning visit: not till sickness falls,
In the charmed circle of your own four walls,
Till fever's throb and pain's relentless rack,
Stretch you all helpless on your aching back—

Not till you play, the patient in your turn
The morning visit's mystery can learn.
'Tis a small matter in your neighbor's case
To charge your fee for showing him your face;

You skip upstairs, inquire, inspect and touch,
Prescribe, take leave, and off to twenty such.
But, when, at last, by Fate's transferred decree,
The visitor becomes the visitee—

O, then it pulls another string,
Your ox is gored, and that's a different thing.
Your friend is sick, phlegmatic as a Turk,
You write your recipe and let it work:

Not yours to stand the shiver and the frown
(And sometimes worse) with which your draught goes down.
Calm as a clock, your knowing hand directs,
"Rhei, Jalapae-ana grana sex."

Or traces on some tender missive's back,
"Scrupulos duos—pulveres ipecac,"
And leaves your patient to his pains and gripes,
Cool as a sportsman banging at his snipes.

But change the *time*, the *person*, and the *place*,
And be yourself, the "interesting case,"
You'll gain some knowledge, which it's well to learn,—
In future practise, it may serve your turn.

Leeches, for instance (pleasing creatures, quite)—
Try them, and bless you! don't you find they bite?
You raise a blister for the slightest cause;
But be yourself, the great sublime it draws.

And, trust my statement, you will not deny
The worst of draughtsmen is the Spanish fly.
It's mighty easy, ordering when you please
"Infusum sennae—capiat uncias tres."

It's mighty different when you guzzle down
Your own three ounces of the liquid brown.
"Pillulae"—"Pulveres"—pleasant sounds enough,
When other jaws receive the shocking stuff;

But oh, what flattery can disguise the groan
That meets the gulp that sends it through your own?
Be gentle then; though Art's inspiring rules
Give you the handling of her sharpest tools,

Use them not rashly—sickness is enough,
Be always "ready"—but be never "rough".
Of all the ills that suffering man endures,
The largest fraction, liberal Nature cures;

Of those remaining, 'tis the smallest part
Yields to the efforts of judicious Art.
But simple kindness—kneeling by the bed
To shift the pillow for the sick man's bed;

To give the draught that cools the lips that burn,
To fan the brow—the weary frame to turn—
Kindness untutored by our grave M.D.'s
But Nature's graduate, whom she schools to please—

Wins back more sufferers with her voice and smile
Than all the trumpery in the druggist's pile.
Once more—be quiet coming up the stair;
Don't be a plantigrade—a human bear—

But stealing softly on the silent toe,
Reach the sick chamber ere you're heard below.
Whatever changes there may meet your eyes,
Let not your looks proclaim the least surprise;

It's not your business, by your face to show,
All that your patient doesn't wish to know.
Nay—use your optics with considerate care
And don't abuse your privilege to stare.

But if your eyes should probe him overmuch,
Beware still further how you rudely touch;
Don't clutch his *carpus* in your icy fist,
But warm your fingers, ere you touch his wrist.

If the poor victim needs must be percussed,
Don't make an anvil of your patient's bust.
Doctors exist, within a hundred miles,
Who thump a thorax as they'd hammer piles.

If you must listen to his doubtful chest,
Catch the essentiels and ignore the rest,
Spare him—the sufferer wants of you an art,
A track to steer by—not a finished chart.

So of your questions—don't, in mercy, try
To pump your patient absolutely dry.
He's not a mollusk squirming in a dish,
You're not an Agassiz, and he's not a fish.

And last, not least; in each perplexing case,
Learn the sweet magic of a cheerful face,
Not always smiling—but at least serene;
When grief and anguish cloud the anxious scene.

Each look, every move and tone,
Should tell the patient you are all his own,
Not the mere artist—purchased to attend—
But the warm, ready, self-forgetting friend.

Whose genial visit in itself combines
The best of tonics, cordials, and anodynes,
Such is the visit, that from day to day
Sheds o'er my chambers its benignant ray.

I give his health who never dared to claim
Her babbling homage from the tongue of Fame.
Unmoved by praise, he stands by all confessed
The truest, noblest, kindest, wisest, best.

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Abdominal Pain

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ABDOMINAL pain means pain felt by the patient in his abdomen and includes the associated symptoms of tenderness, hyperaesthesia and muscular rigidity. It is an outstanding example of the remarkable fact that the precise etiology of so many of the commonest signs and symptoms of disease remains obscure. When properly interpreted there is no single symptom of abdominal disease which can be more informative to the physician. However, the very nature of the problem of abdominal pain makes its investigation and correct interpretation difficult. Obviously, animal experimentation in this field is impossible and the only sources from which information can be drawn are clinical observation and experimentation, carried out during abdominal operations under local anaesthesia. It was not until the introduction of the modern operation of colostomy of the pelvic colon that it was found that a loop of bowel brought out through the abdominal wall was insensitive to cutting, pinching, or burning, that is, to those stimuli which normally produce the sensation of pain when applied to the external surface of the body. This insensitivity was a physiological fact that required explanation, as it was well known that disease of the abdominal organs often gave rise to pain. Numerous investigators have contributed toward the solution of the problem, many theories have been advanced, and many deductions have been made, some logical, and some quite inadmissable. This article is an attempt to review briefly the theories concerning abdominal pain, which have been advanced in the last half century.

In 1887, James Ross, of Manchester, made the first contribution to our knowledge, when he distinguished two types of pain in disease of the internal abdominal organs; a true splanchnic pain, felt in the affected organ, and an associated somatic pain, felt in the cerebro-spinal nerves of the body wall that are connected with the same segments of the cord as the affected splanchnic nerves. His explanation was that strong afferent splanchnic nerve stimulation produced an "irritable focus" in the spinal cord, and that this irritation diffused to the roots of the corresponding somatic nerves, and caused an associated pain in the area of distribution of these nerves. However, when his paper was written, Ross was unaware of the insensibility of the gastro-intestinal tract to the ordinary pain-producing stimuli, and his views lost ground when Lennander showed that stimuli, capable of producing pain when acting on the somatic sensory nerves, are quite incapable of exciting the afferent splanchnic nerves. Lennander himself adopted a simple explanation, in assuming that the abdominal viscera were entirely devoid of sensory nerves capable of producing pain, and that all painful sensations arising in the abdomen were the result of stimulation of the many

cerebro-spinal nerve endings in the parietal peritoneum and its subserous layer. The pain of the inflammatory lesions of the bowel, he explained as partly due to contact of the inflamed parts with the sensitive parietal peritoneum, and partly due to irritation of sensory cerebro-spinal nerves in the root of the mesentery by lymphadenitis, and lymphangitis. He erred in denying the existence of any afferent splanchnic nerves capable of transmitting painful stimuli, and his theory has failed to explain many other facts concerning abdominal pain that have come to light since his original researches.

The late Sir James Mackenzie, whose work has had a more profound influence on the study of abdominal pain than that of any other investigator, took an entirely different stand. He agreed with Ross as regards somatic pain, but rejected splanchnic pain as non-existent. He focused his attention on the referred somatic pain, and the associated cutaneous hyperalgesia and muscular rigidity of the abdominal wall. He explained the symptoms of pain and hyperalgesia, and the contraction of the muscle in consequence of disease of the viscera, by a system of "reflexes", through the splanchnic afferent nerves to the cerebro-spinal nerves of the abdominal parietes. He postulated first a viscero-sensory reflex, by which painful stimuli from a diseased viscus passed up through the splanchnic afferent fibres to the spinal cord, there setting up by radiation an irritable focus, and so, by lowering the threshold, produced cutaneous hyperalgesia in the skin of the abdominal wall supplied by the cerebro-spinal sensory nerves that entered the affected segments of the cord. Likewise he postulated a viscero-motor reflex, whereby strong afferent stimulation through the splanchnic afferent nerves spreading to the anterior horn cells caused a reflex tonic contraction of the muscles of the abdominal wall that received their nerve supply from the same spinal segments. Mackenzie appreciated the fact that stimulation of the parietal peritoneum in peritonitis also produced tonic contraction of the overlying muscles of the abdominal wall, and sometimes cutaneous hyperalgesia, but he attributed this sensitivity of the parietal peritoneum to the somatic nerves supplying the subserous tissues; he said that not until an inflammatory process had spread through the parietal peritoneum, were the cerebro-spinal nerves stimulated, giving rise to true somatic pain. However, in his book, "Symptoms and Their Interpretation," he says: "The difficulty in distinguishing between visceral pain and the pain due to the invasion of the external body wall is very great."

