THE VANCOUVER MEDICAL ASSOCIATION

BULLETIN

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Physiology at High Altitudes

Victoria June 21-26

JULY, 1926

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THE VANCOUVER MEDICAL ASSOCIATION

BULLETIN

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In Memorium

Since the publication of our last issue the medical profession of Vancouver has sustained a serious loss in the death of Dr Alison Cumming, which occurred in the early hours of Saturday, June 5th, after an illness extending over sixteen months. Born in Truro, N.S., where he received his preliminary and High School education, Dr. Cumming went to Dalhousie where he graduated in Arts. He then proceeded to McGill, graduating from that University in Medicine in 1905. After two years internship in the Royal Victoria Hospital, Montreal, he came to Vancouver. During his student days Dr. Cumming was an enthusiast in football and hockey and latterly was much interested in golf. He married in 1909 Miss Edith Rawlings of Montreal.

In Vancouver he was early appointed to the Staff of the Vancouver General Hospital, being Assistant Pathologist from 1908-1914,, Pathologist 1914-1916, and Physician to the Tuberculosis Wards 1916-1918. From that time until his death he was a member of the Senior Medical Staff of the Hospital. He restricted his practice largely to Internal Medicine and occupied a prominent position in that branch. During his later years of practice he was especially interested in the various advances in the pathology and treatment of diabetes and was a leader in this line in Vancouver. His death at the age of 49 ended a professional career of great promise. His funeral was held at St. John's United Church and was largely attended by the general public and by the medical profession of the city. The pall-bearers were Drs. C. F. Covernton, J. W. Thomson, L. Hodgins, Mr. R. E. Burns, Mr. J. Patterson, and Mr. A. P. Foster. Honorary pall-bearers were Drs. R. E. McKechnie, W. D. Brydone-Jack, B. D. Gillies, A. W. Hunter, W. D. Keith, A. Monro, A. P. Proctor, and T. R. B. Nelles.

The sympathy of the whole profession goes out to his widow and family in their bereavement.

EDITOR'S PAGE

We went to Victoria for the Annual Meeting of the Canadian Medical Asociation full of expectations and in the certain anticipation of a good time. These expectations and this anticipation were more than amply fulfilled.

This meeting was the 57th we were told in the history of the Society and one's mind goes back in an endeavor to realize the sure vision and colossal nerve of those who inaugurated this Society so far back as the year 1869, a time almost co-equal with that of the Federation of the Provinces.

Could any of those hardy pioneers have been present, what a lusty growth this early fledgling would show to them to justify and confirm their early foresight as to the greatness of their profession and their country.

For on this occasion 452 members of that profession were registerred at the meeting. They came mostly, of course, from Canada, from the far East and from the North and all the spacious land which lies between. But also they came from all over the North American continent, the Western States as usual sending a bounteous contingent. Delegates to the meeting were there from Great Britain, from far South Africa, from official United States in the person of Dr. Tate Mason of Seattle, from China whence a Canadian came to bring fraternal greetings from his colleagues.

Mnay well known names were inscribed; quite at random we noted Dr. Austin from Kingston, Dr. Starr, Dr. Hendry, Dr. J. G. Fitzgerald and many others from Toronto. With them came Dr. Banting of Insulin fame whose short address on Medical Research was heard with great interest by a crowded house. Montreal sent Dr. Chas. Martin, Dr. Cushing, who ably supplemented Dr. J. G. Fitzgerald's talk on Scarlet Fever and the newer conceptions of that disease. Dr. J. C. Meakins and many others were also present.

Those two stalwart Canadians whom we have temporarily loaned to the Mayo Clinic—Dr. Rowntree and Dr. Lemon—came back to the land of their birth bearing with them the fruits of their latest researches.

They came from everywhere, Calgary and Edmonton did exceptionally well; Winnipeg, of course, sending Dr. Montgomery, our old friend Dr. Hunter and many others.

British Columbia must have been sadly depleted of medical attendance, so many of its professors were at Victoria and we were especially glad to see such a strong registration of the members of the Vancouver Medical Association.

Despite the heat—and the heat on Wednesday and Thursday was very great—the attendance at the lectures was uniformly good and was well rewarded. For the papers were many and the subjects varied.

While most were good—and in our editorial capacity we heard them all or nearly so—some, of course, were better.

If we can bring ourselves to criticize, where every effort had been made to satisfy, it would be to suggest even more attention to the problem of acoustics. Also while we realize that the voice and delivery of the performer are individual traits, possibly a few concise suggestions, especially to those less accustomed to public speaking, might well be sent to each speaker beforehand. Thus the number of words which can with ease be read aloud in a specified time should be well known for we suppose that most papers will continue to be read, despite the manifest advantage in speaking at an audience instead of conversing with the desk immediately below the lecturer. We note that even practised hands tend to try to pack in considerably more than the alloted time will contain. The consequence of this is a high speed delivery and a hurried *denoument* when the hand of the Lord High Executioner signals that time is up.

But more in keeping with the spirit of the occasion we should like to bear witness to the hard work which must have been done by the Victoria men and women before and during the meeting in order that such a large affair could run with the efficiency of a well-oiled machine.

We can understand, as the genial President observed during his inaugural address, how the local Secretary, Dr. Thomas, from being a debonnair young man prior to all these preparations, had now become thin, grey and bowed.

In any event we are sure that there is no better place or more satisfactory climate in which to recuperate than Victoria.

The Empress Hotel made an excellent centre for the meetings and the doctors took possession of it from basement to attic. A large and very nicely arranged selection of exhibits was on hand, effectively but not too conspicously arranged. Dr. Maude Abbott of Montreal was there with a new Osler Memorial volume on which she also gave a short talk.

The lighting and platform arrangements were good and we must not forget to commend the lantern and its custodian, the former only too often a source of irritation. At this meeting both were comfortably efficient, inconspicuous and noiseless.

Of the lighter side of the meeting much might be said did publication exigencies permit.

Victoria lends itself seductively easily to the holiday mood and the work of the Committee was nobly assisted by the well known climatic and geographical advantages this charming city possesses. The call of the out-of-doors was almost irresistible. Even, we noticed, the most stern and naturally undeviating fell ready victims. The numerous and beautiful or difficult or long or tortuous or whatever it is that constitutes Paradise in golf courses, anyway these courses must have been just naturally filled from sunrise to sunset, judging by the sunburn manifested on all hands and most faces.

Luncheons, dinners, teas, receptions, drives, dances and concerts mostly I think or ostensibly at any rate for the ladies of the party, followed one another in almost bewildering confusion. None could go to all, all went to some and the combined picture of sound scientific work and light-hearted play leaves a pleasant sense of appreciation of Victoria and its medical men on the mind.

