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and
Minnesota Medical Foundation

Degenerative Cardiovascular Disease

Volume XX | Friday, March 11, 1949 | Number 20

BULLETIN OF THE
UNIVERSITY OF MINNESOTA HOSPITALS
and
MINNESOTA MEDICAL FOUNDATION

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ANCEL KEYS, Professor and Director, Laboratory of Physiological Hygiene.

III. MEDICAL SCHOOL NEWS 411

Published weekly during the school year, October to June, inclusive.

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I.

UNIVERSITY OF MINNESOTA MEDICAL SCHOOL
CALENDAR OF EVENTS

March 13 - 19, 1949

No. 239

Sunday, March 13

9:00 - 10:30 Surgery Grand Rounds; Station 22, U. H.

10:30 - 11:00 Surgical Topic; Rm. M-109, U. H.

Monday, March 14

8:00 - Fracture Rounds; A. A. Zierold and Staff; Ward A, Minneapolis General Hospital.

9:00 - 9:50 Roentgenology-Medicine Conference; L. G. Rigler, C. J. Watson and Staff; Todd Amphitheater, U. H.

9:00 - 10:50 Obstetrics and Gynecology Conference; J. L. McKelvey and Staff; M-109, U. H.

10:00 - 12:00 Neurology Rounds; A. B. Baker and Staff; Station 50, U. H.

11:00 - 11:50 Roentgenology-Medicine Conference; Staff; Veterans Hospital.

11:00 - 12:00 Cancer Clinic; K. Stenstrom and A. Kremen; Eustis Amphitheater, U. H.

12:00 - 1:00 Physiology Seminar; The Reduction of the Plasma Potassium Level by Vivodialysis and Its Restoration in Non-Visceral Regions; Francis J. Stutzman; 214 M. H.

12:15 - 1:20 Obstetrics and Gynecology Journal Club; Staff Dining Room, U. H.

12:30 - 1:20 Pathology Seminar; Hemorrhagic Disease in the Newborn, Evelyn T. Hartman; 104 I. A.

12:30 - 1:30 Surgery Problem Case Conference; A. A. Zierold, C. Dennis and Staff; Small Class Room, Minneapolis General Hospital.

1:30 - 2:30 Surgery Grand Rounds; A. A. Zierold, C. Dennis and Staff; Minneapolis General Hospital.

1:30 - 2:30 Pediatric-Neurological Rounds; R. Jensen, A. B. Baker and Staff; U. H.

*4:00 - 6:00 Kellogg Lecture; The Problem of Chronic Brucellosis; Wesley W. Spink; Powell Hall Amph.

4:00 - Pediatric Seminar; A Discussion of Psychological Tests Used for the Evaluation of Brain Injury; Miss Audrey Arkola; 6th Floor, Child Psychiatry, U. H.

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* Indicates special meeting. All other meetings occur regularly each week at the same time on the same day. Meeting place may vary from week to week for some conferences.

5:00 - 5:50 Clinical Medical Pathologic Conference; Todd Amphitheater, U. H.

5:00 - 6:00 Urology-Roentgenology Conference; D. Creevy and H. M. Stauffer and Staffs; M-109, U. H.

*8:00 p.m. Clinical Research Club; Morphologic Comparison of the Pancreatic Changes in Experimental and Human Diabetes, Carl A. Peterson; Mucoprotein and Hyaluronidiase Inhibitor Studies in Healthy and Diseased Children, Robert A. Good, Vincent C. Kelley and David Glick; Eustis Amph., U. H.

Tuesday, March 15

8:30 - 10:20 Surgery Reading Conference; Small Conference Room, Bldg. I, Veterans Hospital.

9:00 - 9:50 Roentgenology Pediatric Conference; L. G. Rigler, I. McQuarrie and Staff; Todd Amphitheater, U. H.

10:30 - 11:50 Surgical Pathological Conference; Lyle Hay and Robert Hebbel; Veterans Hospital.

12:30 - Pediatric-Surgery Rounds; Sta. I, Minneapolis General Hospital; Drs. Bosma, Wyatt, Chisholm, McNelson and Dennis.

12:30 - 1:20 Pathology Conference; Autopsies; Pathology Staff; 102 I. A.

1:00 - 2:30 X-ray Surgery Conference; Auditorium, Ancker Hospital.