Striking support was seemingly given to Ross's and Mackenzie's theories of referred pain by the work of Sir Henry Head, on the segmental innervation of the skin as disclosed by the study of a series of cases of *herpes zoster*. According to Head's observations, the herpetic rashes showed a striking similarity in distribution, to the tenderness associated with many abdominal diseases. Based on these observations and a full acceptance of Ross's theory of referred pain, Head constructed a detailed account of the splanchnic innervation of the viscera, and

references to his "zones of hyperalgesia" are found in every paper on abdominal pain. Head made a further contribution to our knowledge, in his paper on "Protopathic and Epicritic Sensation," published in 1905. In this work, he made the suggestion that the viscera, as well as the skin, are supplied with nerves of protopathic sensation, and that the cutaneous protopathic system is one with the afferent fibes of the sympathetic as they supply the viscera. In both cases, the sensation is badly localized, radiates widely, and is frequently referred to parts other than those stimulated.

In a series of lectures on "The Sensibility of the Alimentary Canal," delivered in 1911, A. F. Hurst pointed out that the observations of Mackenzie and Lennander establishing the fact that the stomach and intestines when exposed might be cut, pinched, or burned, without producing pain, could not be held to exclude the possibility of true visceral pain. It was all, Hurst argued, a question of the adequate stimulus. In a series of experiments on the oesophagus, stomach, and colon in man, Hurst proved that increased tension on the sympathetic nerve endings in the muscular wall of the organs produced a dull, griping, poorly localized pain. He concluded that this increased tension on the nerve endings is the only adequate stimulus for the production of true visceral pain in the stomach, intestines, bile ducts, and ureters. His experiments may be said to have established both the existence and the mechanism of visceral pain in the gastro-intestinal tract.

Many other investigators have advanced their opinions in the last twenty-five years. J. A. Ryle was of the opinion that all abdominal pain originated from stimulation of the nerves in the muscular coats of the viscera, whether it be referred, or felt in the viscus itself. On the other hand, H. Tyrrell Gray, after showing that the mesentery was sensitive to mechanical, chemical and thermal stimuli, advanced the alternate view that true visceral pain arose primarily from the mesentery, partly by impulses from the Pacinian corpuscles. Max Kappis, while operating under local anaesthesia, repeatedly demonstrated that the parietal peritoneum, mesenteries, the gastro-hepatic omentum, and the transverse mesocolon were acutely sensitive to mechanical stimuli, and, on the basis of his observations, suggested that all abdominal pain might be explained by irritation of the nerves, sensitive to mechanical stimuli, that are found in the parietal peritoneum, and the mesenteries. None of the many theories concerning abdominal pain, which have been suggested, has been so widely accepted or exerted such a profound influence as has that of Mackenzie. However, the clinician, and the operator were continually being confronted with facts, which they could not reconcile with his teachings. John Morley was one of this group of observers, and investigators, who, convinced of the inadequacy of the orthodox theory, proposed an alternative and simpler theory, in explanation of abdominal sensitivity. I shall now outline Morley's theory, and discuss briefly a portion of the clinical evidence on which it is based.

Morley divides abdominal pain into two types, visceral and somatic. True visceral pain is usually the result of abdominal tension on the splanchnic afferent nerve endings in the muscular walls of the hollow viscera. It is in no sense referred to the superficial structures of the abdominal wall, and is a deep-seated central pain, not accurately localized. When pure visceral pain occurs, as in early intestinal obstruction, or in the early hours of an attack of acute obstructive appendicitis, it is entirely unassociated with any tenderness, superficial or deep, or with any reflex muscular rigidity of the abdominal wall. With regard to the second type, he believes that the objective somatic phenomena of deep and superficial tenderness, and muscular rigidity of the abdominal wall, are in no way concerned with the afferent autonomic system, but are entirely referred from the highly sensitive cerebro-spinal nerves of the parietal peritoneum. He explains these phenomena of referred somatic pain, by two mechanisms, which he describes as Peritoneo-cutaneous Radiation, and the Peritoneo-muscular Reflex; both of these expressions are self-explanatory. Obviously, it would be impossible for me to outline the material which Morley has advanced in support of his theory, in his book, "Abdominal Pain," but I propose to consider briefly his explanation of the mechanism involved in shoulder-tip pain, gastric and duodenal ulcer pain, and the pain of acute appendicitis.

REFERRED PAIN

Shoulder-Tip Pain.

One of the most striking examples of what is known as "Referred Pain" is the pain referred to the shoulder-tip when the under surface of the diaphragm is stimulated. It is of interest because of the considerable distance that separates the site of stimulation from the position in which the pain is felt. Furthermore, it can be more simply explained and understood than most of the other types of referred pain, and it helps us to appreciate the mechanism of pain produced by stimulation of the parietal peritoneum in other regions. Shoulder-tip pain is the pain felt on the upper part of the shoulder, as a result of stimulation of sensory branches of the phrenic nerve. The pain may be felt in either the whole or a part of a well defined area extending from just below the clavicle over the supra-clavicular fossa, across the upper surface of the acromion, and over the supra-scapular fossa. The cutaneous nerves of this region are the supra-sternal, supra-clavicular, and supra-acromial, and they have their origin in the third and fourth cervical segments of the spinal cord. It should also be noted that the phrenic nerve arises chiefly from the fourth cervical segment, but the third and fifth segments also contribute to it. Morley states that the cutaneous branches mentioned above may be regarded morphologically as the superficial branches of the phrenic. Morley, Zachary Cope, Bryce Graham and others have accumulated a mass of clinical and experimental evidence, which demonstrates that irritating fluids, such as escaped gastric or intestinal contents from a perforated peptic ulcer, free blood, pus, etc., or even the roughened surface of an organ, as in

perisplenitis and perihepatitis, when they impinge on the exquisitely sensitive parietal peritoneum lining the under surface of the dome of the diaphragm, cause pain which is felt in the corresponding shoulder, in the area described above; no pain is felt, however, at the point of stimulation. They have described this shoulder-tip pain in biliary colic, perforated gastric and duodenal ulcer, perforative peritonitis from other causes, ruptured ectopic gestation, rupture of the spleen and liver, pneumo-peritoneum, and diaphragmatic pleurisy. In all of these conditions, shoulder-tip pain may be a symptom of great diagnostic significance. In an experimental study of phrenic pain, Capps and Coleman showed that gentle mechanical stimulation of the under surface of the diaphragm caused pain which was felt solely in the shoulder-tip area and not at the point of stimulation. In using the phenomenon of shoulder-tip pain as a foundation on which to base his theory, Morley points out that the cervical segments which give rise to the phrenic nerve and the cutaneous nerves of the shoulder region, have no splanchnic connections whatever with the abdomen, hence the mechanism of referring the pain from the point of stimulation in the abdomen to the shoulder, must occur entirely in the central nervous system and is therefore a good example of true referred pain. No one can seriously contend that the splanchnic afferent nerve fibres have any part in its production and, therefore, the viscero-sensory reflex theory would not apply in this instance at least. The exact mechanism by which the pain is referred is not clearly understood; but since in a series of experiments Morley demonstrated that subcutaneous infiltration of the painful shoulder-tip area with novocain, modifies or abolishes the pain, one would be led to believe that this pain is referred by some mechanism resembling Ross's "Irritable Focus." Whether this occurs in the posterior root ganglia or in the central nervous system is not yet known.

To recapitulate, stimulation of the phrenic sensory nerve endings in the parietal peritoneum covering the diaphragm (with the exception of the peripheral inch or so) produces a true somatic pain in the area supplied by what we may call its superficial branches; in the development of the embryo, they have become widely separated, due to the caudal migration of the diaphragm. Morley argues that since this is true here, why is it not true for the rest of the parietal peritoneum, which has a nerve supply which is essentially the same, in that each spinal segment that supplies nerves to a strip of parietal peritoneum lining the abdominal wall, supplies also a strip of overlying skin, and takes its share in innervating the overlying muscles. He postulates that by a mechanism of peritoneo-cutaneous radiation, painful impulses, arising in the deeper nerves, affect their more superficial branches, producing:

1. A well-localized pain referred to the area over the point stimulated, and no pain in the peritoneum itself,
2. A tenderness of the more superficial structures to a firm palpation

which is not sufficient to cause pressure on the structures deep to the rigid muscles, and,

3. An involuntary reflex rigidity of the overlying muscles.

This latter mechanism occurs in practically the same way, the only difference being that the impulse must affect the anterior horn cells, establishing a reflex—the peritoneo-muscular reflex. This theory of Morley's explains why, in acute appendicitis, the localized pain and the rigidity vary with the position of the appendix and are always directly over it; in other words, it accounts for the great accuracy with which pain is referred to the structures directly over the place where the peritoneum is irritated. The investigations of Capps and Coleman on the localization of the pain sense in the parietal peritoneum lend support to Morley's theory. By piercing the abdominal wall with a trocar, and stimulating the parietal peritoneum with a curved silver wire, they showed that contact of the end of the wire with the anterior parietal peritoneum always caused a pricking pain which the patient localized accurately on the skin to within half an inch of the point of stimulation. Pressure of the wire on the parietal peritoneum towards the flanks caused a more diffuse pain.

