

HITCHCOCK (E.) & SEELYE.

THE
Anthropometric Manual
OF
AMHERST COLLEGE.

1889.

presented by Author



AMHERST COLLEGE.

AN

Anthropometric Manual

GIVING THE AVERAGE AND

MEAN PHYSICAL MEASUREMENTS AND TESTS

OF MALE COLLEGE STUDENTS,

AND METHODS OF SECURING THEM.

PREPARED FROM THE RECORDS OF THE DEPARTMENT OF PHYSICAL
EDUCATION AND HYGIENE IN AMHERST COLLEGE, DUR-
ING THE YEARS 1861-2 AND 1887-8 INCLUSIVE.

SECOND EDITION.

BY DR. E. HITCHCOCK AND DR. H. H. SEELYE.



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PREFACE.

The need of another edition of this manual is evident from the errors incidental to the new treatment of a subject, and the aid of an additional year's series of data by which to help make perfect some of the tables.

The opportunity to furnish this revision is the generous gift of a personal friend and a patron of the College and its Department of Physical Education.

The special features of this revision are: The TABLE OF AGES, a few aberrant items in the TABLE OF THE AVERAGE STUDENT, and in the TABLE OF MEANS, the results of the CAPACITY SPIROMETER, the list of APPARATUS USED, and a few typographical errors. Also, certain directions for the use of apparatus in the Pratt Gymnasium for developing weak parts of the individual, correcting deficiencies and abnormalities and perverted nutrition.

E. HITCHCOCK,
H. H. SEELYE.

Pratt Gymnasium, Amherst College, December, 1888.

The Anthropometric Tables.

The following tables are given to the students of Amherst College because the material from which they are made is furnished by those who have been connected with the college from 1861-2 to 1887-8, and it is but right that they should enjoy the fruit of the seed they have sown. Besides this, the question has been not infrequently asked "What is the use of all these measures and tests?" and if many will remember the answer that has most often been given: "Wait till we get these data by the thousands and we can then show you what are the form and conditions of an average student."

So now college men are of themselves able to judge whether they are up to the standard of the average student, or whether they surpass or fall below him in the conditions and characteristics offered in these pages.

The idea of the *Typical Man* has been in the brain of the anthropologist for these many years, and in certain classes and conditions of society, such as soldiers, sailors, cracksmen, prisoners, and others directly under the control of Governments quite approximate results no doubt have been obtained. And yet to nearly all of these there is the objection that they are selected classes, and will give results which surpass those of the average man, or the "plain people" that Mr. Lincoln used to talk about. But it seems fair to judge that the New England College Student, averaging about 21 years of age, who is neither overworked in body or pampered by luxurious ease or indulgence, would furnish an average, or a mean, that could be used in an Anthropometric study of the Anglo-Saxon race, for a better conclusion than those mentioned.

And certainly we can say to the student who comes to Amherst College that in this pamphlet are facts and data, of both a numerical as well as a physiological character, which will help him to learn his resources, and his relation to the mass of students in his college for the past twenty-five years—and to-day—and to compare himself with the "Typical" Student whenever this personage is satisfactorily worked out.

In addition to these tables, there is to be found the detailed methods of securing these statistics as taken at Amherst College.

The first beginnings of this scheme or method are to be found in the eight items of age, weight, height, chest girth, arm girth, forearm

TABLE I.

ANTHROPOMETRIC TABLE

ARRANGED BY BODILY HEIGHTS.