* * *

1926 SUMMER SCHOOL

The Summer School will be held in the week of September 13th and will last four days. There will be lectures in the morning and evening, with additional clinical demonstrations, arrangements for which will be announced later. The Committee has been fortunate this year in obtaining particularly good speakers and this year's School gives every promise of being a great success.

The lecturers will be: —

Dr. A. S. Warthin, Prof. of Pathology, University of Michigan, Ann Arbor; Dr. Geo. Gellhorn, Prof. Obstetrics and Gynaecology, St. Louis; Dr. C. A. Hedblom, Prof. of Surgery, University of Illinois; Sir Henry Gauvain, Orthopaedic Surgeon, London, England; Dr. George Hale, Prof. of Medicine, Western University, London, Ont.; Dr. Fraser Gurd, Associate in Surgery, McGill University; Dr. R. R. MacGregor, Prof. of Paediatrics, Queen's University, Kingtson.

* * *

CORRESPONDENCE

The Editor, Vancouver Medical Association BULLETIN,

Dear Sir:—Various members of our Association are visiting eastern parts from time to time partly on pleasure but also with the desire to see some of the medical Institutions and what others are accomplishing in different scientific fields.

It is always well to know where one can see the most in the usual limited time and so I thought it might be of interest if I related a few interesting features of the Cleveland Clinic. Dr. Crile has become well known especially on account of his work in goitre cases.

I might state that it seems to be the policy of every member of their Clinic from Dr. Crile down to the Junior Fellow, to take particular care that medical visitors should receive every attention and courtesy. No matter how busy, they are always ready to discuss the subjects in which they are specially interested.

The Clinic building is a sort of clearing house and receives all cases except the very sick, which go direct to the Hospital. Here there is a staff all told of 150 people. All the necessary diagnostic work is done, as well as the treatment of other than hospital cases. The record number of cases handled in one day was over 400.

The surgical cases are referred to the Cleveland Clinic Hospital near by, an institution of 150 beds which is being increased to 220. On account of lack of room there is a waiting list of 200 patients at present. The medical cases for hospital care are handled in temporary quarters with accommodation for about 60. There is a well equipped Physiotherapy section.

The majority of the surgical cases are thyroid and with a few exceptions these are operated on by Dr. Crile, assisted by a wonderfully co-ordinated group of assistants.

The first morning of my arrival I had the good fortune to renew acquaintance with Dr. McCullough, till recently practising in Vancouver, and now a Fellow at the Clinic. Later I met Dr. Pitts, pathologist to the Clinic, who is joining us in Vancouver in August. He is very highly spoken of by all his associates.

The average number of thyroid operations each morning is 15, with a record of 34. They are almost invariably done in the patient's room under local anaesthesia of very large amounts of three-quarters of one per cent. novocaine injected until the whole neck is bulging, and gas-oxygen analgesia given by nurses. The patient is conversing most of the time and very few are heard to complain of any pain.

Fewer ligations are being done. The morning I attended operations there were 11 cases, all for lobectomy or thryroidectomy. There was practically no blunt dissection. Many of the more severe cases are not sutured but packed with Flavine gauze and sutured within 24 hours or if the condition warrants a second lobectomy is done at this time. The actual time of each operation is but a few minutes. The operation mortality rate is around 0.8 per cent.

The treatment which averages 6-8 days before operation consists in the administration of digitalis, of Lugol's solution with a nightly dose of bromide. A large fluid intake is insisted upon. On the night before and morning of operation thyroid ext. gr. ii is given and morphia with atropine. Post-operatively the large fluid intake is maintained with such morphia as is necessary in small doses for the first 24 hours. Lugol's solution is given per rectum or mouth. Drainage is removed in 12-24 hours, and the patient allowed up in 3-4 days.

Practically all are of the opinion that the indiscriminate use of "iodized salt" is the cause of many cases of adenoma becoming toxic, but Dr. Pitts has shown that since its use has become more general the incidence of the severe hyperplastic form has very appreciably diminished.

Much of interest was seen in the very well organized departments of Internal medicine, metabolism, X ray diagnosis, etc. Considerable experimental work is being done in the physiological and chemical sections. One is impressed by the enthusiasm of the staff and especially in the seemnigly unlimited energy of its Chief, who is already beyond the "chloroform age."

C. E. BROWN.

B.C. MEDICAL ASSOCIATION NEWS ITEMS

The Annual Meeting of the B.C. Medical Association was held at the Empress Hotel, Victoria, on June 22nd. The fact that the Canadian Medical Association was in session at the same time rather conflicted with our activities, but we had the pleasure of entertaining the members of Council of the Dominion body at dinner in the evening, when some 125 men were present and had a very pleasant time. Dr. Stewart Cameron, of Peterboro, Ontario, was the guest of honour and spoke at some length regarding the history of the Ontario Medical Association and its difficulties and triumphs since its reorganization in 1918. Apparently the history of one association is very much like the history of another and it was with very sympathetic feeling that one listened to Dr. Cameron's account of the afflictions out of which his Association seems to have eventually obtained a happy issue. He emphasized, however, the advantages that have accrued to the Ontario profession as a result of their organization. When one hears of 47 District Societies all running full blast with some $25,000 expended in five years upon extension work and postgraduate lecturing, one's mouth waters and one looks forward with a somewhat shaky optimism to the time when B.C. will have attained a similar degree of vitality in the work of its organization.

The Election of Officers took place following the Dinner. Dr. J. H. MacDermot was elected President, Dr. H. E. Ridewood, of Victoria, President Elect. Dr. T. H. Lennie was elected Secretary-Treasurer, and Dr. Wallace Wilson was elected Vice-President.

Excellent reports were obtained from the various Committees. A fuller account of these will be given at some future date in the Bulletin, but owing to the exigencies of time and space it is impossible to deal with these now.

A rather pleasant touch was given by the presence of Dr. G. L. Milne at our Dinner and meeting in the afternoon. The B. C. Medical Association has the right to nominate a certain number of honorary life members of the Canadian Medical Association where certain conditions as to age and duration of service are fulfilled. Dr. Milne, who is already and honorary life member of the B. C. Medical Association was our nomination for this year and it is a great pleasure to be able to do this. This pioneer of medicine in B.C. claims 76 years of an active life, a great deal of which has been devoted to the service of his profession. He was one of the little devoted band that against great opposition was instrumental in bringing into effect the Medical Act under which we now work. In speaking after his nomination Dr. Milne gave a brief account of the days in which he first practised in B.C. "Truly there were giants in those days."