2:00 - 2:50 Dermatology and Syphilology Conference; H. E. Michelson and Staff; Bldg. III, Veterans Hospital.

*2:00 - 4:00 Kellogg Lecture; The Laboratory Diagnosis of Virus Diseases; Jerome T. Syverton; Todd Amphitheater, U. H.

3:15 - 4:20 Gynecology Chart Conference; J. L. McKelvey and Staff; Station 54, U. H.

3:30 - 4:20 Clinical Pathological Conference; Staff; Veterans Hospital.

4:00 - 5:00 Pediatric Rounds on Wards; I. McQuarrie and Staff; U. H.

5:00 - 5:50 Urology-Pathological Conference; C. D. Creevy and Staff; Todd Amphitheater, U. H.

5:00 - 6:00 X-ray Conference; Dr. Curtis Messa, St. Cloud; Powell Hall Amphitheater.

Wednesday, March 16

8:00 - 8:50 Surgery Journal Club; O. H. Wangensteen and Staff; M-515, U. H.

8:30 - 9:30 Clinico-Pathological Conference; Auditorium, Ancker Hospital.

8:30 - 10:00 Orthopedic-Roentgenologic Conference; Edward T. Evans; Room 1AW, Veterans Hospital.

8:30 - 12:00 Neurology Rehabilitation and Case Conference; A. B. Baker and Joe R. Brown; Veterans Hospital.

11:00 - 12:00 Pathology-Medicine-Surgery Conference; O. H. Wangensteen, C. J. Watson and Staff; Todd Amphitheater, U. H.

3:30 - 4:30 Journal Club; Surgery Office, Ancker Hospital.

4:00 - 5:00 Infectious Disease Rounds; Medical Conference Room, Veterans Adm. Hospital.

Thursday, March 17

8:15 - 9:00 Roentgenology-Surgical-Pathology Conference; Craig Freeman and H. M. Stauffer; M-109, U. H.

8:30 - 10:20 Surgery Grand Rounds; Lyle Hay and Staff; Veterans Hospital.

9:00 - 9:50 Medicine Case Presentation; C. J. Watson and Staff; M-109, U. H.

10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

10:30 - 11:50 Surgery-Radiology Conference; Daniel Fink and Lyle Hay; Veterans Hospital.

11:00 - 11:50 Urology Seminar; Technique of Biopsy of the Liver; Fred Hoffbauer; E-101, U. H.

11:00 - 12:00 Cancer Clinic; K. Stenstrom and A. Kremen; Todd Amphitheater, U. H.

11:30 - 12:30 Clinical Pathology Conference; Steven Barron, C. Dennis, George Fahr, A. V. Stoesser and Staffs; Large Class Room, Minneapolis General Hospital.

1:00 - 1:50 Fracture Conference; A. A. Zierold and Staff; Minneapolis General Hospital.

2:00 - 3:00 Errors Conference; A. A. Zierold, C. Dennis and Staff; Large Class Room, Minneapolis General Hospital.

4:30 - 5:20 Ophthalmology Ward Rounds; Erling W. Hansen and Staff; E-534, U. H.

5:00 - 6:00 X-ray Seminar; Review of 3-yr. Experience of Carcinoma of the Lung at Veterans Hospital; B. J. O'Loughlin; Todd Amphitheater, U. H.

Friday, March 18

8:30 - 10:00 Neurology Grand Rounds; A. B. Baker and Staff; Station 50, U. H.

9:00 - 9:50 Medicine Grand Rounds; C. J. Watson and Staff; Todd Amphitheater, U. H.

10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

10:30 - 11:20 Medicine Grand Rounds; Staff; Veterans Hospital.

10:30 - 11:50 Otolaryngology Case Studies; L. R. Boies and Staff; Out-Patient Department, U. H.

11:00 - 12:00 Surgery-Pediatric Conference; C. Dennis, O. S. Wyatt, A. V. Stoesser and Staffs; Minneapolis General Hospital.

11:30 - 12:50 University of Minnesota Hospitals General Staff Meeting; Treatment of Hay Fever in the Adult; J. S. Blumenthal; Powell Hall Amphitheater.

12:00 - 1:00 Surgery Clinical Pathological Conference; Clarence Dennis and Staff; Large Classroom, Minneapolis General Hospital.

1:00 - 1:50 Dermatology and Syphilology; Presentation of Selected Cases of the Week; H. E. Michelson and Staff; W-312, U. H.