HEIGHT in m. m.	1600	1610	1620	1630	1640	1650	1660	1670	1680	1690	1700	1710	1720	1730	1740	1750	1760	1770	1780	1790	1800	1810	1820	1830	
HEIGHT in inches.	63.0	63.4	63.8	64.2	64.6	65.0	65.4	65.7	66.1	66.5	66.9	67.3	67.7	68.1	68.5	68.9	69.3	69.7	70.1	70.5	70.9	71.3	71.7	72.0	
WEIGHT.	53.9 118.5	54.0 118.8	54.1 119.0	54.5 119.9	54.7 120.3	55.5 122.1	57.3 127.1	57.9 127.3	60.1 132.6	61.5 135.3	61.3 134.8	61.3 134.8	61.7 135.7	62.1 136.6	62.5 137.5	63.9 140.5	65.1 143.0	67.8 149.1	67.8 149.1	68.0 149.6	68.2 150.0	68.2 150.0	68.3 150.7	68.3 150.7	
HEIGHT	Sternum.	1290 50.8	1300 51.2	1300 51.2	1320 52.0	1330 52.2	1340 52.8	1350 53.2	1350 53.2	1360 53.5	1400 55.1	1400 55.1	1400 55.1	1430 56.3	1440 56.7	1440 56.7	1440 56.7	1450 57.1	1450 57.1	1460 57.5	1470 57.9	1480 58.3	1480 58.3	1505 59.1	
	Navel.	947 37.4	958 37.8	962 37.9	966 38.0	974 38.4	979 38.5	983 38.8	986 38.9	991 39.0	1020 40.2	1020 40.2	1020 40.2	1040 40.9	1050 41.3	1050 41.3	1060 41.7	1060 41.7	1070 42.1	1080 42.5	1090 42.9	1090 42.9	1090 42.9	1120 44.1	
	Pubes.	797 31.3	810 31.6	810 31.9	812 32.0	814 32.1	820 32.3	835 33.0	839 33.1	853 33.6	862 34.0	863 34.0	863 34.0	867 34.1	870 34.3	874 34.4	880 34.6	886 34.8	895 35.2	896 35.2	899 35.4	907 35.7	918 36.1	919 36.2	921 36.3
	Knee.	425 16.7	430 16.9	439 17.3	442 17.4	448 17.6	448 17.6	450 17.7	454 17.8	460 18.1	473 18.6	474 18.7	474 18.7	478 18.8	484 19.0	486 19.1	486 19.1	489 19.3	494 19.6	499 19.7	500 19.7	504 19.9	517 20.3	519 20.5	525 20.7
	Sitting.	851 33.5	856 33.7	869 34.3	870 34.3	879 34.5	880 34.6	883 34.7	884 34.7	891 35.0	905 35.6	908 35.7	908 35.7	910 35.8	918 36.1	918 36.2	918 36.2	924 36.3	925 36.4	925 36.4	933 36.7	934 36.7	937 36.8	939 37.0	939 37.0
GIRTH.	Head.	559 22.0	561 22.0	562 22.1	562 22.1	563 22.1	565 22.2	565 22.2	565 22.2	566 22.2	571 22.4	571 22.4	572 22.5	572 22.5	572 22.5	572 22.5	573 22.5	574 22.6	575 22.6	576 22.6	582 22.9	582 22.9	583 23.0	583 23.0	
	Neck.	335 13.2	338 13.4	340 13.4	345 14.0	345 13.6	346 13.6	347 13.6	348 13.7	348 13.7	350 13.8	350 13.8	352 13.9	353 13.9	354 13.9	354 14.0	355 14.0	355 14.0	355 14.1	355 14.1	356 14.1	356 14.1	356 14.1	356 14.1	
	Chest Repose.	851 33.5	852 33.6	854 33.7	857 33.8	857 33.8	864 34.0	865 34.0	868 34.2	872 34.3	872 34.3	876 34.5	880 34.6	887 34.8	887 34.8	888 34.9	889 35.0	890 35.0	890 35.1	891 35.1	893 35.1	894 35.2	898 35.3	898 35.3	
	Chest Full.	881 34.6	882 34.7	888 34.9	900 35.1	900 35.4	901 35.4	903 35.5	904 35.5	905 35.6	909 35.8	913 35.9	916 36.0	926 36.4	930 36.6	931 36.6	931 36.6	931 36.6	934 36.7	936 36.8	936 36.9	938 37.0	939 37.0	953 37.5	956 37.7
	Belly.	702 27.7	703 27.7	703 27.7	703 27.8	708 28.0	709 28.0	710 28.0	710 28.1	714 28.4	722 28.4	722 28.4	723 28.4	723 28.4	726 28.5	729 28.7	731 29.0	738 29.0	738 29.2	741 29.3	745 29.3	748 29.4	748 29.4	748 29.4	749 29.5
	Hips.	860 33.9	860 33.9	864 34.0	864 34.0	873 34.4	879 34.6	881 34.8	882 34.9	882 34.9	884 34.7	886 34.8	886 34.8	888 34.9	895 35.2	896 35.6	898 35.7	908 35.9	912 35.9	912 35.9	912 35.8	916 36.1	921 36.2	921 36.2	922 36.3
	Thigh.	499 19.7	500 19.7	500 19.7	500 19.8	503 19.8	503 19.9	505 20.0	508 20.3	516 20.3	516 20.3	516 20.3	517 20.4	518 20.5	519 20.5	520 20.5	520 20.5	521 20.6	522 20.6	522 20.6	522 20.6	523 20.6	523 20.6	525 20.7	528 20.8
	Knee.	340 13.4	340 13.4	341 13.4	342 13.5	343 13.5	345 13.6	346 13.6	347 13.7	350 13.8	351 13.8	353 13.9	353 13.9	354 14.0	356 14.2	359 14.2	359 14.3	363 14.3	364 14.4	365 14.4	365 14.4	366 14.4	368 14.5	368 14.5	368 14.5
	Calf.	324 12.7	325 12.8	332 13.1	334 13.2	335 13.2	336 13.2	339 13.4	341 13.5	344 13.6	344 13.6	345 13.6	346 13.6	346 13.6	350 13.8	350 13.8	351 13.9	352 13.9	352 13.9	352 13.9	353 13.9	353 13.9	355 14.0	355 14.0	
	Instep.	230 9.1	230 9.1	231 9.1	232 9.2	233 9.2	234 9.3	234 9.2	235 9.3	235 9.3	236 9.3	236 9.3	238 9.4	240 9.4	241 9.4	243 9.5	243 9.5	244 9.5	244 9.5	245 9.6	246 9.6	246 9.6	246 9.6	246 9.6	
	R. U. Arm contr'ed	275 10.8	277 10.8	280 11.0	280 11.0	282 11.1	283 11.1	285 11.2	285 11.2	287 11.2	287 11.3	290 11.4	292 11.5	293 11.6	295 11.6	296 11.6	296 11.6	296 11.6	297 11.7	300 11.8	300 11.8	300 11.8	300 11.8		
	Upper Arm.	246 9.6	246 9.6	246 9.6	250 9.8	251 9.8	252 9.9	252 9.9	252 9.9	255 10.0	255 10.0	255 10.0	255 10.0	258 10.1	258 10.1	259 10.2	259 10.2	259 10.2	259 10.2	260 10.2	260 10.2	261 10.2	261 10.2		
	Elbow.	239 9.4	239 9.4	240 9.4	240 9.4	242 9.5	243 9.5	243 9.6	245 9.6	247 9.7	247 9.7	247 9.7	250 9.8	250 9.8	252 9.9	252 9.9	252 9.9	253 9.9	253 9.9	254 10.0	254 10.0	254 10.0			
	Forearm.	250 9.8	250 9.8	250 9.8	251 9.8	251 9.8	252 9.9	253 9.9	254 9.9	256 10.1	258 10.1	258 10.1	259 10.2	260 10.2	260 10.2	261 10.3	261 10.3	261 10.3	262 10.3	263 10.3	264 10.4	265 10.4			
	Wrist.	160 6.3	160 6.3	161 6.3	161 6.3	161 6.3	161 6.3	162 6.4	162 6.4	163 6.4	165 6.5	165 6.5	165 6.5	165 6.5	166 6.5	166 6.5	167 6.6	167 6.6	167 6.6	168 6.6	169 6.6				
BREADTH	Head.	151 5.9	151 5.9	151 5.9	152 6.0	152 6.0	153 6.0	154 6.1	154 6.1	154 6.1	154 6.1	154 6.1	155 6.1	155 6.1	156 6.2	156 6.2									
	Neck.	104 4.1	104 4.1	106 4.1	106 4.1	106 4.1	107 4.2	107 4.2	107 4.2	108 4.2	108 4.2	108 4.2	108 4.2	109 4.3											
	Shoulders.	413 16.2	416 16.3	418 16.4	419 16.4	423 16.6	424 16.6	429 16.9	431 16.9	431 16.9	431 16.9	431 16.9	432 17.0	432 17.0	432 17.0	433 17.0	433 17.0	438 17.2	438 17.2	438 17.2	438 17.2	439 17.3	440 17.3	445 17.5	
	Waist.	245 9.6	245 9.6	245 9.6	245 9.6	247 9.7	248 9.7	248 9.8	250 9.8	252 9.8	252 9.9	253 9.9	253 9.9	254 10.0	254 9.9	254 9.9	254 9.9	256 10.1	256 10.1	256 10.1	256 10.1				
	Hips.	313 12.3	313 12.3	315 12.4	316 12.4	316 12.4	316 12.5	318 12.5	320 12.6	324 12.7	330 13.0	332 13.1	332 13.1	332 13.2	335 13.2	335 13.2	335 13.2	335 13.2	336 13.2	336 13.3	337 13.3	340 13.4	341 13.4		
Nipples.	191 7.5	192 7.6	192 7.6	193 7.6	193 7.6	194 7.6	195 7.7	196 7.7	196 7.7	196 7.7	196 7.7	196 7.7	197 7.7	198 7.8	198 7.9	199 7.9	199 7.9	200 7.9	200 7.9	201 8.1	201 8.1	205 8.2	206 8.2		
LENGTH	Shoulder Elbow.	347 13.5	350 13.8	351 13.8	352 13.9	355 14.0	356 14.0	360 14.2	364 14.3	364 14.3	365 14.4	366 14.4	368 14.5	371 14.6	374 14.8	375 14.8	378 14.9	380 15.0	381 15.0	382 15.1	393 15.5	394 15.6	394 15.6		
	Elbow Tip.	430 16.9	434 17.0	436 17.1	438 17.1	442 17.4	443 17.4	445 17.5	445 17.5	446 17.5	450 17.7	455 17.7	457 17.9	460 18.1	465 18.3	468 18.3	468 18.4	468 18.4	470 18.5	475 18.7	480 18.9	484 19.1	485 19.1		
	Foot.	242 9.5	244 9.5	244 9.5	244 9.5	247 9.8	249 9.8	252 9.9	252 9.9	253 9.9	256 10.0	259 10.1	260 10.1	262 10.2	264 10.3	264 10.3	265 10.4	265 10.4	266 10.4	267 10.4	270 10.6	273 10.7	274 10.8		
	Stretch of Arms.	1660 65.4	1690 66.5	1690 66.5	1690 66.5	1700 66.9	1700 66.9	1700 67.7	1720 68.1	1730 68.5	1740 69.7	1770 69.7	1770 69.7	1780 70.1	1810 71.3	1810 71.3	1810 71.3	1810 71.3	1810 71.3	1820 71.7	1850 72.8	1870 73.6	1880 74.0	1890 74.4	
Horizontal Length.	1610 63.4	1620 63.8	1640 64.6	1650 65.0	1650 65.0	1660 65.4	1680 66.1	1680 66.1	1690 66.5	1700 66.9	1750 69.3	1760 69.3	1760 69.3	1770 69.7	1770 69.7	1770 69.7	1780 70.1	1780 70.1	1790 70.5	1790 70.5	1820 71.7	1840 72.4			
STRENGTH	Lungs.	1.5 3.3	1.3 2.8	1.4 3.0	1.2 2.6	1.2 2.6	1.3 2.8	1.2 2.6	1.2 2.6	1.2 2.6	1.1 2.4	1.3 2.8	1.1 2.4	1.1 2.4	1.3 2.8	1.2 2.6	1.2 2.6	1.2 2.6	1.2 2.6	1.3 2.8	1.2 2.6	1.2 2.6	1.1 2.4	1.2 2.6	
	Back.	126 275.0	126 277.2																						