We cannot let this occasion pass without tendering our hearty congratulations to the Victoria Medical Society for the truly amazing way in which they have "put over" the C.M.A. Meeting. Those of us who remember the meeting here in 1906 can fully appreciate the difficulties of such a venutre and looking on the smoothness of working and

the wonderful completeness of detail of the Victoria meeting one is filled with sincere admiration. "Fortune favours the brave" and no more delightful weather could have been prayed for by the Victoria medical men. Added thus to the natural advantages of Victoria one feels that the meeting of 1926 will long remain a mark to be aimed at.

Important Notice

The lock on the Library door will be changed on July 15th. Members holding keys can have them exchanged free of cost. Others desiring keys can procure same from the Librarian on payment of 35 cents.

CITY HEALTH DEPARTMENT

Vancouver, B.C.

STATISTICS—May, 1926.

Total Population (estimated		128,366
Asiatic Population (estimated)		10,100
		Rate per 1000 of Population per Annum
Total Deaths	131	12.0
Asiatic Deaths	11	12.8
Deaths (Residents only)	102	9.4
Total Births	302	27.7
Male, 158		
Female, 144		
Stillbirths—not included in above	15	
INFANTILE MORTALITY—		
Deaths under one year of age	9	
Death Rate per 1000 Births	29.8	

CASES OF INFECTIOUS DISEASES REPORTED IN CITY

	April, 1926		May, 1926		June 1st to 15th, 1926	
	Cases	Deaths	Cases	Deaths	Cases	Deaths
Smallpox	0	0	1	0	0	0
Scralet Fever	15	0	13	0	5	0
Diphtheria	27	3	18	3	7	0
Chicken Pox	47	0	70	0	41	0
Measles	101	0	180	1	121	0
Mumps	120	0	111	0	34	0
Erysipelas	4	0	2	1	0	0
Tuberculosis	43	13	7	8	4	
Whooping Cough	9	2	34	1	9	0
Typhoid Fever	0	0	1	0	2	0
Cases from Outside City—included in above.						
Diptheria	5	2	2	1	1	0
Scarlet Fever	2	0	3	0	1	0
Typhoid Fever	0	0	1	0	1	0

PHYSIOLOGICAL FACTORS OF MUSCULAR WORK AT HIGH ALTITUDES

By Dr. R. E. Coleman

The development of aerial transportation during recent years has again brought to the fore many old phsiological problems. As is to be expected experience was gained in the early stages by the hit or miss method characteristic of our savage ancestors; but even yet the trial and error method pervades to an undue extent. Though the most highly educated man of today has more resemblance to, than differences from, the savage in this respect, it is that modicum of difference which distinguishes between the relative successes and failures of the two groups. "The modern conception of man as a product of and a part of nature brings the subject of man's individual physical adjustments into its proper place as the fundalmental study." The application of the science and art of conscious physical adjustment between man and his surroundings in the universe, distinguishes the educated man's adjustment from that of the savage. It is true that the savage element in all of us frequently drives us, hit or miss, to hard won successes; but the careful analysis and experimental study of individual factors in the end place the educated group far in advance of their savage ancestors.

One of the most recent attempts at an elaborate physical readjustment is our attempt to conquer our aerial surroundings. Chiefly to improve our transportation, we have set out to make ourselves as much at home as we can in the air. At first this new venture appeared to many as entirely different from all previous ventures, but again we find some old physiological factors entailed, differing in degree rather than in kind from those we meet every day. That such relationships might exist between flying and the climbing of high mountains was more or less predictable; but it was not anticipiated that we would encounter many of the same factors as would be found in such conditions as surgical shock, starvation, diabetic coma, insulin excess, death from exposure, the care of premature infants, athletic fatigue, Graves' disease, anaemia, and many other clinical conditions in which there is evidence of a failure to maintain an adequate rate of energy supply.

For this reason the "Conquest of Mount Logan," which appeared in a recent issue of the *Bulletin* has even more interest for the clinician and the physiologist than it has for the mountaineer. To the mountaineer it was only a glorious adventure; but to the clinician and the physiologist it also supplied valuable data towards "man's conscious physical adjustment to his surroundings." As a physiological experiment its beauty lies partly in the fact that it was only partly successful. Two of the party were compelled to turn back, and there is evidence that some, if not all, of the other members of the party pushed the experiment into a "*critical*" physiological zone. We can therefore expect that a careful analysis of the data may reveal a clue to some of the various "*critical*" factors.

Briefly, the physiological experiment consisted of eight selected men attempting to walk a particular two hundred and eighty miles without becoming reduced below a certain mimimum of physiological efficiency. If they should become reduced below this minimum of physiological efficiency, they would not be able to make satisfactory observations. Frequent examples of the latter condition are to be found in the literature of altitude flights in aeroplanes and balloons, where the pilots have lost the power of judgment (or have even lost consciousness) at the higher altitudes when the only records made were made by automatic instruments. In addition to this loss of records a further slight reduction of physiological efficiency might lead to death. Of those who started, a party of eight, six, or seventy-five per cent., successfully completed the experiment. Why did twenty-five per cent fail, and how much of a margin of safety was exhibited by the individual members of the successful group? Since the essential factors of the experiment revolved chiefly, if not entirely, round the rate of energy production only, the factors of energy production will be considered in detail.

The base line for all measurements of rate of energy production is the "basal metabolic rate." This basal metabolic rate is the rate of energy production during complete muscular rest and in warm surroundings. From the very nature of the Mount Logan "experiment" it is apparent that this base line could never have a comparable value, for the members of the party were never in warm surroundings.. Above 8,000 feet it was always distinctly cold and, with the high wind velocity, the rate of body cooling was often considerable. Even when sleeping three in a robe on the higher levels, the effect of excessive body cooling could be appreciated, since they did not feel actually warm. In other words each member of the party, even when at rest, had to maintain a rate of energy production in excess of his basal rate *merely to maintain his normal body temperature.*.. The work of Coleman and Dubois and others make it highly probable that in this experiment all energy production in excess of the basal rate would be produced by muscular work (through sensible or insensible contractions—shivering) so that for twenty-four hours of the day the muscular system of the climbers was continually at work and no period of complete muscular rest for recuperation was available. It is true that for such a group under normal conditions the added amount of work, due to shivering, would be insignificant, but in this experiment a critical physiological zone of rate of energy production was entered and such factors, though small under other conditions, might assume relatively large proportions in such a zone. Certainly the account of the last attack on Mount Everest indicates that the energy production necessary to maintain normal temperature of the climbers may have assumed vital importance and since Mount Everest has not yet been conquered all factors which may reach critical values should be carefully studied.