Pain in Acute Appendicitis.

The pain of acute appendicitis must be considered in any discussion of abdominal pain, since this condition is the commonest of all the acute abdominal disorders that come under the surgeon's care. Morley describes two distinct pains in typical attacks, which differ in subjective quality, in their associated physical signs, and in their mode of production. The initial pain of a typical attack is an example of true visceral pain. It is felt in the mid-line, just above the umbilicus, or in a vague area around that region, and is a griping, intermittent, colicky and very poorly localized pain, which is not associated with any tenderness or true rigidity, either in the central area in which the pain is felt or in the right iliac fossa. It originates in the appendix itself, and is excited by vigorous peristaltic efforts on the part of the muscular wall of the appendix to force the irritating contents of its lumen past an obstruction at its base. It is due to tension on the splanchnic nerve endings in the smooth muscles, producing painful impulses. Some degree of obstruction to the lumen of the appendix is essential to its production. Evidence of such an obstruction is found in all appendices removed at operation from patients who suffered from what we may call appendicular colic, in the early stages of their disease. In acute appendicular obstruction, the central pain continues until general gangrene or localized perforation of the appendix relieves the tension within it, when it disappears. Occasionally, recurrent attacks of acute obstructive appendicitis, too mild to cause perforation, gives rise to this initial visceral pain alone, and not to the second or localized pain. Usually the second pain makes its appearance a few hours after the onset of an acute attack. The initial central pain is usually still present, but it tends to disappear as the second pain develops. The second pain differs from the initial pain in

location and character; it is limited to the right iliac fossa, and is sharp or stabbing in nature. It is accentuated by any movement of the abdominal muscles, and the right iliac fossa becomes very tender on palpation. Occasionally this second or localized pain is the sole manifestation of acute appendicitis, just as sometimes only the initial, or visceral, pain is observed.

The objective signs associated with this second pain are cutaneous hyperalgesia, muscular rigidity, and deep tenderness. Mackenzie attached a great deal of importance to the area of cutaneous hyperalgesia found in the right iliac region, which he explained by his theory of a viscero-sensory reflex. Morley disagrees with Mackenzie both with regard to the importance of cutaneous hyperalgesia in appendicitis, and the mechanism of its production. He says that, due to the inconstancy of its occurrence in genuine acute appendicitis and the fact that it may be elicited very frequently over the right iliac fossa in the abdomen of a neurotic patient in whom exploration reveals no evidence of organic disease in the appendix or any adjacent organ, it is of little practical importance in diagnosis.

He also believes that the afferent splanchnic nerves take no part in its production, but that its unilateral distribution points to its production by stimulation of the sensitive parietal peritoneum, with resulting peritoneo-cutaneous radiation. He attaches much greater importance to the sign of reflex muscular rigidity and the deep tenderness on palpation which is invariably associated with it. The deep tenderness corresponds in position and degree with the rigidity, and the area of tenderness and rigidity corresponds accurately with the area to which the patient points when asked to indicate the position and extent of his spontaneous localized pain. Muscular rigidity and deep tenderness may be regarded as the objective signs of the second or localized pain in acute appendicitis, and if their exact position in an early case is noted, the position in which the inflamed appendix will be found can be accurately predicted in most cases.

The fact that the area of muscular rigidity and deep tenderness is unilateral, combined with the fact that in the early stages it corresponds exactly with the position of the underlying inflamed appendix, as has been repeatedly demonstrated by operating surgeons, points to a complete refutation of Mackenzie's theory, as Morley points out. For it is essential to that theory that the rigidity and tenderness should not vary with the position of the appendix, for their location would be determined by the segmental splanchnic innervation of the appendix, which is naturally unalterable. But their location does vary with the position of the appendix, and therefore, Morley feels justified in explaining the localized pain in acute appendicitis, with its accompanying muscular rigidity and deep tenderness, by his peritoneo-cutaneous radiation, and his peritoneo-muscular reflex from the sensitive parietal periteonum, the peritoneo-muscular reflex giving rise to the muscular rigidity and the peritoneo-cutaneous radiation being responsible for the localized pain

and deep tenderness. His contention that the muscular rigidity and the localized pain and tenderness of appendicitis are entirely due to irritation of the parietal peritoneum, renders the diagnosis of the disease much more simple, and, he contends, more accurate.

Peptic Ulcer Pain.

In considering the production of pain by ulcers in the stomach and duodenum, we must continually bear in mind the distinction between visceral (or splanchnic) pain, and somatic pain, with its associated objective tenderness. The visceral pain of chronic gastric and duodenal ulcers is centrally situated in the epigastrium, and is only vaguely localized, while its character is variously described as "aching", "gnawing", or "boring", but never as "sharp" or "stabbing". The pain has three distinctive clinical features. The first of these is a constant relationship with the intake of food, the pain occurring generally two to three hours after meals. The interval between food intake and onset of pain is remarkably constant in any patient with a chronic ulcer, provided that the nature and bulk of the meals do not vary. The next important feature is the periodicity of the pain; it occurs in "attacks", in which the pain recurrs day after day in the manner just described. These attacks vary in duration from two or three days, to several weeks, tending to become longer and more severe with the passage of time. The attacks are separated by intervals of immunity from pain which vary from a week to several months, and often tend to grow shorter as time goes on. The third feature of the pain is the relief afforded by alkalies, or vomiting. The relief is usually prompt, but it is not always of long duration. The mechanism of production of this pain in gastric and duodenal ulcer has never been satisfactorily explained, although many theories have been advanced; none of these seem to be in entire harmony with all of the clinical and experimental data. The true stimulus is, as yet, unknown, although tension on nerves in the muscular coat, hydrochloric acid irritation, vascular congestion, and even combinations of these have been suggested; however, it is evident that a more precise knowledge is necessary before the true stimulus can be defined accurately.

The chief objective signs that may be observed in the abdominal wall over a gastric or duodenal ulcer, are cutaneous hyperalgesia, deep tenderness and muscular rigidity. Hyperalgesia and muscular rigidity are far too inconstant in their association with gastric or duodenal ulcer to be of value in diagnosis; they are probably only present in those cases where there is an unusual degree of inflammatory reaction around the ulcer, in such a situation that it comes into immediate relation with the anterior parietal peritoneum. On the other hand, a localized point of deep tenderness in the epigastrium is found as a common, though by no means constant sign, in cases of gastric and duodenal ulcer, and is of diagnostic importance. It is usually more marked during an attack of spontaneous visceral pain, but it may be found where the pain is temporarily in abeyance, and it often lingers for some days after the cessa-

tion of an attack. Morley and his colleague, E. W. Twining, by physical and radiological examination of a large series of patients with proved gastric and duodenal ulcers, showed that the point of deep tenderness corresponds closely with the situation of the local lesion in the intestinal wall. It is so accurately localized that a comparatively slight shift of the position of the ulcer crater with changing posture, respiration or manipulation, causes an appreciable corresponding shift of location on the anterior abdominal wall. Morley contends, that the fact that the localized area of deep tenderness coincides more or less accurately with the subjacent ulcer, cannot be explained by Mackenzie's theory of a viscero-sensory reflex, since that hypothetical process could only give rise to a fixed and immobile tenderness. It is satisfactorily explained by his theory, he says, in that the sensitive parietal peritoneum, when it is pressed down into closer contact with the visceral peritoneum over the ulcer, receives a stimulus of some kind, sufficient to cause pain referred to the superficial structures by peritoneo-cutaneous radiation. With each change of position of the ulcer in relation to the abdominal wall, a fresh area of parietal peritoneum is stimulated, with a fresh group of nerve endings, and the accurate localization of the tender point over the ulcer is readily explained. When the tender point, with the patient in the supine position, is found to the left of the midline, the ulcer is more likely to be gastric, and when it is to the right, the ulcer is more usually duodenal. However, we must not place too much reliance on the site of the tender point in the differentiation of the two types of ulcer.