girth, lung capacity and pull up, which were secured from every student in Amherst College since 1861 till about the year 1881, when more elaborate and multiplied items were suggested by Dr. W. T. Brigham of Boston, which were much better methodised and arranged by Dr. D. A. Sargent of Harvard College and first used here in 1882.

In 1885 the American Association for the Advancement of Physical Education at a meeting in Brooklyn appointed an Anthropometric Committee consisting of Dr. D. A. Sargent of Cambridge, Dr. E. Hitchcock of Amherst, and Dr. W. G. Anderson of Brooklyn to propose a uniform method of taking and securing these statistics. At the meeting of the Association in 1886 this report was made, accepted and adopted by the Association, a copy of which follows the tables in this pamphlet. And it is this method which is practically used at Amherst to-day, as the fundamental parts of it have been used for the past 26 years.

The **FIRST TABLE** offers to the student the series of measurements and tests of men in college who have been exactly of his own HEIGHT—within a centimeter, or about half an inch—and with no reference to any other bodily characteristic as a standard. This is considered a more reliable and unchanging criterion than is that of age, weight, or the showing of means or averages, since bodily proportions in the average man will be much more controlled by height than any other datum.

When the student is examined by one of the physicians in the department on his entrance to college, his own record will be placed in the blank column of one of the tables, each item of his own being inserted directly against the average printed item, as derived from those of his own perpendicular height who have gone before him.

With this ideal at his own immediate command, by many measures and tests which he may himself repeat, in many cases at least, he can learn if he gains, loses, or remains constant, or he may request a repetition of the examination from the professor or his assistant, and thus he can the better know himself all the while he is in college, and perhaps through life.

The **SECOND TABLE** gives results the most comprehensive of all the tables offered. This embraces certain statistics secured from all the students who have been connected with the college since 1861-2. These added together and divided by the number of students furnishing them give us an average, or approximate ideal of what an Amherst Student has been for a quarter of a century. This table can essentially aid the student by gratifying a general desire, common everywhere and to everybody, to know his relation to the general average, and whether he be up to or below the medium qualification and condition of his associates.

The **THIRD TABLE** is based entirely upon the element of AGE, which characteristic is much modified in the individual by both present and past surroundings of life. When however combined with the history of the man, and his ancestry and circumstances bearing upon sani-

tary matters, it may serve a good purpose in predicting the possibilities of longevity, rather than declaring the muscular and organic development of the individual. People of the same age vary greatly in their bodily proportions, and yet the short man may live a long life, and the tall man a short one. And it is very natural to want to compare one's self with those of his own age.

It will be observed that the succession of items here is not so perfect as it is in the Table of Height, partly because of a smaller number of students observed, but mainly owing to the fact that age is probably not so good a basis of comparison for the physical measurements.