It would therefore be well worth while determining by actual experiment the relative efficiency of various types of clothing for reducing the rate of body cooling. As a preliminary experiment it would be worth while determining the rate of cooling through the clothing as worn by the Everest climbers, the clothing as worn by the Logan climbers, and the native winter clothing of the Esquimaux, of whom Stefan-

sson remarks, "they lead a tropical life, sleeping in the open, even during a blizzard." (By making use of the windways developed in modern aeroplane research laboratories this factor could be accurately determined). That the clothing used by the Mount Logan climbers or the Everest climbers was not one hundred per cent. efficient was clearly indicated during both climbs. The Mount Logan climbers suffered from "frost bites" which is simply due to excessive cooling. The Everest climbers also suffered from frost bites and they considered it suicidal to sleep in the open because of the difficulty of keeping warm. In both cases the clothing had been developed by the "hit and miss" method. If we really wish to surmount the obstacles of high altitudes by conscious physical adjustment and experimental study of all the factors which may reach critical values should be attempted.

The factor which exhibits the widest fluctuations in rate of energy production is one which frequently reached "critical" values in the present experiment and on the high levels was constantly in a "critical" zone. This factor is the rate of energy demand for the performance of *conscious* muscular work such as walking and dressing. Above 14,000 feet all unacclimatized human beings experience symptoms indicating that a "critical" physiological zone of rate of energy production has been entered. By acclimatization and adaption these symptoms may not appear till much higher levels are reached. For example some native Thibetians do not show symptons even at 19,000 feet or even higher. But in the present experiment all the members of the party began showing signs at 14,000 feet. Therefore since this one factor was constantly important (and as will appear later, probably entailed most of the elements of success or failure), its various components are worthy of careful analysis.

From the work of A. V. Hill and others it would appear that in the first instance when a muscle contracts it yields energy quantitatively equivalent to the glycogen converted at the time into lactic acid. This glycogen-lactic acid reaction is anaerobic, taking place in the absence of free oxygen. During the recovery period free oxygen (from oxyhaemoglobin) is used to further oxydize a part of this lactic acid, permitting at the same time a reformation of glycogen from the remaining lactic acid. The net loss of glycogen is probably replaced chiefly from the glucose of the blood in the presence of insulin, though Krogh has shown that it may, under certain conditions, be replaced from fat. When muscular work is performed at such a rate that no fatigue develops, as in the normal heart rhythm, the rates of lactic acid production and of the redeposition of glycogen in the muscle cells continue equal. It is apparent then that muscular work is at the expense of preformed carbohydrate and that the recovery process necessitates an adequate supply of free oxygen.

When muscular work is performed at high altitudes, limiting values for several of the above factors manifest themselves. At an altitude of 14,000 feet the oxygen tension is considerably less than at sea level. Therefore, since the rate at which oxygen is given up to the tissues by oxyhaemoglobin depends indirectly upon the tension at which the oxygen is received into the lungs, the low oxygen tension of high

altitudes will decrease the rate at which the oxyhaemoglobin will yield oxygen to the tissues.

The physiological adaption to this defficiency of oxygen tension is one of the chief factors of acclimatization and has received considerable attention. It consists partly of a compensatory increase in the haemoglobin concentration. Dwellers in high altitudes have regularly an increased haemoglobin concentration in the blood, partly through an increase in the total number of red cells and partly by an increased concentration of haemoglobin within the individual cells; but it has not yet been definately established that the compensation is ever complete. Certainly the data available from the Mount Logan and Mount Everest experiments indicate defective compensation on the part of the climbers.

As stated above, the first stage of muscular contraction is accompanied by conversion of glycogen into lactic acid. If a contracting muscle is suspended in saline solution, the lactic acid accumulates with the coincidental development of fatigue. If after the development of fatigue a recovery period of sufficient length is provided during which there is an adequate supply of free oxygen, the lactic acid and the fatigue disappear; but in the absence of free oxygen the lactic acid persists and recovery from fatigue does not occur. Similarly in the body, an inadequate oxygen supply is always accompanied by early muscular fatigue. Familiar clinical examples of the onset of early fatigue following slight exertion in the absence of an efficient rate of oxygen supply are simple anaemia from haemorrhage, CO poisoning and the condition under discussion, namely the low oxygen tension of high altitudes. Many examples of this phenomena are to be found in the literature of high altitudes. In both the Mount Logan and Mount Everest expeditions particular note was made of the fact that a recovery period of deep breathing was needed after every few paces forward. According to Krogh, however, in altitude flights, not all muscular work is at the expense of pre-formed glycogen; for this worker has shown that during muscular work in the absence of an adequate CHO supply some sustenance of a fatty nature may be converted into a carbohydrate, (glycogen). The compensatory mechanism which provides for CHO deficiency however, would only accentuate any oxygen deficiency, for the conversion of fat into a carbohydrate requires extra oxygen. As a result Krogh's reaction requires even more oxygen than the simple glycogen-lactic acid reaction. Therefore, the conditions of oxygen deficiency characteristic of high altitudes would be accentuated if Krogh's reaction were invoked. Krogh has also shown that the mechanical efficiency of this source of energy for muscular work is distinctly less than the glycogen-lactic acid reaction and as a result a given quantity of work would require even more energy than normally. Thus such adaption as the body does possess to compensate for a deficient supply of preformed CHO is of such a character that it exaggerates any oxygen want and by impaired mechanical efficiency calls for a larger total rate of energy supply both of which would serve to exaggerate factors already critical.

An efficient rate of oxygen supply is then a pre-requisite for efficient muscular work. If the rate at which oxygen is supplied to the

tissues is not efficient then lactic acid will accumulate in the muscle, from hence it will diffuse into the blood and finally may be excreted in the urine. If a normal individual under normal conditions performs severe muscular work lactic acid will appear in the urine. That is, the body can compensate in part for a deficient rate of oxygen supply by a wasteful combustion of pre-formed glycogen, losing energy which would be obtained had the lactic acid been completely burned.

It is now apparent that the deficient rate of oxygen supply constantly present when severe muscular work is attempted at high altitudes would throw an ever-increasing strain upon the available supply of pre-formed glycogen. It was also noted that in our present experiment the rapid cooling of the body caused the muscles, even when the climbers were at rest, to use up glycogen for the maintenance of their normal temperature. It is essential then that all of the factors affecting the production of, and the consumption of, glycogen should be carefully studied with a view to supplementing the production of glycogen and to conserving its use.