1:00 - 3:00 Pathology-Surgery Conference; Auditorium, Ancker Hospital.

1:00 - 2:50 Neurosurgery-Roentgenology Conference; W. T. Peyton, Harold O. Peterson and Staff; Todd Amphitheater, U. H.

4:00 - 5:00 Electrocardiographic Conference; George N. Aagaard; 106 Temp. Bldg., Hospital Court, U. H.

Saturday, March 19

7:45 - 8:50 Orthopedics Conference; Wallace H. Cole and Staff; Station 20, U. H.

8:30 - 9:30 Surgery Conference; Auditorium, Ancker Hospital.

8:00 - 9:00 Pediatric Psychiatric Rounds; Reynold Jensen; 6th Floor, West Wing, U. H.

8:00 - 9:00 Surgery Literature Conference; Clarence Dennis and Staff; Minneapolis General Hospital, Small Classroom.

9:00 - (;50 Medicine Case Presentation; C. J. Watson and Staff; E-101, U. H.

9:00 - 10:30 Pediatric Grand Rounds; I. McQuarrie and Staff; Eustis Amphitheater, U. H.

9:00 - 11:30 Surgery-Roentgenology Conference; Todd Amphitheater, U. H.

9:00 - 12:00 Neurology Conference; Powell Hall Amphitheater.

10:00 - 11:50 Medicine Ward Rounds; C. J. Watson and Staff; E-221, U. H.

10:00 - 12:50 Obstetrics and Gynecology Grand Rounds; J. L. McKelvey and Staff; Station 44, U. H.

II. SOME PRELIMINARY FINDINGS FROM THE RESEARCH PROGRAM ON CARDIOVASCULAR DEGENERATION AT THE LABORATORY OF PHYSIOLOGICAL HYGIENE*

Ancel Keys

With some notable exceptions, the large majority of cases of cardiovascular disease present problems of management rather than of cure. The fact is that continued hypertension and vascular sclerosis produce what at present must be considered irreversible changes and the great bulk of current clinical practice consists in making the best of a bad situation, not in the hope of making it fundamentally better, but in the effort to prevent it from getting worse too rapidly. Clinical research along classical lines with such cardiovascular patients would seem to have strictly limited possibilities. At best we might hope for more exact diagnosis, for more objective evaluation of the actual status, and for improvements in supportive therapy. These worthy objectives for research are now under attack in scores of institutions.

It could be suggested that if rheumatic fever and endocarditis could be controlled, and if surgery could be further developed to correct physical malformations, then the remaining major cardiovascular conditions merely would reflect the inevitable aging process for which we can never hope for more than good management and support.

There are two objections to the acceptance of this conclusion. The first, which is perhaps of no scientific importance, is the fact that these "remaining" conditions comprise the cause of something like half of all cardiovascular deaths. The second is the fact that hypertension, coronary occlusion, and cerebrovascular accidents do not intervene solely as the terminal stage of the general disintegration of the aged organism. The real problem is posed by the fact that these distressing developments are very imperfectly related to age and often enough intervene when, otherwise, the physical and mental abilities of the person are of greatest use to society. Obviously, to prevent or delay the degenerative processes in the cardiovascular system so that at least they do not outspeed those in the other tissues of the body, is an objective of the highest importance.

But how does one begin? Without knowing the why of these degenerative developments, it is still possible to ask, who? If it were known, for example, who would have coronaries and hypertension and so on in the next year, or the next ten years, one could at least try to discover how these unfortunates differ from their fellows not so destined. But statistically, at least, one can predict that a very significant proportion of any sizeable group of adults will have such developments and that these will come at different times beginning at no very distant time from the present. In other words, detailed and continued study of any sizeable number of men who are disease-free at the outset, must automatically provide a considerable gradation in eventual rate of cardiovascular degeneration.

This is one facet of the philosophy of the long-range research program at the Laboratory of Physiological Hygiene.

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* The research program discussed in this paper is supported in part by the Research Grants Division of the United States Public Health Service, and, in part, by the National Dairy Council, acting on behalf of the American Dairy Association. The Program is planned and operated by the Senior Staff of the Laboratory of Physiological Hygiene including, besides the author, Drs. Austin Henschel, Ernst Simonson, Henry Longstreet Taylor, Josef Brozek and Carleton B. Chapman. Dr. Olaf Mickelsen, now with the United States Public Health Service in Washington, took part in the planning and the first year of work in this program.