The FOURTH TABLE is prepared by grouping together the items and arranging them by their simple NUMERICAL QUANTITIES. Taking for example the item of Height, and placing together the shortest student measuring say 1600 m. m., we shall find but a few of these. Then selecting those who measured 1610 m. m., we shall find a few more individuals, and so on till we reach a point at which the numbers begin to fall off till we reach the very tallest persons who will be say 1830 m. m. or six feet, the tallest men. This point at which we have found the greatest number of the series or the top of a curve is 1725 m. m. or 67.7 inches. This we say is the mean or medium height of a student of Amherst College, a point, or a criterion, all deviations from which may be regarded as deviations from a standard, since it represents the largest actual number of objects in this group of characteristics. By thus grouping all of the fifty-four items observed, the Table No. IV is constructed. Or, if represented by an upward curve the lowest and highest objects will place themselves at the ends of the curve, and the one which has the largest number of representatives at the top of the curve; the medium or mean will be at the height of the curve. In this table the Right and Left members are averaged for the result.

The Table No. V is mainly of college interest as showing the difference in classes. Of course it is paralleled somewhat with Table No. III, and corroborated by it. And the fact is shown that the growth and increase is more conspicuous during the early than the later college years. The physiological truth is also corroborated that bodily growth is mainly attained before the period of majority, as is always recognised in civil law.

The detailed method of securing these statistics is to be found in the report of the Anthropometric Committee of the American Association for the Advancement of Physical Education made in November, 1886 at Brooklyn, New York, which is in a subsequent part of this manual.

THE
ANTHROPOMETRIC CARD
OF

Mr.

at the age of years, months, made out this day,

His height is millimeters, or inches.

Condition of

Eyes :

Ears :

Heart :

Lungs :

Muscles :

Remarks :

HEIGHT m. m.		1600	1610	1620	1630	1640	1650	1660	1670
HEIGHT inches.		63.0	63.4	63.8	64.3	64.0	65.0	65.4	65.7
BREADTH.	Head.	151 5.9	151 5.9	151 5.9	152 5.9	152 6.0	152 6.0	153 6.0	153 6.0
	Neck.	104 4.1	104 4.1	106 4.1	106 4.1	106 4.1	107 4.1	107 4.2	107 4.2
	Shoulders	413 16.2	416 16.3	418 16.4	419 16.4	423 16.6	424 16.6	429 16.9	431 16.9
	Waist.	245 9.6	245 9.6	245 9.6	245 9.6	347 9.6	248 9.7	248 9.7	250 9.8
	Hips.	313 12.3	313 12.3	315 12.4	216 12.4	316 12.4	316 12.4	316 12.5	318 12.5
	Nipples.	191 7.5	192 7.6	192 7.6	193 7.6	193 7.6	194 7.6	195 7.7	196 7.7
LENGTH.	Shoulder Elbow.	347 13.5	350 13.8	351 13.8	352 13.9	355 14.0	356 14.0	360 14.2	364 14.3
	Elbow Tip	430 16.9	434 17.0	436 17.1	438 17.1	442 17.4	443 17.4	445 17.5	445 17.5
	Foot.	242 9.5	244 9.5	244 9.5	244 9.5	247 9.8	249 9.8	252 9.6	252 9.9
	Stretch of Arms.	1660 65.4	1690 66.5	1690 66.5	1690 66.5	1700 66.9	1700 66.9	1700 66.6	1720 67.7
	Horizontal Length.	1610 63.4	1620 63.8	1640 64.6	1650 65.0	1650 65.0	1660 65.4	1680 66.1	1680 66.1
STRENGTH.	Lungs.	1.5 3.3	1.3 2.8	1.4 3.0	1.2 2.6	1.2 2.6	1.3 2.8	1.2 2.6	1.2 2.6
	Back.	126 275.0	126 277.2	126 277.2	126 277.2	126 277.2	127 279.4	128 281.6	129 283.8
	Dip.	10	7	8	9	8	6	7	6
	Pull Up.	11	10	10	11	9	10	11	10
	Legs,	130 286.0	143 314.6	147 323.4	148 325.6	149 327.0	150 330.0	151 332.2	154 338.8
	Forearm.	33 72.6	33 72.6	33 72.6	34 74.8	34 74.8	35 77.0	35 77.0	35 77.0
Total.	462 1016.4	463 1018.6	438 963.6	455 1001.0	378 831.6	397 873.4	363 798.6	427 939.4	
LUNG CAPAC'Y.	3.16 192.8	3.21 196.0	3.25 198.3	3.27 199.6	3.33 203.2	3.44 209.9	3.50 213.6	3.52 214.8	
PILOSITY.	2.2	2.2	2.4	2.5	2.4	2.4	2.3	2.2	

HEIGHT m. m.		1680	1690	1700	1710	1720	1730	1740	1750	
HEIGHT inches.		66.1	66.5	66.9	67.3	67.7	68.1	68.5	68.9	
WEIGHT.		60.1	61.5	61.3	61.3	61.7	62.1	62.5	63.9	
		132.0	135.3	134.8	134.8	135.7	136.6	137.5	140.5	
HEIGHT.	Sternum.	1360	1400	1400	1400	1430	1440	1410	1440	
		53.5	55.1	55.1	55.1	56.3	56.7	56.7	56.7	
	Navel.	991	1020	1020	1020	1020	1040	1050	1050	
		39.0	40.2	40.2	40.2	40.2	40.9	41.3	41.3	
	Pubes.	853	862	863	863	867	870	874	880	
		33.6	34.0	34.0	34.0	34.1	34.3	34.4	34.6	
Knee.		460	473	474	474	478	484	486	486	
		18.1	18.6	18.7	18.7	18.8	19.0	19.1	19.1	
Sitting.		891	905	908	908	910	918	918	918	
		35.0	35.6	35.7	35.7	35.8	36.1	36.2	36.2	
GIRTH.	Head.	565	566	571	571	572	572	572	572	
		22.2	22.2	22.4	22.4	22.5	22.5	22.5	22.5	
	Neck.	348	350	350	352	353	354	354	355	
		13.7	13.8	13.8	13.9	13.9	13.9	14.0	14.0	
	Chest		872	872	876	880	887	887	888	889
		Repose.	34.3	34.3	34.5	34.6	34.8	34.8	34.9	35.0
	Chest		905	909	913	916	926	930	931	931
		Full.	35.6	35.8	35.9	36.0	36.4	36.6	36.6	36.6
	Belly.		714	722	722	723	723	726	729	731
			28.1	28.4	28.4	28.4	28.4	28.5	28.7	28.7
	Hips		882	884	886	886	888	895	896	908
			34.9	34.7	34.8	34.8	34.9	35.2	35.6	35.7
	Thigh.		516	516	516	517	518	519	520	520
			20.3	20.3	20.3	20.3	20.4	20.5	20.5	20.5
	Knee,		350	351	353	354	356	359	359	363
			13.8	13.8	13.9	13.9	14.0	14.2	14.2	14.3
	Calf.		344	344	345	346	346	350	350	351
			13.6	13.6	13.6	13.6	13.6	13.8	13.8	13.8
	Instep.		235	236	236	238	240	241	243	243
			9.3	9.3	9.3	9.4	9.4	9.4	9.5	9.5
	R. U. Arm contracted.		287	287	290	292	293	295	296	296
			11.2	11.3	11.4	11.5	11.6	11.6	11.6	11.6
	U. Arm.		255	255	255	255	258	258	259	259
			10.0	10.0	10.0	10.0	10.1	10.1	10.2	10.2
	Elbow.		245	247	247	247	250	250	252	252
			9.6	9.7	9.7	9.7	9.8	9.8	9.9	9.9
Forearm.		256	258	258	259	260	260	261	261	
		10.1	10.1	10.1	10.2	10.2	10.2	10.3	10.3	
Wrist.		162	163	165	165	165	165	166	166	
		6.4	6.4	6.5	6.5	6.5	6.5	6.5	6.5	