It was noted above that during muscular work glycogen is first destroyed and later a part of the glycogen is replaced from the lactic acid produced. The replacement of glycogen was noted to occur only during the recovery period and in the presence of an adequate supply of oxygen. It is apparent from this that the breathlessness experienced by both the Mount Logan and Mount Everest climbers may have more significance than simply to indicate an embarrassed circulatory reserve. For this reason in future experiments it would be worth considering reducing the rate of locomotion to a minimum of breathlessness. In the Mount Everest expedition Col. Norton aimed at twenty paces without stopping. He found about thirteen his limit. If he had aimed at five or six followed by an adequate recovery period he might have saved enough glycogen waste to more than compensate for the time lost. Col. Norton's marked loss of weight would seem to indicate a continued drain on his glycogen reserves.

The relation of diet and the maintenance of body temperature is also worth considering. It was noted that at high altitudes the climbers when once cooled off had considerable difficulty getting warm again, even in a sleeping robe. The nature of this difficulty becomes apparent when it is recollected that if the body at rest is warmed by shivering, it is accomplished by the consumption of glycogen. If the glycogen reserve becomes depleted then Krogh's reaction becomes the only source of new glycogen and since this reaction is relatively slow and inefficient a rapid recovery would not be expected. A few lumps of sugar might have shortened the recovery period by supplying a ready and economical source of pre-formed CHO.

After conserving glycogen waste as much as possible, the next step would be to provide a maximum supply of pre-formed CHO from the diet. After ingestion, all available CHO in the food is quickly and economically converted into glucose in the body and as such is available for storage as glycogen. Therefore, it would seem that a high CHO diet would be the diet of election at high altitudes. That such diets were actually chosen by the climbers was clearly indicated by Col.

Foster's account, as given before the Section of Physiology and Pathology. The climbers had actually planned to use the meat and vegetable extracts of their iron rations for making soup because the extracts were thought to be strengthening. From the above discussion it is evident that such extracts, consisting as they do chiefly of salts and the simpler nitrogen derivatives of protein, would yield little or no energy. They were in fact really contra-indicated, for such products require water for their elimination and water was always scarce. As a matter of experience and in spite of their firm belief in the efficacy of these extracts, the members of the party found them distasteful. On the other hand the diet actually eaten was largely CHO.

In the earlier part of this discussion it was suggested that even those who successfully made the climb showed signs of their having been in a critical physiological zone. To show this it will be necessary to leave the consideration of the muscles and to consider the body as a whole, particularly the nervous system. The muscles are by no means the only tissues which do work at the expense of pre-formed CHO. On the contrary, for equal units of weight, nervous tissue consumes more glucose and oxygen than muscle tissue. Though the exact quantitative relationship between rate of energy produced and glucose used up has not been determined for nerve tissue still we do know that the consumption is high. Unfortunately the nerve cell has little if any capacity for storing CHO and it is therefore dependent upon the glucose of the blood from minute to minute. It is apparent then that under conditions in which the muscles are keeping the blood depleted of glucose the nervous system will suffer. A familiar example of this is seen today when an excessive dose of insulin is given to the diabetic patient. In this condition the sugar of the blood is reduced to a very low concentration. The nervous system is thus starved of its CHO supply and all of the symptoms resulting are referable to this starvation.

Clinical experience in diabetes mellitus furnishes another example of the effect of deficient CHO combustion. In diabetes there is an abundant supply of pre-formed CHO but the body is unable to burn it. In many ways the symptoms are similar to the above and their particular application in the present discussion is that one of the members of the Mount Logan expedition was diagnosed a diabetic. The frequency of symptoms referable to the nervous system, even in the mildest diabetic, suggest very strongly a connection between this climber's disease and the fact that after being exposed to the above conditions, this individual became ill, one symptom being numbness of the legs with loss of function. Further suggestive data of a similar nature is obtained from the Mount Everest account; the only overweight member of the party developed a neuritis. Clinically the association of overweight, diabetes and neuritis is familiar. The dry gangrenous frost bites which occurred on the Mount Everest climb also suggest the possibility of a physiological deficiency in rate of glycogen combustion being common to the two conditions.

Returning to the two young athletes who were compelled to turn back a consideration of the above discussion suggests some of the factors which probably contributed to their failure. In the first place, as A. V. Hill says of young athletes in general, it can usually be assumed that

such individuals will go "all in," so we have only to consider why such a group will go "all in" before the older men who Col. Foster reported were not as strong at the start. Col. Foster remarked that these two young athletes could and would pick up more than their alloted loads and walk off as easily with no more effort than the older men would exhibt under a regulation load. It is possible that this was their very undoing for when such a rate of energy demand was met by a deficient oxygen supply all of the above mentioned critical values would be sooner reached. As a result, their very prowess would precipitate their breakdown. There is also another factor which probably contributed: neither of the young athletes had been in very high altitudes before and experience has shown that the acclimatization is slowest during the individual's first ascent. That they were not efficiently acclimatized is also indicated by the fact that one at least developed Cheyne-Stokes respiration.

In conclusion then, if we are to adapt ourselves to life at high altitudes, the attempt should be made to study all of the physiological factors. Many of these factors are capable of experimental investigation and even many experiments are cheaper than a few lives. They would also lead to our "conscious physical adjustment" in contrast to the hit or miss successes which may or may not be capable of repetition and are so costly in lives. The chief factors are rate of energy production, rate of energy supply, degree of acclimatization and rate of body cooling.

* * *

VANCOUVER GENERAL HOSPITAL LABORATORIES

Miss Donna E. Kerr, Biochemist of the Laboratory, recently made her 10,000th collection of blood, by venous puncture.

The literature on Blood Grouping and on the Kahn Precipitation test, placed last month in the physician's room at the V.G.H., has disappeared rapidly. Good—that is what they were placed there for.

Congestion of the rapidly increasing work of the staff in the Clinical Laboratory has necessitated shifting the autopsy room from its present situation on the second floor of the Laboratories building to the first floor. The autopsy room will occupy what has hitherto been the View Room, which latter will in turn be shifted to the Morgue proper. The space thus gained for the Clinical Laboratory will be so assigned as to relieve the overcrowded "Front Room." The new autopsy room will be much more convenient to the Morgue than the present one, better fitted up, and equally roomy and well lighted.

Dr. C. H. Vrooman and the Director of the V.G.H. Laboratories returned May 24, 1926, from the first of several trips to be made for the Federal Government, in the attempt to determine the incidence and factors of the tuberculosis amongst the B.C. Indians. The first trip yielded first-hand clinical and fluoroscopic data concerning about 175 to 190 Bella Bella Indians. The examinations were conducted at the R.

W. Large Memorial Hospital, Bella Bella, with the invaluable aid of Dr. George Darby, Medical Superintendent, and his staff of Nurses.