I have purposely not mentioned the pain in chronic disorders, or the so-called chronic abdomen, as there are so many other factors (temperament, psychogenesis, habit pains, neuroses, and the like) to be considered that it is a topic in itself. Nor have I dwelt on the differential diagnosis of the various abdominal diseases from the types and localization of pain in each.

Mr. Morley's work undoubtedly deserves thoughtful consideration. Throughout his inquiry, he attempted to apply experimental methods on the human subject at the bedside, and in the operating theatre, and did everything in his power to exclude possible fallacies and test the accuracy of his findings. By careful and patient observations upon a large number of patients, he discovered certain constant facts, which seemed, on analysis, to indicate and to be consistent with, only one interpretation. He tested this interpretation by employing, in an ingenious fashion and on suitable patients, regional anaesthesia, and radiography. Thus it may be said that his main thesis regarding the causation of abdominal pain rests upon a sound foundation and therefore must be seriously considered.

"The Cholera Beacon"

ELAM STIMSON, M.D.

PART III.

The difficulty with which the blood pervades these vessels in this stage of the disease, and as we have mentioned, acting upon the nervous extremities produces the tormenting sensation of heat, while the part is actually colder than natural—owing to the same cause the sensibility of the skin is greatly increased—and this, too, together with the suppressed secretion of saliva sufficiently accounts for the intensity and peculiarity of the thirst, at the same time exuding serum covers the skin, mouth and faces, keeping them moist or wet. This intense thirst and the sensation of heat and burning that is sometimes experienced internally has been adduced as evidence of gastric or internal inflammation.

Now it is known that there is no cutaneous inflammation—yet the sensibility and sensation of heat in the skin is even greater than is experienced internally. These symptoms then, when properly viewed (i.e. in connection) render it plain that inflammation does not exist internally.

The universal suppression of the secreting function of the whole glandular system has excited the general notice and wonder of the faculty.

Whenever the imperfection in arterialization has existed so long—or the impurity in the blood amounts in degree to a state which the nerves can no longer endure, they fail (often suddenly) to impart their wonted influence to the glandular system (for reasons to be hereafter mentioned), the first failure is in the hepatic secretion. This succour to the decarbonizing process being cut off, the necessary change in the lungs is now less perfect, not only on account of their diminished nervous energy, but because the blood has now become so surcharged with hydrogen and carbon that it may be said to be incapacitated to the action of atmospheric air, consequently the accumulation of the matter that the lungs and liver should excrete, will now be very rapid, and in a short time (perhaps in a few moments) every other secretion is suspended. From blood so highly contaminated, no gland can secrete even an imperfect or vitiated fluid. When we recollect that combined with this (of itself insuperable disadvantage) is the greatly diminished nervous energy—this phenomena ceases to excite our surprise, for no other effect could be expected, a priori. Physiologists have compared the glands to manufacturing establishments to which blood is brought for the purpose of having certain mechanical and chemical changes performed upon it. This simple simile may be continued in illustrating the suspension of the secretions in Cholera. In health they (the glands) are well paid (i.e., receive a due degree of nervous excitement) and are supplied with materials properly fitted and prepared.

The work goes smoothly on and is properly performed—but when their pay is much reduced and at the same time more labor is required on account of the imperfect state of the materials, there is a general "turn out" (revolt), the whole business is suspended, and unless the pay is rendered adequate to the labor the whole concern must inevitably fail.

Now recall to mind the first morbid sensations; view several cases collectively. It is not most evident that the disease even in this incipient state is co-extensive with the whole vascular and nervous system? The disease progresses and affects the secretions and all secretory glands are implicated.

In coincidence with these circumstances, consider the effect produced by respiring the contaminated air at the Galt show, and the appearances of the blood—drawn early in the disease, before any diarrhoea takes place it is more thick and black than in health—later still more so—and thus increases until it becomes so thick and highly carbonated that it will not flow at all.

In the absence of all evidence that any other cause could produce these effects—such corroborating circumstances must go far, very far, to bring the whole difficulty home to the blood—to its imperfect arterilization, not as a secondary effect, but primarily.

Few observing practitioners are unwilling to admit that the fluids in the course of many diseases undergo changes by which their essential qualities are altered and depraved. But *in Cholera impurities exist first in the blood itself*, and that too without its being the result of any change of action in its vessels.

Early in the disease the vascular system becomes implicated from the action of this retained impurity upon the nerves which it affects most forcibly in the capillaries. A diminished action of the heart and congestions follow, which plainly denote the directly sedative quality of the existing state of the blood.

Before answering any objection that may be brought to this theory we ought to direct our attention to the two different systems of nerves. The spino-cerebral destined not only to supply the various parts under the control of the will, but to form an intimate connection, particularly in the stomach with another system—the great sympathetics which "supply motion and life to the inward assimilating and nutritive functions," organs not under the control of the will. The sympathetic system of nerves has with propriety been called the abdominal brain, notwithstanding their intimate connection and usual reciprocated action, yet it does not follow that this sympathy cannot be suspended. A specious objection to our theory (one certainly more specious than solid) is that if the respiratory organs were primarily affected, "the effects would fall upon the sensorium, as in the burning of charcoal in a close room." If the change in the lungs was more sudden and complete it might produce that effect. Under the canvas at Galt this effect was in a degree produced. We have interrogated more than 50 that were

present and all say they "felt so sick and dizzy during the exhibition that they were hardly able to stand." Under the effect of ordinary epidemic influence a very small portion only of the matter that should be excreted passes the lesser circulation so small that no immediate evil results from it—and some days elapse before it affects the system at all. In some instances, where there is a retention of this matter, its effects are resisted for months, when, owing to some change in the system, favorable to the operation of this retained poison, its deleterious influence is exhibited.

As already observed, when the impurity in the blood becomes insupportable by the nerves, the first gland affected is the liver. The hurtful impression is upon the sympathetics, because it is in the organs supplied by this system of nerves that the blood arrives most highly charged with the poison—and upon the liver, too, devolves the labor of purifying the blood by eliminating the hydrogen and carbon in the form of bile. It is consistent then to anticipate an inadequacy in the function of the liver, and the priority so universally discovered in the entire failure of its secretory function. The hurtful impression being thus concentrated upon the sympathetic system of nerves, so diminishes their energy and abolishes their power that the usual reciprocated influence between them and the spino-cerebral is superseded, and thus the brain escapes uninjured.

Again, it has been alleged that if the proximate cause of Cholera was an imperfection in the chemical function of the lungs, the inhalation of oxygen gas would prove an effectual remedy, whereas it has not been known to produce any lasting or beneficial effects. In the treatment of almost every disease, the curative plan must be directed not to the proximate cause, but to its effects. The cause of Cholera is a dimunition of the excretory functions of the lungs—contaminated blood—diminished excitement—congestions, impaired or suppressed secretions are the effects. Can it be supposed that the inhalation of oxygen can repair all this mischief? Can it simultaneously purify the blood—excite the nervous energy, unload congestions, and open the secretions?

Some whose opinions we have reason to respect conclude that a specific virus actually enters the blood with the oxygen, and yet do not consider the disease contagious—but does not the specific virus in all diseases produce specific effects, as in the smallpox and measles?

Fortunately the practice of some holding this opinion has been eminently successful, because they were convinced that this poison which they suppose enters the blood produces the same effects as that morbid matter which we believe is generated in the system itself, and retained in it.

By some the "premonitory symptoms" are not considered as any part of the disease, "only showing a predisposition to it"—and yet all acknowledge them to be the effects from the same cause. In our opinion these morbid sensations are the disease itself in its incipient state. At least the first grade symptoms should be considered as bearing the same

relation to Cholera as pneumonia does to effusion or phthisis—and as pneumonia often spontaneously subsides without producing effusion or phthsis, so the premonitory symptoms subside without producing Cholera. A knowledge of the existence of these symptoms should be sufficient (not to alarm) but to put all upon their guard—for not only these but all apparent stomach and bowel complaints frequently merge in the watery diarrhoea. The general and most frequently fatal error is in mistaking the disease in its forming state; but few ever suppose they have anything of the Cholera until they are actually "taken down." This certainly is in some degree chargeable to physicians themselves, especially such as hold and propagate an opinion that the "premonitory symptoms"—the dyspeptic and other ailments so common during the prevalence of Cholera, are no part of that disease—an opinion fraught with no less danger than error—for while a patient imagines he has nothing but a "common bowel complaint," he is suddenly "taken down" and in a short time in collapse. Often the patient on being asked when he was taken, refers to the time the vomiting and spasms commenced, and when upon cross-questioning acknowledges that his stomach has been out of order, or that he has been troubled with a relax for some time previous, frequently adds that he "thought" nothing of that as it gave him no pain. In almost all diseases incident to the man family, pain is a natural and faithful sentinel to warn us of danger. Not so in Cholera. The absence of pain in the bowels during the relax is a feature in the disease highly calculated to lure the unwary within its fatal grasp.