HEIGHT m. m.		1680	1690	1700	1710	1720	1730	1740	1750
HEIGHT inches.		66.1	66.5	66.9	67.3	67.7	68.2	68.5	68.9
BREADTH.	Head.	153 6.0	153 6.0	153 6.0	153 6.0	153 6.0	153 6.0	154 6.1	154 6.1
	Neck.	108 4.2	108 4.2	108 4.2	108 4.2	108 4.2	109 4.2	109 4.3	109 4.3
	Shoulders	431 16.9	431 16.9	431 16.9	431 16.9	432 17.0	432 17.0	432 17.0	433 17.0
	Waist.	252 9.8	252 9.8	253 9.9	253 9.9	254 10.0	254 9.9	254 9.9	254 9.9
	Hips.	320 12.6	324 12.7	330 13.0	332 13.0	332 13.1	332 13.1	335 13.2	335 13.2
	Nipples.	196 7.7	196 7.7	196 7.7	196 7.7	197 7.7	198 7.7	198 7.8	199 7.9
LENGTH.	Shoulder	364	365	366	368	371	374	375	378
	Elbow.	14.3	14.4	14.4	14.5	14.6	14.8	14.8	14.9
	Elbow Tip	446 17.5	450 17.7	455 17.9	457 17.9	460 18.1	465 18.3	468 18.3	468 18.4
	Foot.	252 9.9	253 9.9	256 10.0	259 10.1	260 10.2	264 10.3	264 10.3	265 10.4
	Stretch of Arms.	1730 68.1	1740 68.5	1770 69.7	1770 69.7	1780 70.1	1810 71.3	1810 71.3	1810 71.3
Horizontal Length.	1690 66.5	1700 66.9	1750 68.9	1760 69.3	1760 69.3	1770 69.7	1770 69.7	1770 69.7	
STRENGTH.	Lungs.	1.2 2.6	1.1 2.4	1.3 2.8	1.1 2.4	1.1 2.4	1.3 2.8	1.2 2.6	1.2 2.6
	Back.	130 286.0	135 297.0	136 299.1	137 301.4	138 303.6	140 308.0	140 308.0	140 308.0
	Dip.	7	6	6	6	7	6	5	6
	Pull up.	10	10	9	9	10	10	8	8
	Legs.	159 349.8	160 352.0	163 358.6	164 360.8	164 360.8	164 360.8	165 363.0	167 367.4
	Forearm.	37 81.4	38 83.6	38 83.6	38 83.6	38 83.6	39 85.8	39 85.8	39 85.8
	Total.	464 1020.8	434 954.8	426 937.2	405 891.0	452 994.4	459 1009.8	433 952.6	437 961.4
LUNG CAPAC'Y.	3.54 216.0	3.60 219.7	3.63 221.5	3.66 223.4	3.78 231.8	3.90 238.0	3.91 238.6	3.94 240.4	
PILOSITY.	2.3	2.4	2.2	2.4	2.7	2.5	2.3	2.8	

HEIGHT m. m.,		1760	1770	1780	1790	1800	1810	1820	1830
HEIGHT inches,		69.3	69.7	70.1	70.5	70.9	71.3	71.7	72.0
WEIGHT.		65.1	67.8	67.8	68.0	68.2	68.2	68.3	68.3
		143.0	149.1	149.1	149.6	150.0	150.0	150.7	150.7
HEIGHT.	Sternum.	1440	1450	1450	1460	1470	1480	1480	1505
		56.7	57.1	57.1	57.5	57.9	58.3	58.3	59.1
	Navel.	1060	1060	1070	1080	1090	1090	1090	1120
		41.7	41.7	42.1	42.5	42.9	42.9	42.9	44.1
	Pubes.	886	895	896	899	907	918	919	921
		34.8	35.2	35.2	35.4	35.7	36.1	36.2	36.3
Knee.		489	494	499	500	504	517	519	525
		19.3	19.6	19.7	19.7	19.9	20.3	20.5	20.7
Sitting.		924	925	925	933	934	937	939	939
		36.3	36.4	36.4	36.7	36.7	36.8	37.0	37.0
HEAD.	Head,	573	574	575	576	582	582	583	583
		22.5	22.6	22.6	22.6	22.9	22.9	23.0	23.1
NECK.	Neck.	355	355	356	356	356	356	356	356
		14.0	14.0	14.1	14.1	14.1	14.1	14.1	14.1
CHEST.	Chest	890	890	891	893	894	898	898	899
	Repose.	35.0	35.0	35.1	35.1	35.2	35.3	35.3	35.4
CHEST.	Chest	931	934	936	936	938	939	953	956
	Full.	36.6	36.7	36.8	36.9	37.0	37.0	37.5	37.7
BELLY.	Belly.	738	738	741	745	748	748	748	749
		29.0	29.0	29.2	29.3	29.4	29.4	29.4	29.5
HIPS.	Hips.	912	912	912	916	921	921	922	923
		35.9	35.9	35.8	36.1	36.2	36.2	36.3	36.4
THIGH.	Thigh.	521	522	522	522	523	523	525	528
		20.5	20.6	20.6	20.6	20.6	20.6	20.7	20.8
KNEE.	Knee.	364	365	365	366	368	368	368	368
		14.3	14.4	14.4	14.4	14.5	14.5	14.5	14.5
CALF.	Calf.	352	352	352	353	353	355	355	355
		13.9	13.9	13.9	13.9	13.9	14.0	14.0	14.0
INSTEP.	Instep.	244	244	245	246	246	246	246	246
		9.5	9.5	9.6	9.6	9.6	9.6	9.6	9.6
R. U. ARM.	R. U. Arm	296	296	297	300	300	300	300	300
	contracted.	11.6	11.6	11.7	11.8	11.8	11.8	11.8	11.8
U. ARM.	U. Arm.	259	259	260	260	260	261	261	262
		10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.3
ELBOW.	Elbow.	252	253	253	254	254	254	254	255
		9.9	9.9	9.9	10.0	10.0	10.0	10.0	10.0
FOREARM.	Forearm.	261	262	263	264	265	265	266	266
		10.3	10.3	10.3	10.4	10.4	10.4	10.5	10.5
WRIST.	Wrist.	167	167	167	168	169	170	170	171
		6.6	6.6	6.6	6.6	6.6	6.7	6.7	6.8