WANTED.—Attention has been drawn again recently to the occurrence of a small bluish patch in the skin of the sacral region and neighborhood in new-born Indian babies. This same marking is also found in Japanese babies, and (said to be) in Chinese babies. It is stated to last until the child is from eight months to one year old. The V.G.H. Laboratories will be glad to secure appropriate autopsy material for the microscopic study of this area, in an attempt to determine its nature.

Dr. A. W. Hunter, President of the Vancouver Medical Association and Pathologist to the Vancouver General Hospital, has tendered his resignation from the latter, taking effect July 1st, 1926, in order to devote himself more completely to private practice. He will, however, continue as consulting Pathologist. Dr. H. H. Pitts, originally of Nelson, B.C., at present and for some years past doing pathological work in Dr. Crile's clinic at Cleveland, Ohio, is to succeed Dr. Hunter, as part-time pathologist to the Hospital. He is expected to begin his work here August 1, 1926.

Dr. R. E. Coleman, Assistant Director, was called away suddenly to Toronto at the end of May, on account of the illness of his father. Dr. Coleman returned on June 28th.

* * *

DISEASES OF LOWER GENITO-URINARY TRACT

Paper read before a meeting of the Vancouver Medical Association on April 6, 1926, by Dr. B. H. Champion

My purpose in presenting this paper on the diseases of the lower urinary tract, is to refresh our minds on what we have already learned, for I have little or nothing new to offer. By the lower urinary tract I mean the bladder, prostate and urethra with their adnexa. I shall deal principally with the prostate as time will only permit a mere mention of the pathological conditions of other portions of the lower urinary tract.

According to Sir Everard Home, prostatism has existed from time immemorial. In the Book of Ecclesiastics, we read ". . . . ere the pitcher be broken at the fountain, or the wheel broken at the cistern"; this suggests two principal effects of the disease: the involuntary passing of urine and its total stoppage.

Niccol Massa, a Venetian physician, about the middle of the 16th century was the first to suggest that the bladder could be obstructed by a swelling of the prostate.

John Hunter, Sir E. Home, Brodie and others, practised piercing the prostate with a catheter, but this method was too painful and soon fell into disfavour.

Perineal operations were performed in the 17th century.

Covillard, in 1639, successfully removed a prostate by the perineal route, by crushing it with the forceps. Perineal prostatectomy, combined with lithotomy was frequently done in the early part of the 18th century. The first regular work on the prostate was done in 1834 by Guthrie. He divided the bar at the neck of the bladder.

Then came Mercier, Bottini, Freuderberg, Young, Horwitz, Keyes, Chetwood, Sir Henry Thompson, Freyer, Sir Thomson Walker, etc., all of whom gave to the world many improvements thus making operation on the prostate gland safer for the patient.

EMBRYOLOGY

You will recall that the genito-urinary tract is developed from three main sources—the Wolffian bodies and ducts, the Mullerian ducts and the Allantois. The Allantois juts out from the primitive gut, near its posterior end, in the second week, and becomes the urinary bladder.

The prostate is now held to be formed from the mesoblastic tissue that surrounds the urogenital sinus and the genital cord. Into this annular mass of mesoblastic tissue which surrounds the lower end of the Wolffian and Mullerian ducts, offshoots of epithelial lining from the urethra project to form the glandular portion of the prostate.

Lowsley claims that the glandular portion is derived from 5 sets of tubules in contra distinction to the older view of only 3. He claims the median lobe has an independent origin (Albarran's tubules).

There is a bursa between the prostate and the rectum called the aponeurosis of Denonvilliers; it is a down growth from the peritoneum.

ANATOMY OF PROSTATE

The prostate measures 4 cm from base to top; 4 cm tranversely and is 2½ cm thick. It weighs 15 to 24 grms.

The capsule of the prostate is the condensed peripheral portion of the fibro-muscular stroma and is inseparable from the gland. The surgical capsule, so-called, is derived from the pelvic fascia. The stroma constitutes about half the bulk of the gland. The number of prostatic ducts varies from 15-20, and the acini are lined with columnar epithelium. The ejaculatory ducts empty into the floor of the prostatic urethra. (Lowsley).

The prostate is made up of 5 lobes, viz—

Median lobe	10	tubules
Right lateral	16	"
Left lateral	16	"
Post. lobe	9	"
Ant. lobe	7	"
In all	58	tubules

BLOOD SUPPLY

Internal pudic and middle hemorrhoidal arteries and the prostatic branch of the hypogastric axis.

NERVE SUPPLY

From the sympathetic, through the inferior hypogastric plexus.

LYMPHATICS

There are two groups, the lateral which communicates with the internal iliac glands and the upper which drains into the obturator lymph nodes.

The lateral lobes have a thin capsule at the base, especially where the uretha enters them and for this reason: Neoplasms arising in them have a tendency to invade the bladder by way of the urethal orifice. The tubules enter the urethra on either side of the verumontanum.

Lowsley compares the posterior lobe to a wedge with its base at the apex of the gland. Benign hypertrophy rarely, if ever begins in the posterior lobe, while primary cancer rarely, or never, begins in any other portion of the prostate.

Accessory glands—subcervical group of Albarran, consist of 30 or more branched tubules whose ducts open into the midline of the floor of the urethra. In 24 per cent. of autopsies on men over 30 years of age, Lowsley found these glands enlarged sufficiently to cause obstruction to the vesical outlet.

PHYSIOLOGY

The function of the prostate gland is to furnish fluid to liquify the sperm and facilitate its passage from the genital glands. Testicular fluid is acid. Prostatic fluid is alkaline.

CAUSES OF HYPERTROPHY

Little has been added to our knowledge of the etiology of prostatic hypertrophy within the past 50 years. Some observers claim that inflammation precedes hypertrophy and vice-versa.

Rousing, Pilcher, Young and Keyes oppose the inflammatory theory because the usual result of inflammation is atrophy rather than hypertrophy.

Henry Wade offered the hypothesis that benign hypertrophy is due to some alteration in the normal internal secretion, and suggests the name "chronic lobular prostatitis" in differentiation from the interstital prostatitis, the end product of which is a sclerosed gland.

Vulpian held that prostatic hypertrophy was analogous to fibroid disease of the uterus, because of the common embryological origin.

Reginald Harrison claimed that the prostate enlarged to compensate for a primary descent of the bladder floor.

At the present time we cannot hope to reach any definite conclusion as to the influences exerted by occupation, personal habits, previous disease of the generative organs and similar possible causes of prostate enlargement.

The man with hepatic and portal congestion, with a tendency to hemorrhoids, or varicose veins of the legs, is not an infrequent victim of enlarged prostate. Over-indulgence in sexual intercourse has long been considered a possible factor. J. William White states that it is

quite as logical, if not more so, to blame the enlarged prostate with exerting unnatural desires.