That the disease has such a forming stage or symptoms by which it can be detected, when completely controllable, even when caused by the most highly concentrated epidemic influence, is evident from several facts connected with the Galt show.

Of several families that we attended who had been at the show, several of which were attacked, not one died that followed the course we have recommended.

In a letter from A. Shade, Esq., after giving a detailed and very lucid account of the appearance and progress of the disease in Galt, says in conclusion: "I believe, generally speaking, all were sick at the stomach or felt a tremor or faintness throughout the whole system, and then a relax, *before* the puking and cramps set in."

The disease improperly called Dysentery, prevalent during the time of Cholera, is very different from Dysentery as it prevails in seasons and situations unoccupied by Cholera.

Although the blood is obstructed in the vena portea, and the bile diminished, yet it is not substituted by the more common increased secretion from the gastro-enteric mucous membrane but by vitiated mucous—and when the portal congestions are more complete, a reflux of blood takes place, and is effused undissolved from the numerous minute veins, which alike accounts for the dark color, and intimate admixture with mucous. The peculiar appearance of the inside of the mouth, lips and tongue, the absence of the usual tenderness discoverable

by pressing the abdomen and the appearance of the stools are sufficient to distinguish it from Dysentery.

TREATMENT RECONSIDERED

When the theory of a disease is correct, it supports and is supported by the practice. The most conclusive evidence of the correctness of the premises here set forth is in the efficacy of the practice they indicate—which is to rouse the energy of the sympathetic nerves—to restore the secretions and to remove congestions. These are the primary and cardinal indications in the cure of Cholera.

In the animated machinery of man we perceive a system of causes and effects so mutually connected and mutually dependent that we cannot understand the operation of a single isolated part without reference to the whole. So in this disease, and fulfilling the indications of cure, all must be viewed relatively, as cause and effect—for no one indication can be fulfilled and a cure performed without affecting all—and the different indications should be fulfilled simultaneously.

The object of bleeding is to prevent or remove congestions, or in other words, to increase the power of the heart over the circulating blood. The principle is plain. By diminishing the body to be moved the relative power of the mover is increased. It is apparent, then, that bleeding is necessary, not only for the plethoric and robust, but also for the aged and infirm. The feeble and ineffectual efforts of the heart must be assisted by abstracting a portion of that fluid which clogs and impedes its motion. It is true the aged and infirm, the debilitated emigrant will not bear—neither do they require so large bleedings as patients of an opposite description. But the principle—the object to be attained is the same, which should be borne in mind and abstract such a quantity as will enable us to excite a more vigorous action of the heart, by the use of pure stimulants, and thus the congested vessels will be unloaded.

We have said that the distress at the pit of the stomach, so uniformly present before or at the time of the patient being taken down, strongly indicates the necessity of bleeding. This sensation is generally in the situation of the semi-lunar gaglion, and may be considered strictly a nervous affection. But if the nerves are thus injured, a corresponding dimunition in the action of the heart, and consequent congestions may be expected, as well as an entire failure in the function of the secretory glands—but should the glands partially maintain their wonted secretions, before they could sufficiently purify the blood, the action of the heart would be so impaired that congestions would ensue. The precept to draw blood until it flows "a full stream" is intended for that advanced stage of the disease in which blood is procured with difficulty. It not unfrequently happens that after congestions have taken place, the blood upon opening a vein starts suddenly and flows freely. If allowed to flow thus freely the pulse will sometimes fail, growing weak and tremulous. Under such circumstances it is safer (as in other congestive

diseases) to draw it slowly, or restrain it until the action of the heart be excited by pure stimulants.

The uniformity with which Calomel promotes the secretions, particularly the biliary, naturally led to its employment for that purpose in Cholera, and it has not disappointed any reasonable reliance that has been placed upon it. But to the neglect of powerful, and in many cases indispensible auxiliaries, some have placed their dependence on Calomel alone, or what is worse, have joined with its use such narcotic or nauseating medicines as to counteract its efficacy. So dependent are all glands upon a due degree of nervous energy, which is so depressed and inefficient, that with Calomel should be joined the most pure stimulants—that is, such as are unalloyed with any narcotic properties. These excite the nervous energy and render the operation of the Calomel upon the liver much more speedy and certain. In the significant term of a patient "the Capsicum makes the Calomel take hold."

A professional friend, and gentleman of well-merited celebrity, prefers giving the Calomel in small doses, lest larger ones induce nausea and further depress the nervous power. But when the importance of early opening the secretions is considered, and as we have no unfortunate precedent when pure stimulants only have been joined with the Calomel, we cannot but look upon the most efficient measures as the most safe.

In the impaired and irregular biliary secretion and consequent uneasy or painful sensation in the abdomen, which often precedes a decided attack, and which seldom fails of following one, the Elixr. Pro. is singularly efficacious. We have so uniformly noticed its anodyne effects, as induce us to believe it a most valuable and well-adapted stimulus, and so certainly does it subsequently produce bilious evacuations that under these circumstances it may be said to have a specific action on the liver.

Having denounced the use of several medicines heretofore used, we give our reasons for so doing by referring to their operation in connection with the pathology.

The absence of bile in the excretions has induced some to prescribe Emetics, in the hope to stimulate its secretion. Others have supposed bile of a highly deleterous quality was retained in the biliary ducts of the liver and gall-bladder—and that the injurious and highly depraved quality of this bile acted as a poison to the system, and have prescribed Emetics to dislodge it. Without recurring to facts and arguments to prove the falacy of these premises, the effect of an Emetic only need be considered. Whenever nausea is induced a depressed or diminished action of the heart is sure to follow. In Cholera all acknowledge the dangerous depression in the action of heart. Whatever induces nausea, then, increases the disease, so far as the action of the heart is concerned—and also increases the serious effusion and diarrhoea. Of such importance are these considerations that with a knowledge of indigestible substances in the stomach, we could not recommend an emetic to eject them, lest more danger be incurred from further sinking of the

heart's action. The safer course being to excite the nervous energy and raise what in other circumstances would be considered an undue degree of excitement, when the offending matter could be evacuated without danger—but should it be thought necessary to dislodge indigestible substances, the most safe emetic would be the sulphate of zinc (white vitrol). Several cases of Cholera where emetics had been given have come under our care and more have come to our knowledge, not one of which survived.

Scarcely less injurious are such cathartics as induce nausea, though their hurtful impression is not so suddenly made—yet if the disease is somewhat advanced, they as surely increase the profuse discharges, and their injurious effects are of longer continuance.

To allay the spasms in Cholera a most unfortunate use has been made of Opium. Ordinarily, spasmodic action is the result of nervous irritation produced by some irritating substance of matter, remote in situation from the muscles thus spasmodically affected—and the use of Opium as an antispasmodic in Cholera has been predicated upon the supposition that the spasms were produced by an accrimonious or some other poisonous quality of the bilious or other matter acting upon the stomach or other internal parts. But in Cholera cramps are produced by the direct application of the irritating matter to the extremities of the spino-cerebral nerves (see p. 35). At the same time the effect of the poison upon the parts supplied by the sympathetics are suffering a great dimunition of power—or in other words, the effect of the poison upon them is that of a narcotic. Now if opium be given in sufficient quantity to affect the spasms—the nervous depression—impaired or suppressed secretion and congestions are all increased. The too common idea then that the quantity of opium may safely be apportioned to the violence of the spasms is a most gross and dangerous error.

It is evident from the works of Drs. Rush and Armstrong that opium has not been found a safe medicine in the yellow and typhus fever, where they were attended with great venous congestions.

But in the morbid bilious or other secretions which are attended with pain, opium in small doses is safe and useful. After a decided attack of Cholera it is commonly several days before the functions of the abdominal viscera become regulated. To relieve the pains often attending this state of the bowels opium is very necessary, especially if the Elixr. Pro. fails of having its usual anodyne effects.