HEIGHT in m.		1760	1770	1780	1790	1800	1810	1820	1830
HEIGHT in in.		69.3	69.7	70.1	70.5	71.3	71.7	72.0	
BREADTH.	Head.	154 6.1	154 6.1	154 6.1	155 6.1	155 6.1	156 6.2	156 6.2	156 6.2
	Neck.	109 4.3	109 4.3						
	Shoulders	433 17.0	438 17.2	438 17.2	438 17.2	439 17.3	439 17.3	440 17.3	445 17.5
	Waist.	254 9.9	256 10.1	256 10.1	256 10.1	256 10.1	260 10.2	263 10.3	263 10.3
	Hips.	335 13.2	335 13.2	336 13.2	337 13.3	340 13.3	341 13.4	341 13.4	341 13.4
	Nipples.	199 7.9	200 7.9	200 7.9	201 7.9	201 7.9	205 8.1	206 8.2	206 8.2
LENGTH.	Shoulder	380	381	382	393	394	394	395	396
	Elbow.	15.0	15.0	15.1	15.5	15.6	15.6	15.6	15.7
	Elbow Tip	468 18.4	470 18.5	475 18.7	480 18.9	484 19.0	485 19.1	486 19.1	488 19.2
	Foot.	265 10.4	266 10.4	267 10.4	270 10.6	273 10.7	274 10.8	274 10.8	276 10.9
	Stretch of Arms.	1810 71.3	1810 71.3	1820 71.7	1850 72.8	1870 73.6	1880 74.0	1890 74.4	1890 74.4
	Horizontal Length.	1770 69.7	1780 70.1	1780 70.1	1790 70.5	1790 70.5	1790 70.5	1820 71.7	1840 72.4
STRENGTH.	Lungs.	1.2 2.6	1.3 2.8	1.2 2.6	1.2 2.6	1.1 2.4	1.2 2.6	1.1 2.4	1.2 2.6
	Back.	141 310.0	141 310.2	141 310.2	142 312.4	145 319.0	147 323.4	147 323.4	148 325.6
	Dip.	5	5	5	5	5	5	6	6
	Pull Up.	8	8	8	9	8	8	8	11
	Legs.	168 369.6	168 369.6	169 371.8	171 376.2	172 378.4	173 380.0	174 382.8	174 382.8
	Forearm.	39 85.8	39 85.8	40 88.0	41 90.2	41 90.2	41 90.2	42 92.4	42 92.4
Total.	457 1005.4	432 950.4	427 939.4	462 1016.4	426 937.2	451 992.2	458 1007.6	478 1051.6	
LUNG CAPAC'Y.	4.02 245.3	4.03 245.9	4.05 247.2	4.18 255.1	4.42 263.6	4.43 265.5	4.43 265.5	4.48 273.4	
PILOSITY.	2.6	2.5	2.2	2.3	2.2	2.4	2.6	2.5	

TABLE II.

THE AVERAGE STUDENT as gathered from 7988 individuals in Amherst College between 1861-2—1885-6, of the age of 21 years and 1 month.

		METRIC.	ENGLISH.			METRIC.	ENGLISH.
		Kilos.	Pounds.			m.m.	Inches.
HEIGHTS.	Weight,	61.2	134.6	BREATHS.	Head,	155	6.1
	{ Body, Sternum, Navel, Pubes, Knee, Sitting,	1725	67.9		{ Neck, Shoulders, Waist, Hips, Nipples,	108	4.2
		1410	55.5			430	16.9
		1030	40.6			250	9.8
		860	33.9			323	12.7
		476	18.7			198	7.8
		903	35.5				
GIRTHS.	{ Head, Neck, Chest Repose, Chest Full,	572	22.5	LENGTHS.	{ Shoulder Elbows,	370	14.6
		349	13.8		{ Elbow Tips,	458	18.0
		880	34.6		{ Feet,	260	10.2
		927	36.5		{ Arm Stretch, Hor. Length,	1780	70.1
	Belly,	724	28.4		1732	68.2	
	Hips,	893	35.1	STRENGTHS.	{ Lungs,	Kilos. 1.5	Pounds. 3.30
	Thighs,	515	20.3		{ Back,	137	301
	Knees,	355	14.0		{ Legs,	166	365
	Calves,	345	13.6		{ Forearms,	39	85.8
	Insteps,	241	9.4			Times 6	
	R. U. Arm cont'd,	295	11.6		{ Chest Dip,	6	
	Upper Arms,	257	10.0		{ Chest Pull Up,	9	
	Forearms,	260	10.2				
	Elbows,	249	9.8	Lung Capacity,	Liters. 3.77	Cub. In. 230	
Wrists,	161	6.3	Pilosity,	Part of Body. 2.25			

TABLE III.

ANTHROPOMETRIC TABLE, ARRANGED BY YEARS.