Hodgson claims that the extra work upon the prostate in supplying a fluid after the secretion of the testicles had become insufficient for that purpose, causes hypertrophy. Here again the many theories are analogous to the many remedies for an incurable disease—not one of them is of any specific value.

PROSTATITIS

The prostate becomes infected in about 75 per cent. of all cases of gonorrhoea. The prostate may become infected from other causes; this is far more prevalent than is generally known.

It may become infected locally from the urethra, from fissures about the rectum, hemorrhoids, congestion due to constipation, and through the blood stream from other possible foci as the teeth or tonsils. I have had numbers of cases following 'flu. Some of those cases have had few or no symptons, except, perhaps, a little urgency or frequency, or something a little unusual noticed about the act of micturition.

Mostly, in G.C. prostatitis, only one portion of one lobe becomes involved. These can be easily felt per rectum. The affected area or areas are first somewhat painful and soft, but as the condition becomes chronic, cellular infiltration is replaced by fibrous tissue. The area becomes hard and later on becomes indented by the contraction of the fibrous tissue. So one can usually determine whether an infected prostate is acute or chronic by the consistency under the finger. Smears of the expressed fluid will usually determine whether G.C. is the offender or other bacteria are causing the inflammation. Broadly speaking, in all smears, male or female, the presence of G.C. denotes gonorrhoea. The presence of polynuclear leucocytes and absence of bacteria, is in favor of G.C. Strangely enough, the usual flora of the anterior urethra and cervix are not found in the presence of gonorrhoea, so if you stain a smear and find pus and no germs of any kind, be suspicious until you get another smear. On the other hand, the presence of polynuclear cells and presence of bacteria other than G.C., is in favor of a secondary infection.

The presence of epithelial cells in abundance, is suggestive of overtreatment.

Instrumentation causes posterior urethritis and prostatitis.

PROSTATIC ABSCESS

This may result from a prostitis. If the gland is enormously enlarged, painful, and the two lobes cannot be differentiated, the centre or mid-sulcus greatly swollen, you have a prostatic abscess. The temperature is elevated to, perhaps, 105. These cases often cause retention of urine, necessitating the passage of a catheter.

TREATMENT—Rest in bed. Gentle massage (with emphasis on gentle) to facilitate drainage through the urethra; urinary antiseptics administered internally; suppositories containing morphia and belladonna. Hot or cold rectal washes through psychophore.

If pus shows at meatus, all well and good, if not, the abscess should be opened by perineal section or may open spontaneously into rectum, or urethra. Rupture into other situations is rare.

EPIDIDYMITIS

This occurs in 25 per cent. of all cases of G.C. Here, rest with withdrawal of local treatment and application of ice or heat. Some surgeons incise the epididymis and relieve the pressure of a hydrocele which is always present. Instrumentation of the urethra and prostatic massage should be withheld if possible. Rectal examination may be done, with caution, to determine the condition of the prostate. Sometimes it is found to be swollen over the infected side; gentle massage may start drainage of pus into urethra, which relieves the situation.

Generally speaking, all urethral treatment should be stopped until the "fire burns down."

CALCULI

They occur in the prostate as a result of strictures of the urethra; may only be detected by X-Ray.

RETENTION CYSTS

of the prostate are not very common. When they occur, they may cause obstruction.

SYPHILIS

of the prostate is rare and has no definite characteristics.

TUBERCULOSIS

of the prostate and seminal vesticles, is often associated with T.B. of the kindney finding its way down through the bladder and through the vesticles and testis, the prostate becoming infected secondarily. T.B. of the lower genital tract is slow in development and there is in the beginning little local or constitutional evidence of its presence. T.B. infection is found in early life. The globus major is more likely to be involved in T.B., the globus minor, in G.C. The absence of acute symptoms should make one suspicious of T.B.

CARCINOMA OF THE PROSTATE

Malignant disease of the prostate ,to quote Deaver, "is chiefly of the adeno-carcinomatous variety. The rapidly-growing medullary carcinoma is rarely seen on the prostate. One of the chief characteristics of prostatic carcinoma is its tendency to metastasize early and widely. Practically all organs are subject to these metastases, but the bones are particularly liable. The medullary cavities of long bones are frequently involved. It must be remembered that carcinoma of the prostate is far commoner than is usually believed. Young states that 20 per cent. of all hypertrophied prostates are carcinomatous. Some authorities give even a higher percentage. The symptomatology of early cancer of the prostate is almost identical with that of benign hypertrophy, with which indeed it is often associated. The differential diagnosis between these conditions is an impossible one to make, or, if made at all, is based entirely on physical signs. There is, however, one exception to this, i.e., pain, independent of micturition, which is very suggestive of malignancy

At first localized in the region of the prostate, and constant in character, later it becomes referred to the perineum, to the back, the buttocks and the thighs. Referred pain is a late symptom of carcinoma. It means the involvement of the prostatic sheath in the vicinity of the large nerve trunks.

On rectal examination, increased density, with or without nodules, is very suggestive of carcinoma. Then, areas of stony hardness are the most important physical finding in carcinoma of the prostate, especially when associated with pain and independent of micturition.

The large, soft, adenomatous prostate may contain areas of carcinoma, but I think if one carefully palpates the lateral sulci, he will find one to be fuller and more resistant under the finger than the other. Carcinoma of the lateral lobe may spread laterally towards the pelvic wall. Lowsley says: "Benign hypertrophy rarely, if ever, begins in the posterior lobe, while primary carcinoma rarely, if ever, begins in any other portion." Carcinoma of the posterior lobe is easily detected, and in these cases good results are obtained from prostatectomy. Hematuria, especially after catheterization, is mostly found in benign hypertrophy, and is favorable evidence against carcinoma.

CYSTOSCOPIC DIAGNOSIS

Deaver states that the diagnosis of prostatic hypertrophy cannot be said to be complete without a cystoscopic examination.

True, a large hypertrophied prostate may be felt on rectal examination, but the vesical complications and vesical picture of the prostate should be determined before operation.

There are six reasons for cystoscopic examination:—

1. To determine whether the enlargement is lateral, or of the middle lobe. Median lobe enlargement can only be determined by cystoscopy.

2. To ascertain whether the enlargement encroaches upon the urethral surfaces.

3. To ascertain the presence of:—
   (a) Bladder tumors, if any.
   (b) Stone.
   (c) Diverticulae, in which case if these are not detected, the patient has little or no relief after operation.
   (d) A median bar.

If every case of obstruction of the bladder neck was carefully cystoscoped before operation, we would have fewer cases of bad results seeking relief elsewhere.