With some persons cold water has had the credit of curing Cholera. Every case within our knowledge where a recovery was attributed to the use of cold water, large doses of Calomel had been previously given, to which the cure, in our opinion, was attributable.

It is a well-known fact that cold water, when taken in large quantities, has a tendency to produce sudden and dangerous congestions, especially in the intemperate, who are also most liable to Cholera. Its use in Cholera, therefore, is attended with much risk, and many more cases could be adduced of its evident bad effects than of its supposed efficacy.

ON EXCITING CAUSES

First Cold: The temperature of the body being diminished from the imperfect generation of animal heat, abstraction of caloric from the surface is one of the most common causes of the disease becoming suddenly aggravated. During rest and sleep the circulation becomes more languid, and upon exposure to cold air the vomiting, flux, etc., are excited.

Second: The depressing passions of the mind, but few are wholly unacquainted with the distressing sensation which grief, fear, or great anxiety, produce at the pit of the stomach. Any of these depressing passions have an almost direct influence in inducing a depressed state of the system of nerves principally concerned.

Third: Many articles of diet have been considered as exciting Cholera. In the impaired state of the digestive organs they become incapable of digesting almost any substance—and sometimes the gastric juice possesses some accrimonious or other quality capable of exciting a capricious or depraved appetite, and at others a full meal is taken after undue fasting and fatigue. These are all circumstances under which the disease is likely to become developed. But the fault is not so much in the diet as in the state of the digestive apparatus. A course of stimulating deobstruents, tonics and perhaps Calomel should be resorted to rather than attempt to elude the disease by avoiding a numerous list of prohibited articles. We would not be understood that the use of unripe or other indigestible substances are not improper and attended with danger—or that when the digestive organs are weak, light, easily-digested food is not most proper.

But our protest is against the general system of starvation which in some instances has been so injudiciously recommended and adopted. If the appetite continues unimpaired and the habit of body unchanged, the accustomed diet should not be altered. Under such circumstances a regular and usually nutritious diet is the natural and certain stimulus to the whole abdominal viscera, whereby all the natural and healthy functions of the system are promoted.

We should have mentioned in its proper place that in the dangerous consecutive fever of collapse we have succeeded by small and repeated bleedings, mild stimulants and tonics—congestions and local inflammation existing at the same time.*

In proportion to the importance of our subject we find upon reviewing it but a bare introduction. Some parts requiring much reflection and length of discussion—the limits and intention of this paper admit of little more than a general position. To the arguments adduced to support our opinion of the proximate cause of Cholera many might be added. The fact that the elementary principles of alcohol are principally hydrogen and carbon, that it is indigestible and enters the blood unchanged—that it produces a disease (mania a potu) strikingly analagous to many cases of the consecutive fever of Cholera, and the

*In this fever Emetics are safe and often useful.

marked susceptibility of the intemperate to the disease, are all grounds for arguments in support of our hypothesis, strong and convincing, and if porperly advanced might be interesting to the profession; but as they would be devoid of interest or use to that class of readers for which this book is written, we present it to the world as it is, unfinished and unsightly, but in humble confidence that even in this state it will serve as a "Beacon" by which to guide upon safe and philosophical principles that practice which has been so much tossed upon the wild and conflicting waves of empyricism.

AUTHOR

APPENDIX

1. (See p. 29.) Mrs. S., aged 50, of strong and robust constitution, and for many years previous of uncommon good health, was attacked in the night (14th August) about 12 o'clock with great distress at the heart and oppression in breathing. The day previous she had several times "a strange weakness and trembling and quick beating at the heart," and also felt the same when she first awoke. We saw her within an hour. The surface of the body, particularly the extremities, were cold (but not the coldness and clammy sweat common in Cholera), the pulse frequent and oppressed, with an occasional intermission — the tongue and mouth a little darker color than natural, and rather moist, somewhat thirsty, and an "awful weight at the heart"—the panting or laborious breathing most resembling a person completely exhausted by running. When presented with a drink, swallowed with avidity, from the necessity of constant respiration. The first remedy used was bleeding 20 oz., followed by mild aromatics and stimulants, with hot applications to the feet and legs. It gave immediate relief to the distressed and oppressed breathing, but there was little alteration in the pulse short of an hour—they then began to rise; in three hours bled again, and gave a large dose, 30 grs. Calomel. A high fever through the day with full bounding pulse—the excitement was marked by great irregularity—the medicines were moderate stimulants and laxatives, castor oil and an infusion of senna. She recovered without any other difficulty except unusual debility. She has up to this time (May) enjoyed perfect health.

2. D. B., of Beverly, a stout, hale lad of 18, was attacked much in the same way (as case 1) and had the same symptoms the day previous. When he first awoke, felt much sickness, but vomited only once. Saw him in two hours. The distress and difficulty of breathing very great, and the pulse barely perceptible. The treatments the same as the first case and with the same result.

Elixr. Pro.—properly elixir proprietatus—is prepared by infusing in three half pints of spirits or strong whiskey 1 ounce of Gum Myrrh and the same quantity of Gum Aloes.

Huxham's Tincture is prepared by infusing in three half pints of spirits or whiskey 2 ounces of Peruvian Bark, 1 ounce of dried Orange Peel and half an ounce of Virg. Snake Root.

Organized Medicine

By J. H. GEDDES, M.D.
London, Ontario

IN a few short weeks the class of "37" will be leaving Western. You are probably saying to each other, "It won't be long now until we are out in the cold, cold world." One way in which the atmosphere can be made less frigid is by linking yourselves with organized medicine. In other words, join your local medical society. Attend its scientific sessions and have your brains dusted, be present at its social functions and have your corners rubbed off, and if you get into trouble, ask your medical society for help. It will be given gladly.

Originally, medical societies were formed with the idea of improving the scientific and ethical standards of their members. In those days medical publications were few in number and the new advances in medicine were learned at medical meetings. Of late years, the rapid dissemination of medical knowledge in journals has made the physician less dependent upon his society for scientific knowledge, but the recent changes in economic conditions have made the medical society even more important to the physician than it was in the "horse and buggy" age.

We hear a great deal these days about state health insurance. The people are demanding it, and the politicians are busy framing bills to give it to them. The young graduate must ask himself, "How is this going to affect me?" The answer is, of course, unfavorable, unless the medical profession is united and is able to make itself felt in the framing of any health insurance law. In 1912 a health insurance act was foisted on the unorganized medical profession of Great Britain. In 1936, the Government of British Columbia framed an Act that was to have come into effect on March 1st, 1937. It did *not* come into effect, because the British Columbia Medical Association was organized one hundred per cent.

Those of you who, on graduation, register with the Ontario College of Physicians and Surgeons, automatically become members of the Ontario Medical Association for the first year, without the payment of any fee. On beginning practice in Ontario, the membership fee for the first year is two dollars, the second year five dollars, and from the third year the full fee of eight dollars is charged. If you elect to practice in some other province or state than Ontario, you will find some similar arrangement. The important thing is to at once identify yourself with organized medicine. Join the medical society in your community. It will be affiliated with the provincial, state, or national association to which you should also belong.

A man is known by the company he keeps. Make sure you are in good company. You will find it in your medical society.

Editorial

Valedictorian Address of Class of '37

MY duty on this momentous occasion is an exceedingly pleasant one. I sincerely appreciate the high honour which has been conferred upon me in being asked to deliver this address. It is a very great privilege indeed, to herald the entrance of the class of '37 into the medical profession. You shall travel long and far before you shall meet as many sincere young men and women gathered together as a class.

It behooves me at this point to express our deep appreciation to our Faculty. From all Ontario and parts of the country to the south of us we have been drawn hither to partake of the educational facilities, rich and manifold, within a young progressive university. The men of our Faculty have given us the best that medical teaching can offer. They have been patient with us in our profound state of ignorance and have shared their valuable time unselfishly with us. To these men all we can return is a promise—a promise of life-long devotion to our profession and loyalty to the community which we shall serve.

We have enjoyed abundant opportunities of mixing with all sorts and conditions of men, whereby our personality and character have doubtless become more strongly developed. Education is the cultivation of faculty not the acquisition of knowledge. It aims at the development of character and intellect not at erudition and is sought in order to fulfill the desire for self-realization and social progress. Of all the sciences concerning man, Medicine is said to be the most comprehensive and therefore the most difficult. The educational path which we have trod for the past six years is but the prelude to that which we shall continue to pursue. Together with all other members of the medical profession we are now guardians of a noble heritage which has been handed down since the days of Hippocrates.