AGE IN YEARS,	17	18	19	20	21	22	23	24	25	
WEIGHT,	57.9 127.3	60.1 132.2	61.4 135.0	62.0 136.4	62.9 138.3	63.4 139.4	63.8 140.3	64.7 142.3	65.0 143.0	
HEIGHTS.	Body,	1720 67.7	1721 67.8	1725 67.9	1725 67.9	1727 68.1	1726 68.1	1727 68.1	1740 68.5	
	Sternum,	1404 55.3	1405 55.3	1405 55.3	1406 55.3	1408 55.4	1405 55.3	1407 55.4	1414 55.6	
	Navel,	1020 40.2	1021 40.2	1024 40.3	1024 40.3	1024 40.3	1024 40.3	1024 40.3	1040 40.9	1043 41.1
	Pubes,	861 34.0	863 34.1	863 34.1	864 34.1	863 34.1	863 34.1	863 34.1	863 34.1	863 34.1
	Knee,	474 18.6	474 18.6	474 18.6	474 18.6	479 18.8	479 18.8	479 18.8	479 18.8	481 18.9
	Sitting,	897 35.3	897 35.3	903 35.6	904 35.6	907 35.7	907 35.7	907 35.7	909 35.9	913 36.0
GIRTHS.	Head,	565 22.2	567 22.3	567 22.3	568 22.3	573 22.5	571 22.4	572 22.4	573 22.5	577 22.7
	Neck,	342 13.5	346 13.6	352 13.8	352 13.8	355 13.9	356 14.0	357 14.0	360 14.2	360 14.2
	Chest Repose,	852 33.5	864 34.0	878 34.6	885 34.8	896 35.2	899 35.3	901 35.4	906 35.6	914 35.9
	Chest Full,	890 35.0	909 35.8	925 36.4	928 36.5	936 36.8	938 36.9	942 37.1	950 37.4	944 37.2
	Belly,	705 27.8	717 28.2	723 28.4	725 28.5	739 29.1	742 29.2	743 29.2	755 29.7	753 29.6
	Hips,	876 34.4	877 34.4	895 35.2	893 35.1	899 35.4	903 35.5	910 35.7	911 35.8	905 35.6
	R. Thigh,	506 19.9	507 19.9	514 20.2	516 20.3	522 20.5	519 20.4	517 20.3	518 20.3	521 20.5
	L. Thigh,	503 19.8	502 19.8	512 20.1	511 20.1	519 20.4	517 20.3	514 20.2	523 20.6	517 20.3
	R. Knee,	355 14.0	356 14.0	358 14.1	358 14.2	360 14.2	362 14.3	354 14.0	361 14.2	362 14.3
	L. Knee,	355 14.0	355 14.0	358 14.1	359 14.2	360 14.2	358 14.1	353 13.9	360 14.2	361 14.2
	R. Calf,	338 13.3	342 13.4	346 13.6	347 13.6	355 14.0	350 13.8	350 13.8	355 14.0	362 14.2
	L. Calf,	337 13.3	341 13.4	347 13.7	347 13.7	348 13.7	350 13.8	347 13.7	352 13.8	351 13.8
	R. Instep,	238 9.3	240 9.4	241 9.4	242 9.5	243 9.5	243 9.5	243 9.5	246 9.6	247 9.6
	L. Instep,	237 9.3	239 9.4	239 9.4	239 9.4	240 9.4	242 9.5	242 9.5	245 9.6	246 9.6
	R.U. Arm c't'd	280 11.0	286 11.2	293 11.5	297 11.5	299 11.8	300 11.8	301 11.8	307 12.0	309 12.1
	R. U. Arm,	252 9.8	250 9.7	258 10.1	260 10.2	265 10.4	267 10.4	267 10.4	267 10.4	267 10.4
	L. U. Arm,	242 9.4	247 9.6	247 9.6	254 9.9	257 10.0	257 10.0	255 9.9	262 10.2	262 10.2
	R. Elbow,	244 9.5	247 9.6	250 9.8	252 9.8	254 9.9	252 9.8	253 9.8	254 9.9	256 10.0
L. Elbow,	241 9.4	244 9.5	245 9.5	247 9.6	250 9.8	249 9.8	248 9.8	252 9.8	249 9.8	
R. Forearm,	258 10.1	260 10.2	262 10.2	263 10.3	266 10.4	265 10.4	267 10.4	268 10.5	271 10.6	

AGE IN YEARS,		17	18	19	20	21	22	23	24	25
GIRTHS.	L. Forearm,	248 9.6	253 9.9	255 9.0	258 10.0	259 10.1	258 10.0	264 10.3	264 10.3	264 10.3
	R. Wrist,	163 6.4	165 6.5	165 6.5	165 6.5	165 6.5	165 6.5	166 6.5	167 6.6	167 6.6
	L. Wrist,	162 6.4	164 6.4	163 6.4	163 6.4	164 6.4	163 6.4	164 6.4	165 6.5	165 6.5
BREADTHS.	Head,	153 6.0	153 6.0	153 6.0	154 6.0	154 6.0	154 6.0	154 6.0	154 6.0	156 6.1
	Neck,	105 4.1	106 4.1	107 4.2	109 4.3	108 4.3	109 4.3	109 4.3	109 4.3	109 4.3
	Shoulders,	422 16.5	422 16.5	428 16.8	431 16.9	437 17.1	435 17.1	436 17.1	441 17.3	443 17.4
	Waist,	244 9.6	248 9.7	250 9.8	250 9.8	255 10.0	254 10.0	261 10.2	265 10.4	265 10.4
	Hips,	320 12.6	320 12.6	324 12.7	324 12.7	327 12.8	327 12.8	327 12.8	332 13.0	332 13.0
	Nipples,	189 7.4	193 7.6	194 7.6	198 7.7	202 7.9	201 7.9	202 7.9	205 8.1	204 8.2
LENGTHS.	R. S. Elbow,	372 14.6	372 14.6	372 14.6	373 14.6	372 14.6	374 14.7	374 14.7	378 14.8	374 14.7
	L. S. Elbow,	370 14.6	370 14.6	370 14.6	370 14.6	371 14.6	370 14.6	374 14.7	378 14.8	378 14.8
	R. E. Tip,	461 18.1	460 18.1	460 18.1	460 18.1	460 18.1	463 18.2	465 18.3	465 18.3	465 18.3
	L. E. Tip,	457 17.9	460 18.1	459 18.0	458 18.0	459 18.0	459 18.0	460 18.1	462 18.2	462 18.2
	R. Foot,	260 10.2	259 10.2	259 10.2	259 10.2	261 10.2	259 10.2	260 10.2	260 10.2	262 10.3
	L. Foot,	260 10.2	260 10.2	259 10.2	258 10.1	260 10.2	259 10.2	249 10.2	260 10.2	262 10.2
	Stretch Arms,	1774 69.8	1780 70.1	1780 70.1	1781 70.1	1786 70.2	1784 70.2	1803 71.0	1802 71.00	1803 71.00
	Hor. Length,	1732 68.1	1733 68.1	1732 68.1	1734 68.2	1734 68.2	1734 68.2	1734 68.2	1734 68.2	1734 68.2
STRENGTH.	Lungs,	1.3 2.86	1.3 2.86	1.3 2.86	1.3 2.86	1.4 3.08	1.4 3.08	1.4 3.08	1.4 3.08	1.4 3.08
	Back,	120 264	129 284	133 282	137 301	142 312	142 312	143 314	142 312	142 312
	Dip,	4.5	5.6	6.3	7.1	7.3	7.1	7.4	7.4	7.0
	Pull Up,	8.0	9.3	9.5	10.0	10.1	10.0	10.0	10.0	10.0
	Legs,	144 316	157 345	164 360	164 360	175 385	172 378	176 387	168 369	174 382
	R. Forearm,	35 77	39 86	41 90	42 92	44 97	44 97	43 94	42 92	43 94
	L. Forearm,	32 70	35 77	38 84	38 84	41 90	40 88	38 84	40 88	41 90
Tot. Strength,	379	423	436	467	471	471	457	451	475	
LUNG CAPACITY,	3.69 225.2	3.78 230.7	3.90 238.0	3.94 248.4	3.96 241.7	4.03 245.9	4.03 245.9	4.03 245.9	4.05 247.2	
PILOSITY,	2.20	2.31	2.33	2.34	2.45	2.52	2.52	2.64	2.75	