A WORD ABOUT POST-OPERATIVE TREATMENT

1. A troublesome complication following prostatectomy, is epididymitis. The French, to avoid this, divide the vas deferens, which does away with the fear of this complication, and a catheter may be inserted, without fear, into the bladder.

2. Control of hemorrhage: The French have abandoned packing and put patient on calcium lactate prior to operation.

3. About 2 to 2½ inches of the urethra is torn away, leaving a large cavity to fill in with scar tissue. When healing is complete, the new urethra in this area may be narrowed. It may be above the floor of the bladder; it may be distorted, or it may be encroached upon by folds of mucous membrane causing obstruction. Also, granular tissue may persist and this raw surface causes frequency of urination. I believe that cases of prostatectomy should be treated in the same way as strictures of the posterior urethra, by the passage of sounds until no more bleeding is detected; and if the urine is dirty, irrigate the bladder after each dilation until it becomes clear.

A WORD ABOUT THE USE OF THE CATHETER

The more one has to do with genito-urinary cases, the more cautious one becomes in the use of the catheter and sound.

We all have had experience with the so-called urethral fever. I have two sudden deaths to my debit as a result of urethral instrumentation. In case of urinary obstruction, where a catheter or sound has never been passed, one should proceed with caution. The anterior urethra harbors germs which in the healthy urethra do no harm, but if the mucos membrane is broken or they are carried back into the posterior urethra, a urethritis is set up. Lowsley states that he believes in every case of catheterization a posterior urethritis is set up. To avoid this, the anterior urethra should be syringed out with an antiseptic before a catheter is introduced into the bladder.

In cases of obstruction, the utmost care should be exercised in attempting to enter the bladder. A small coude is perhaps the safest. If it fails to enter the bladder easily, discontinue and try the filiform to avoid damaging the urethra which is always congested in prostatic enlargement. Every general practitioner should have a set of filiforms with followers. On failing to enter the bladder, after a reasonable trial, without force, suprapubic puncture and drainage should be done.

ACUTE AND CHRONIC CYSTITIS

Time will permit of only a few words on this common disease. The essential cause of cystitis is bacterial contamination, but such bacterial invasion to produce cystitis must be in the presence of a contributing factor which renders the organ readily susceptible to microbic infection. In the commonest form of cystitis, the susceptibility thereto and the bacterial infection are derived simultaneously; and this refers to that type of cystitis which comes as a result of extension of inflammation, be that from the posterior urethra which is the commonest of all, from the ureter, or from a neighboring focus of suppuration outside the bladder. The less common method of invasion is by way of the blood current or lymph stream. In this case, the predisposing and infecting agencies derived separately. The predisposing factors in general are embraced in an enumeration of all causes of vesical irritation or congestion, namely:—

Highly irritating urine due to an excess of acid or alkaline constituents. The presence in the urine of certain chemical substances in excess, such as turpentine, copaiba, cubeb, cantharides, over-indulgence in alcoholic beverages, etc.

Physical strain, and anything that may produce traumatism directly or indirectly, such as violent exercise, falls, and other injuries, and direct wounds, such as the unwise and careless introduction of instruments.

The microorganisms that are responsible for cystitis, are the staphylococcus, streptococcus, proteeus vulgaris, penumococcus, bacillus coli, and the specific organisms of gonorrhea and tuberculosis, as well as those of typhoid, glanders, anthrax, etc.

One word about the results of chronic cystitis. Here we get a condition not unlike that seen sometimes following prostatectomy, namely a contracture of the neck of the bladder. Chronic inflammation in this area results in fibrotic contraction producing partial occlusion with elevation of the opening above the floor of the bladder. This condition is found both in men and women. The mucosa of the bladder presents a polypoid appearance or a hob-nailed condition caused by fibrotic contraction.

Treatment of acute cystitis should be carried out by rest and daily lavage and by injecting one of the milder silver preparations. Operation is often the only means of relief of the contracture mentioned above. This is done by removing the obstructing portion on the floor of the bladder, thus leaving the floor of the bladder on the same plane as the urethral floor.

TUMORS OF THE BLADDER

Dr. Champion concluded his paper by a brief reference to tumors of the bladder. These he divided into 3 groups:—

1. The epithelial group which includes papilloma, carcinoma, adenoma and cysts.

2. The connective tissue group which includes sarcoma, myxoma, fibroma and angioma.

3. The muscle tissue group as myoma.

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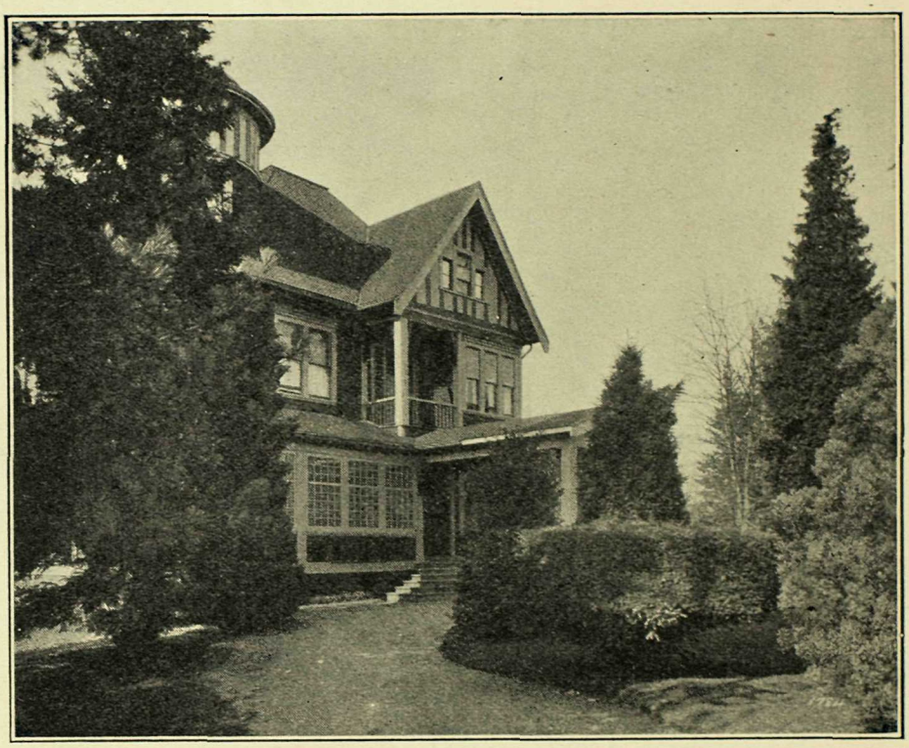

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