Another major concept is embodied in several facts, or convictions, that will need little defense. In the first place, it will be agreed that the differences between men which appear in the outcome of earlier or later degeneration do not begin with the recognition or appearance of the degenerative changes. They must reside implicitly in the individuals before the event, there to be operated on by the mode of life of the individual so as to result in, let us say, severe coronary sclerosis at 40 years of age or relative freedom from this at 80. The predisease differences may be well-concealed; certainly they are not now recognized as such but they must exist. Perhaps they are genetic, perhaps they have arisen from the accidents and characteristics of earlier life, but in any case they must cast their shadows before, though not necessarily at first in the form of a gradual, direct development from a little hypertension or a little sclerosis.

In the second place, individuals differ in countless many ways in the "normal" or pre-degenerative state and many of these differences are relatively stable characteristics of the individuals. The anatomy and the general mechanisms of the functional machinery may be much the same from man to man but there are quantitative differences which are often much larger than the textbooks indicate. I have no difficulty in recognizing my friend Dr. X from his appearance, his voice, or even from his handwriting. Such recognition proceeds from a synthesis of many details which may be combined in a single observation. What is not so generally appreciated is that, given the appropriate quantitative data, I could just as surely recognize him from the pattern of his hemoglobin concentration, his electro-cardiogram, the shape of his aorta, and the level of cholesterol in his blood, even though all of these be what is considered normal. Such characteristics together are, in perhaps a more important sense for disease prediction, my friend Dr. X, the person out of whom will come the patient.

The difficulty is that there are few clues as to which characteristics, in what combination, are important for the present problem. What items, measured now, will prove to be of possible predictive value in regard to eventual cardiovascular degeneration? At this juncture the best that may be done is to select a few standard items, and to develop good methods for more, which seem to be directly or indirectly related to the cardiovascular system and the manner in which it fulfills its task of propelling and conducting the blood. To these might be added some items which portray, quantitatively, the body and its function as a whole. If attention is confined to items for which there are at present objective, reliable, sensitive, quantitative, methods, which are within reason from the standpoint of time and expense, this list will be shorter than might be thought at first. If the specification were further added that for each method there must be at hand good statistical norms, the list would shrink to include little more than height-weight, hemoglobin, and basal metabolism -- and none of these is perfect. Quantitative human biology is so little developed that there are few acceptable norms nor will there be great improvement until the rudiments of standardization and measurement are more widely understood and applied. In other words, having chosen the items and their methods for study, there is a major task, and opportunity, of standardization.

I have noted that the future characteristics of the individual must be dependent on the present characteristics and the continuing circumstances which operate on them -- the mode of life, if you will. This includes, I suppose, the accidents of infection -- which do not seem likely to be of high importance -- and the habits of diet, of physical activity, and of emotion. Information on all these points is included in the research program at the Laboratory of Physiological Hygiene.

The basic plan of the central part of the program, then, is to select a con-

siderable number of men who are disease-free at the outset, and to study them repeatedly over a long period of time so as to characterize them as fully as may be at the several stages along the degenerative path. The plan is frankly empirical and, though not scorning theoretical analysis, is developed in the conviction that at the present state of knowledge a great deal of rigorously standardized exploration is necessary. Ideally, such a program should result in showing how to predict the likelihood of later cardiovascular disease and to afford potent guidance in discovering causal relations. At the worst, it should provide much-needed standards of normality and would eliminate some items for major consideration in future researches.

The argument here presented is worthy of emphasis, partly to make the research program understandable, but mainly because some of the elements of quantitative human biology which are involved seem to be rarely considered in this or in other connections. Some details of the research work itself should give point to the general thesis.

There are two main groups of subjects, or volunteer "guinea pigs." Originally we had about 200 young men, 17 to 24 years of age, and 320 older men, from 45 to 54 years old. All were supposedly "normal" at the start but the first examination disclosed a few disqualifying defects as well as a considerable number of men who must be classed as not completely "normal" in every respect. There remain 381 men who represent the central group of our normal subjects.