We know that great doctors in all ages have pursued their scientific studies ceaselessly and that even in the midst of the most strenuous practical work, they have continued to search for, acquire and assimilate knowledge with great zeal. A man who does not keep pace with the rapid advance of his art, and who does not master all the new therapeutic methods, soon falls in the rear where he is rapidly overtaken by the vigorous onward march of the younger generation. Our distinguished professors have been models, who have shown us how, in spite of strenuous professional labours, it is possible to follow the new discoveries of our science.

We are all in the prime of physical life but our mental processes are still very immature. The faculty of judgment shall develop extremely

slowly and only in close association with environmental experience. Even so, the immediate future must not find us floundering in the dismal swamp of inactivity. We must always keep in mind the fact that old men dream vivid dreams of the glorious past, while young men see hazy visions of the future. In years to come the prestige of our Alma Mater will be entrusted with you and me, the lives of men and women will be moulded and their destinies guided by us.

By WILLIAM E. GIBSON, '37.

THE undergraduate of today has some problems with which his predecessors were never faced. One which has confronted many students in the past few years, and one which must be faced by all from now on, is the question of the desirability of special degrees.

Most important phase of this problem to us is "Should I attempt the primary F.R.C.S. (Canada)?" The consensus of opinion, obtained from faculty men and the recent and older graduates, is as follows:

For the student who plans an immediate career in general practise, the degree is useful, but unnecessary; the average layman, who will compose the bulk of his practise, is interested in results, and not in degrees. But to the student who contemplates post-graduate study, and especially to those who will be seeking positions in the teaching centres, it is extremely desirable; it is a certificate of his knowledge in the all-important basic sciences of medicine. For the student whose ambition is surgery, and who plans to obtain his training in Canada, it is almost a necessity; even now, it is an indispensable prerequisite to the better senior appointments in surgery. It will be, as similar degrees in England are at present, the "sine qua non" for those residencies, for which competition is so keen, and which alone can give the graduate an adequate training in this specialty.

It is true that degrees do not make a surgeon. But technique in surgery has become so precise, and knowledge so exacting, that a man needs more than his word to prove his ability. The young surgeon beginning a practise will depend to a great extent to work referred to him by his colleagues in general practise. The higher degrees, and the appointments they have brought, are his guarantee that he has the proficiency he pretends to have. They are his only legitimate form of advertising to the medical men, upon whose trust and co-operation he must depend for a livelihood.

* * *

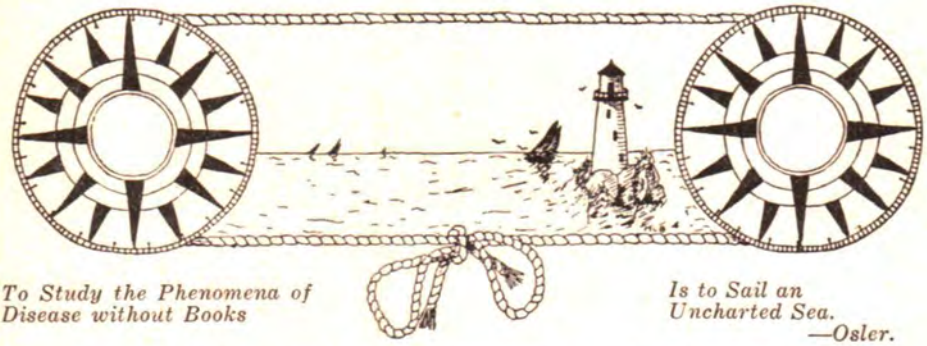
With this issue, we complete Volume VII. of the Medical Journal. This has been, in many ways, the most important year in the existence of this publication. In the early months of the school year, interest had fallen to such a low ebb that some questioned the advisability of continuing it. However, realizing that the turning point had come, and that any change would be for the better, the present staff pledged themselves to continue the Journal at all costs.

You, our readers, shall be the best judge of our success. Four

numbers of the Journal have appeared in ten weeks, and the April issue has appeared *in April*. This has been the largest volume since our inception, its total of 181 pages of text being only exceeded by that of Volume I., which had 210 pages. The quality of the material has been equal, we hope, to our best traditions. In line with our original policy, almost half the articles have been by undergraduates; we hope in the future to see this mark exceeded. Graduates have been very helpful in submitting manuscripts, and we gratefully acknowledge their assistance.

The possibilities for next year seem very bright. We are now installed in new and more convenient quarters, and student, faculty and graduate support is very active. Under the guidance of next year's staff, we foresee for the Journal a very optimistic future.

It only remains to extend our thanks to our associates, all of whom have labored tirelessly, and whose co-operation has been invaluable. We wish also to express our appreciation to the Hunter Printing Company, without whose counsel and assistance it would not have been possible to bring the Journal *up to date*.



To Study the Phenomena of Disease without Books

Is to Sail an Uncharted Sea.
—Osler.

RECENT ACCESSIONS TO THE MEDICAL SCHOOL LIBRARY

Beers—A Mind That Found Itself. 1935.
Brennemann—Practice of Pediatrics; 4 v. 1937.
Breuer & Freud—Studies in Hysteria. 1936.
British Encyclopaedia of Medical Practice; v. 1-2. 1936.
Bull—Biochemistry of the Lipids. 1935.
Doll, Phelps and Melcher—Mental Deficiency Due to Birth Injuries. 1932.
Harris—Facial Neuralgias. 1937.
Hartman—Anatomy of the Rhesus Monkey. 1933.
Hendrick—Facts and Theories of Psychoanalysis. 1934.
Jung—The Psychology of Dementia Praecox. 1936.
Kuntz—A Text-Book of Neuro-Anatomy; 2d ed. 1936.
McClung—Handbook of Microscopical Technique; 2d ed. 1937.
MacKee & Cipollaro—Skin Diseases in Children. 1936.
Osman—Original Papers of Richard Bright on Renal Disease. 1937.
Semon—An Atlas of the Commoner Skin Diseases. 1934.
Tauber—Experimental Enzyme Chemistry. 1936.
Walter—A Half Century of Nu Sigma Nu in 2 vols. 1935.
White—Outlines of Psychiatry; 14th ed. 1937.
American Association for the Study of Goiter. Trans. 1936.
American Proctologic Society. Trans. v. 37. 1936.
Association of American Physicians. Trans. v. 51. 1936.
Interstate Post-Graduate Medical Association of North America Proceedings. 1936.
New Subscription—Yale Journal of Biology and Medicine.

Abstracts

SOME PRACTICAL AIDS IN THE DIAGNOSIS OF PULMONARY TUBERCULOSIS

By CHAMPNEYS H. HOLMES, M.D.

Diseases of the Chest, March, 1937.

This is an exceptionally good article on the above subject for the general practitioner or student.

It is significant that the taking of a careful history is stressed at the beginning and as each symptom is discussed. Typical symptoms are given as they occur in the history taken in pulmonary tuberculosis, lung abscess, bronchiectasis, pneumonia, whooping cough, fuso-spirochetal disease and cancer of the lung.

Cough, hemoptysis and pleurisy are discussed as symptoms of pulmonary tuberculosis. The physical examination, X-ray, and sputum examination are presented in an interesting manner.

Lastly appear a few brief comments on special procedures such as thoracentesis and bronchoscopy and the Mantoux test.

D. M. SHARPE, 38.

CARCINOMA OF THE STOMACH AND INTESTINES

By E. C. HUGHES

Practitioner, February, 1937

No matter what organ carcinoma is in, it calls attention to itself in one of three ways: by forming a lump, by interfering with the function of the organ, by finally causing a cachexia.

The stomach is the commonest site of carcinoma in the male, in whom it is twice as common as in the female and occurs most often between 40 and 60 years. When a middle-aged person, who has been hitherto free from any abdominal discomfort begins to develop indigestion, which persists or if it remits and soon returns, the possibility of gastric carcinoma must be considered. Anorexia and a distaste for meat in particular is an early and common sign. Flatulence and vomiting are common, the vomitus being often of the coffee-ground variety, and as the disease progresses the patient rapidly loses weight and strength. When the disease begins at the pylorus, which is the most frequent site in the stomach, stenosis tends to occur with all the signs of pyloric stenosis. If the growth is towards the cardia of the stomach it may spread to the oesophagus and it will produce all the signs of carcinoma of the oesophagus. A small percentage of cancer of the stomach develops from a preceeding gastric ulcer, and this must be remembered when treating a chronic peptic ulcer. If the symptoms of the ulcer get worse or if the radiologist says that the ulcer is very large or is increasing in size or if the pain becomes constant and the appetite fails the possibility of malignant change is very great.