These men are not random samples of mankind or even of the Twin Cities. In the first place, the young men were selected from the University population and the older men from the Twin Cities population of business and professional men. Both groups are made up of men of the white-collar type, of more than the average sense and reputation of responsibility, and who are interested and able to devote one day each year to being "guinea pigs." So far as can be seen, both younger and older groups are samples of the same general population and the older men represent the kind of men into which the younger men will develop in 25 to 30 years. They are, then, fairly homogeneous and comparable in several important respects.

In order to provide the desired range of body types and eating habits within this homogeneity, each age group is made up of men selected to range from "thin" to "fat" in fairly equal numbers. The distribution of the normal subjects with regard to relative body weight is summarized in Tables 1 and 2.

Table 1

Younger (17-24 years) "guinea pigs." Numbers of men in 5 groups according to relative obesity.

Class	No. Men	Relative Weight Limits	Mean
A	33	76.0-91.4	86.1
B	33	91.8-97.5	94.6
C	32	97.7-104.1	100.9
D	29	104.4-114.1	109.6
E	32	114.6-161.3	123.6
Total	159	76.0-161.3	102.7

Table 2

Older (45-54 years) "guinea pigs." Numbers of men in 5 groups according to relative obesity.

Class	No. Men	Relative Weight Limits	Mean
A	40	67.5-85.3	78.3
B	49	86.1-94.7	90.1
C	45	95.0-101.8	98.5
D	46	102.0-108.4	105.2
E	42	109.0-137.7	118.0
Total	222	67.5-137.7	98.6

The general arrangement is that each of these men spends a day at the Laboratory once a year where he undergoes a battery of tests and measurements in the basal fasting state as well as some

measurements under non-basal but standardized conditions. The latter have included, for example, the response to fixed exercise on the treadmill, and the electrocardiogram after a standard meal. The battery of tests is not identical from year to year but is amended on the basis of experience. It always includes a physical examination, a series of blood pressure studies, electrocardiograms, urinalysis and chest x-ray. Between years we obtain information as to significant developments from the men and their cooperating private physicians.

Obviously the interest and value of the results in such a longitudinal study will increase in more or less geometrical progression from year to year. To begin with we can only compare groups; thereafter we can follow changes and each man becomes his own control. But at this time it is of interest to note a few findings from the first group comparisons.

In selecting these men one criterion for normality was a basal blood pressure value of less than 140/90 but it is of interest to examine the blood pressure distribution in those accepted in the subject groups. The mean values are summarized for the age and relative weight groups in Table 3. In the first place, there are no significant differences in the mean blood pressures at the two ages. And in the second place, though there is a trend toward higher blood pressures with increasing fatness, this is slight. It is also of interest that there was no significant relation between basal pulse rate and either age or relative body weight, the lowest average, 57.7, being in group E of the young men and the highest, 69.0, being in group B, also of the young men.

Table 3

Mean blood pressure, for the younger (Y) and older (O) men in the subgroups from very thin to very fat (A to E).

Item	Age	A	B	C	D	E
Systolic	Y	116.9	119.0	121.3	121.8	124.4
"	O	117.9	118.3	117.5	122.1	122.9
Diastolic	Y	73.5	73.9	73.9	76.3	75.0
"	O	72.8	72.7	72.5	76.3	76.3

We have long observed that the most significant differences between people are often seen not in rest but in exercise. It is of interest therefore to examine the results of measurements during and after a 15-minute walk on the treadmill. Among numerous points available for comparison, two examples may be noted. The systolic blood pressure in the last 2 minutes of work shows some slight relation to relative body weight but none to age. The recovery pulse rate shows some relation to relative obesity in the older men but none in the younger men; the age factor, however, is readily apparent.

Table 4

Mean systolic blood pressure in the 14th minute of treadmill walking (3 m.p.h. at 5% grade) and mean pulse rate after 1 minute of recovery. Younger men = Y, older men = O, by weight groups from very thin to very fat (A to E).

Item	Age	A	B	C	D	E
Systolic B.P.	Y	130.3	138.9	139.8	146.7	147.5
" "	O	140.2	136.3	143.9	141.2	154.7
Recov. Pulse	Y	77.5	88.0	74.2	78.5	79.7
" "	O	86.8	89.6	90.0	90.4	96.6

These are typical of other data in this study which indicate that the differences between the young and the older men are not so large as would have been anticipated, nor is the effect of differences in relative body weight very striking. In some items of measurement, however, there are larger differences. An example is the concentration of total cholesterol in the blood serum. Mean values are summarized in Table 5. Here there is a fairly clear relation to body weight in the young men but this is almost absent in the older men. The effect of age, however, is very great. For all weight classes combined the average for 180 young men was 176 mg., while that for 287 older men was 250 mg.