The diagnosis of this condition is made by a careful history of the case and a thorough physical examination, after which a gastric analysis, an X-ray examination after an opaque meal and a test for occult blood in the stool. In the cases with carcinoma the occult blood will always be present in spite of any type of treatment.

Most cases of gastric carcinoma have a complete achlorhydria, a small percentage of hypochlorhydria, whereas in ulcer cancer, free acid is present. An early growth is difficult to diagnose by X-ray. The larger the ulcer the more likely it is to be malignant. In addition, a complete blood examination and Wasserman should be done to rule out pernicious anaemia and syphilis of the stomach respectively.

Treatment: It can only be cured by gastrectomy when in its early stages. If a mass is palpable the chance for cure is quite poor. With pyloric stenosis a gastrojejunostomy will make the patient more comfortable.

Carcinoma is a common disease in the large intestine, especially at its lower end. It is a more hopeful type of malignancy as far as surgery is concerned. It presents itself in one of two ways:

1. The constricting type.
2. The symptomless tumor type of the caecum.

The constricting type is the commoner form of carcinoma in the large intestine and causes a slowly progressive form of intestinal obstruction. The first symptom is increasing trouble in bowel movement. Later there is occasional discomfort in the abdomen and as the obstruction becomes more severe, definite recurring colic, associated with distention. The clinical examination may reveal no obvious sign of the disease but often in stout patients you find a large area of the abdomen to be resonant. Late in the disease, especially in thin individuals, visible peristalsis may be seen and noisy borborygmia felt by the examining hand. Frequently the patients are first seen when the acute intestinal obstruction is present. The diagnosis of carcinoma of the large intestine is arrived at by a careful study of the case, clinical examination and the following routine methods of examination: inspection and digital examination of anus and rectum; examination of the stools; the tests for occult blood and pus; proctoscopy and sigmoidoscopy; opaque enema and occasionally the opaque meal; examination under anesthesia.

Resection is the only curative treatment for carcinoma of the large intestine except the squamous-celled carcinoma of the anal canal where radium is useful. As the condition is complicated by obstruction this is first relieved by some type of colostomy proximal to the growth. The bowel is drained for two or three weeks while the patient's general health is improved and then resection is performed.

H. T. NORRY, '38.

SURGICAL TREATMENT OF ANGINA PECTORIS

By L. O'SHAUGNESSY

Clinical Journal, XLVI., 3; 124-125; 1937

After coronary occlusion, which is not immediately fatal, the problem is to get adequate compensatory circulation. It is known that this circulation can be made up by blood supply brought in by pericardial adhesions provided the capillary bed is not too degenerated. By grafting omentum to the heart, the author felt he could provide adequate circulation. To prove this experimentally, he tied off the descending branch of the left coronary artery of a dog and grafted the omentum to the heart and it was found that the animal could chase an electrical hare without distress.

Operation in Man

The operation is under general anesthesia, oxygen and ether being supplied at a positive pressure, by means of Tiegel-Hale apparatus. The entrance to the chest is by means of an incision, along the fifth intercostal space from mid-line to the anterior axillary line and the pericardium is exposed by removing the fifth and sixth costal cartilage. The phrenic nerve is crushed, the pericardium incised and through the left leaf of the diaphragm a piece of omentum is brought up and attached to the heart and edges of the pericardium by fine linen thread sutures.

Results

Five cases of angina pectoris and one case of thrombosis were treated. One patient died seven days later from a bleeding chronic ulcer.

The second patient, who previously had nine attacks of angina, had no more attacks.

The third, aged 72, had relief from angina, but died of uremia. The fourth, who had been bed-ridden for eighteen months, was able to get up and walk. The fifth and sixth left the hospital in good condition.

D. STATE, '39.

INSTITUTIONAL CARE IN THE TREATMENT OF POLIOMYELITIS

By F. H. H. MEWBURN

Can. Med. Ass. J., 1937; 36; 263

The author in this paper gives an outline of the early, medical and after-treatment of infantile paralysis. For his purposes treatment must be begun as soon as the patient is released from the isolation ward or from quarantine in the home and wherever possible as soon as the diagnosis is made.

For purposes of discussion and treatment he divides the course of the disease into the following three stages:

1. The acute stage which lasts from the onset until the disappearance of all tenderness—usually 4 to 6 weeks.
2. The convalescent stage persisting for two years and during which period there is some spontaneous improvement in all cases.
3. The chronic stage which lasts throughout life and in which no further advance is expected.

Therapeutics: The author advocates the following method of treatment:

1. In the acute stage:
   (a) Rest:
      1. In children it is not sufficient to order rest, but some means of seeing that it is procured must be employed,

e.g., the use of Bradford frames.
2. Support of the knees by a pillow.
3. Continual eliciting of reflexes and testing of muscles for improvement is to be condemned.

(b) Prevention of Deformity: especially flexion deformities.
1. Keep patient in the horizontal position, with a minimum of sitting up.
2. Apparatus for extremities such as drop-foot appliances and drop-wrist splints.
3. Protection of involved abdominal muscles by many-tailed binder.

(c) Avoidance of Meddlesome Therapeutics:
1. Serum is only of value when given early and in this treatment would be of no avail.
2. Morphia may sometimes be necessary for pain. Otherwise drug therapy is contra-indicted.

2. In the convalescent stage:
Physiotherapeutic measures replace the absolute rest and an increasing degree of active treatment is administered. All muscles are tested as good, fair, poor, or trace. Muscle tests are taken every three months to note progress. If during treatment tenderness recurs, the regimen of absolute rest must be returned to. Physiotherapeutic measures recommended are: massage; electricity; muscle training; hydrotherapy under water or pool treatment.
3. In the chronic stage:
No further improvement is expected here and surgery is usually resorted to after first making sure that the affected muscles have lost all their power.

A short course of treatment in physiotherapy is usually given following these operations.

NELLES J. ENGLAND, '39.

OSTEITIS DEFORMANS—"PAGET'S DISEASE"

By LOUIS BERMAN

Endocrinology, 2; 226-7; March, 1936

"The exact nature of Paget's Disease is somewhat uncertain, although at first sight it would appear to be merely a variant of generalized osteitic fibrosa eystica. However in Paget's signs of hyperparathyroidism are absent, the blood calcium and phosphorus are normal and there is no parathyroid hyperplasia." —Wm. Boyd.

In this report the author treated a series of twenty cases of osteitis deformans with Adreno-Cortical Extract. These cases had florid manifestations of the disease of from six months to three years duration.

All these patients were greatly benefited by the treatment with cessation of pain, cessation of increase in the circumference of the skull, arrest of evolution of deformities, restoration to normal or a comfortable degree of general bodily movement and activity as well as the ability to carry on economic work. Muscular atrophy, fatifuability, inability to concentrate, psychic irritability and tendency to melancholia were all markedly improved.

In the author's most recent collection of twelve cases, determinations of the blood phosphatase were made before and after treatment with Adreno-Cortical Extract. The duration of treatment lasted from six months to one year.

A phosphatase unit of activity is the number of milligrams of inorganic phosphorus liberated per hour by the enzyme contained in one cc. of blood plasma from a substrate of sodium beta-glycerophosplate buffered with sodium baritol at 8.6° F. and at 38° C.

Discussion:

Blood phosphatase is increased in condition of disturbed bone metabolism, e.g., richets, osteomalasia, osteitis fibrosa, cystica and Paget's disease. This increase results from the new osseous tissue stimulating the bone phosphatase which in turn is involved with the deposition of phosphate in the normal bone because phosphatase releases inorganic phosphate from the acid soluble phosphorus compounds of the blood as well as glycerophosplate and hexophosphate. Phosphatase is not obtainable from fully grown bone or non-ossifying cartilage, but is recovered from actively growing traumatized or pathological bone, i.e., from osteocartilaginous tissue in an unstable state of metabolism.

The highest figures of blood phosphatase are reached in Paget's disease. This increase is held in check and decreased by administering Adreno-Cortical Extract which prevents further progress of the disease and alleviates the clinical symptoms.

WM. R. WEBSTER, '37.

AUTHORS INDEX

SUBJECT INDEX