Table 5

Mean basal serum cholesterol concentration (mg. per 100 cc.) for the relative body weight classes A, B, C, D, E, for the younger (Y) and the older (O) men.

Age	A	B	C	D	E
Y	169	171	179	177	186
O	232	258	247	248	258

This age effect demands further study. Does the serum cholesterol increase linearly with age? To answer this question the present age groups have been subdivided and additional studies have been made on 85 normal males of other ages. The result, given in Table 6, indicates that there are no large differences between childhood and about 30 years. Thereafter, however, the cholesterol level rises steeply to about the age of 40, with only slight further increase to the early fifties; by the late sixties and early seventies the level has declined somewhat. These are group averages; it is entirely possible that these do not correspond, especially in later life, to the ontogeny of the individual. It may be, for example, that the 20 men we studied at average age 68 represent the survivors of a population in which the high-cholesterol men have died or are no longer active and accessible to us as "normals."

Table 6

Mean serum total cholesterol concentration, in mg. per 100 cc., in "normal" males

Age		Colest.	
Limits	Mean	No.	Mean
5-12	9	30	182
17-20	18.5	104	173
21-24	22.5	76	182
29-34	32	11	184
39-44	42	14	219
45-47	46	87	242
48-50	49	98	250
51-54	52.5	102	255
63-74	68	20	234

These questions about cholesterol are sufficiently interesting that further questions must be asked. One of the first may be, are the differences between individuals related to differences in the dietary intake? For this we have collected data on the habitual cholesterol consumption of our subjects. It so happens that cholesterol is one of the simplest items in the diet to estimate, particularly in an area where eggs, butter, milk and cheese are abundant but are consumed in widely different amounts by different persons. We have found it possible, at least, to divide our subjects into 5 groups according to the habitual cholesterol intake. The mean serum cholesterol levels in these men are given in Table 7.

Table 7

Mean total serum cholesterol concentration, in mg. per 100 cc., for normal men grouped according to age and to habitual cholesterol intake, in gm. per week, Younger men = Y, older men = O.

Y	Intake limits	to 1.8	1.9-2.5	2.6-2.9	3.0-3.4	over 3.4
"	" mean	1.49	2.18	2.64	3.15	4.20
"	Serum "	175	180	165	176	184
O	Intake limits	to 2.0	2.1-2.5	2.6-3.1	3.2-3.9	over 3.9
"	" mean	1.62	2.27	2.83	3.56	4.81
"	Serum "	242	258	249	253	251

Obviously, these data give no support whatever to the theory that, in otherwise fairly normal people, there is any relation between the level of cholesterol in the blood and the dietary intake. It may be true, though the evidence leaves much to be desired, that a low-cholesterol diet will sometimes reduce the blood level in persons with very high levels. If so, the situation may be analogous to that in diabetes where restriction of carbohydrate will reduce the blood sugar but where no such dietary effect is observed in normal persons. In other words, we should differentiate between normal persons and those

who have a disordered cholesterol metabolism.

At present it may be suggested that such a disorder might be suspected in men over 45 who show total cholesterol values above 400 mg. per 100 cc. In our series of 307 men, otherwise normal, and over 45 years of age, we found values (means of duplicates) over 300 mg. in 25 men and over 350 in 5 men; the highest value recorded in this series was 380 mg. In a total of 235 males under 35 years, likewise normal, the level of 300 was never reached and 250 was only surpassed in 3 men; for this age range a disordered cholesterol metabolism might be suggested at levels over 300 mg. in the serum. But a full evaluation of the significance of the cholesterol level in seemingly normal individuals can only come from such long-range follow-up studies as the present program will provide. Eventually we should know whether there is any important relation between the rate of aging, or of "hardening of the arteries," if you will, and the cholesterol level in the blood when this is within the bounds of what now seems to be "normal" for age.

This research program is still in an early stage. We completed the second year's study of the young men last fall and the second year's examination of the older men is being finished this week. The percentage of returns is very high; in the older men all but 4 or 5 have come in for their second examination and several of these are not yet lost to us. There have been some serious illnesses and one severe coronary occlusion but no deaths. The analysis of the changes from first to second examination has just started but one example of the findings may be of interest.

One obvious change in the young men is that a fair number have gained or lost, mostly the former, substantial amounts of weight and these changes were not primarily the direct result of disease. The greatest loss was 27.3 kg. (28.7 per cent of the 1947 weight), and the greatest gain was 18.3 mg. (24.3 per cent of the 1947 weight). In order to examine these changes and related effects on other items, we have arranged all of these young men in five groups from greatest loss to greatest gain and have compared the blood cholesterol changes over the year in these groups. The result is given in Table 8.

Table 8

Changes in body weight and related changes in blood cholesterol. Mean values for the younger men. Cholesterol in mg. per 100 cc. of serum.

No. of Men	22	24	22	23	22
1947 Wt., kg.	73.1	71.4	75.3	69.9	75.6
1948 " "	68.7	71.0	76.4	72.4	82.6
Δ, % of 1947	-4.4	-0.4	+1.1	+2.5	+7.1
1947 Cholesterol	187	176	178	162	175
1948 "	198	190	188	180	201
Δ, % of 1947	+5.9	+7.9	+5.6	+11.1	+14.9

On the average, all of these men exhibited higher cholesterol values after a year, but this effect is most prominent in the men who gained the most weight. Here is evidence on the response of cholesterol to relative obesity in the same individuals. Again the full significance of the data will emerge only after further work and time.

In this discussion the main thought has been to present the theory, plan and general operation of a major part of the program in the Laboratory of Physiological Hygiene. Only a few examples of the data are given as illustrations and even in these no mention is made of the detailed statistical analysis which necessarily forms an essential segment of the job and which is designed to give a full picture of inter- and intra-individual variability, as well as the significance of group means and trends. Obviously, the analysis of the intercorrelations between the measured variables will be a large but, we hope, rewarding job. And, as the data grow in number, the results will grow in value, but at the same time the analytical labor also expands. The more one considers this project and the problems it is designed to examine, the more it is clear that this must be a long-range program in which the Staff has its own problem of out-surviving the subjects.

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III. MEDICAL SCHOOL NEWS

Doctors Spink and Syverton to Give Kellogg Lectures

Two of the Medical School's outstanding scientists will close the current series of Kellogg Lectures by presenting subjects in their own fields of interest.

Dr. Wesley W. Spink will speak on "The Problem of Chronic Brucellosis" on Monday, March 14, at 4:00 p.m. in Powell Hall Amphitheater. Dr. Spink's contributions to this field have been acclaimed throughout the world. He has been for some time chairman of the Committee on the Public Health Aspects of Brucellosis of the National Research Council.

Dr. Jerome T. Syverton, Professor and Head of the Department of Bacteriology and Immunology, will speak on Tuesday, March 15, at 2:00 p.m. in Todd Amphitheater on the subject of "The Laboratory Diagnosis of Virus Diseases." Among Dr. Syverton's contributions to viral diseases is his discovery of the role of the mosquito in the transmission of encephalitis.

Alumni News

Dr. O. H. Hegge of Austin, Minnesota, was one of the group of Minnesota and North Dakota physicians who attended the recent continuation course in Cancer given at the Center for Continuation Study. Dr. Hegge, who attended the University of Minnesota in 1890 and 1891 and who received his M.D. degree from the University of Illinois, has been practicing in Austin for 53 years. He was a recipient of the Minnesota Medical Association's award to physicians who have practiced 50 years or more.

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Dr. Malcolm A. McConnell, former fellow in Ophthalmology at the University of Minnesota Hospitals, has announced his association with Dr. Walter E. Camp of Minneapolis for the practice of ophthalmology and ophthalmic surgery. Dr. McConnell received his Master of Science degree in ophthalmology from the University of Minnesota in 1946.

Kellogg Foundation Lectures

The following lectures will be given during the week of March 14. All medical students, interns, nurses, technicians, dietitians, and physicians are cordially invited to attend these lectures. A special invitation is extended to University Fellows.

Dr. Wesley W. Spink	"The Problem of Chronic Brucellosis"	Monday, March 14, 4:00-6:00 p.m. Powell Hall Amph.
Dr. Jerome T. Syverton	"The Laboratory Diagnosis of Virus Diseases"	Tuesday, March 15, 2:00-4:00 p.m. Todd Amphitheater