FOR EXPLANATION SEE "NOTE" UNDER TABLE I.

TABLE V.

TABLE OF COLLEGE CLASSES.

AGE, in years and months.	WEIGHT, in pounds and <i>Kilos.</i>	HEIGHT, in inches and <i>Millimetres.</i>	CHEST GIRTH in inches and <i>Millimetres.</i>	ARM GIRTH, in inches and <i>Millimetres.</i>	FOREARM GIRTH, in inches and <i>Millimetres.</i>	LUNG CAPACITY, in cubic inch's and <i>Litres.</i>	PULL UP number of times.	
22-4	143.21 64.55	67.95 1726	35.87 911	11.77 299	11.02 280	231 3.79	10.99	Seniors.
21-10	140.59 63.77	67.87 1724	35.59 904	11.73 298	11.02 280	229 3.75	11.12	Juniors.
20-3	138.23 62.70	67.60 1717	35.51 902	11.69 297	10.94 278	229 3.75	10.35	Sophomores.
19-2	132.98 60.32	67.40 1712	34.51 878	10.98 279	10.39 264	220 3.61	8.65	Freshmen.

ANTHROPOMETRIC MEASUREMENTS.

NUMBER.—In order to secure privacy the individual should be entered in the record book by number. As a means of identification the number can be entered in an alphabetical index book opposite the corresponding name, as :

Smith, John H.,

526.

For further convenience it is advisable to enter the name in a numerical index book opposite the corresponding number, as :

526,

John H. Smith.

DATE.—Record the year, month, day and hour, as : Jan., '86, 12, 9 A. M. Where perfect accuracy is desired, note should be made of the time that has elapsed since eating, the occupation of previous hours, and of the temperature of the room.

AGE.—Record years and months, as : 21, 9, *i. e.*, twenty-one years and nine months.

WEIGHT.—The weight of the body should be taken without clothes. Where this is impracticable the weight of the clothes should be deducted.

HEIGHT.—The height should be taken without shoes and with the head uncovered. The head and figure should be held easily erect, and the heels together. This position is best secured by bringing the heels, the buttocks, the spine between the shoulders and the back of the head in contact with the measuring rod.

HEIGHT OF KNEE.—The subject should place one foot on a box or chair of such a height that the knee is bent at a right angle. A box about 12 in. high is suitable for adults. Press a ruler upwards with a force of about one pound against the ham string tendons close to the calf of the leg. See that the ruler is held in a position at right angles to the vertical rod, and measure the height of the top of the ruler from the box.

HEIGHT SITTING.—Let the subject sit on a hard, flat surface about 12 inches high, such as afforded by a box or chair, with the head and figure easily erect so that the measuring rod will touch the body at the buttocks, between the shoulders, and at the back of the head. Measure the distance from the box to the vertex.

HEIGHT OF PUBES.—With the subject standing easily erect on the box or floor, measure up to the lower edge of the pubic bone.

HEIGHT OF CROTCH.—With the subject standing easily erect on the box or floor facing the vertical rod, press a ruler firmly against the perineum (crotch) and measure the height of the top of the ruler.

HEIGHT OF NAVEL.—With the figure and head of the subject erect, measure the height of the centre of the cicatrix.

HEIGHT OF STERNUM.—With the figure and head of the subject erect, measure the height of the interclavicular notch.

GIRTH OF HEAD.—This measurement should be taken around the head with the tape at the upper edge of the eye brows, over the supra orbital and occipital prominences. All girths should be made on the skin itself and at right angles to the axis of the body or limbs at the point of measurement. No oblique measurements are taken.

GIRTH OF NECK.—With the head of the subject erect, pass the tape around the neck half way between the head and body, or just below the "Adam's apple."

GIRTH OF CHEST.—Pass the tape around the chest so that it shall embrace the scapulae and cover the nipple. The arms of the subject should be held in a horizontal position while the tape is being adjusted and then allowed to hang naturally at the sides. Take the girth here before and after inflation.

Where it is desirable to test the elasticity or extreme mobility of the walls of the chest, a third measurement may be taken after the air has been forced out and the chest contracted to its greatest extent. To test the respiratory power, independent of muscular development, pass the tape around the body below the pectora line and the inferior

angles of the scapulae, so that the upper edge shall be two inches below the nipples. Take the girth here before and after inflation.

GIRTH OF WAIST.—The waist should be measured at the smallest part after a natural expiration.

GIRTH OF HIPS.—The subject should stand erect with feet together. Pass the tape around the hips above the pubes over the trochanters and the glutei muscles.

GIRTH OF THIGHS.—With the feet of the subject about six inches apart, the muscles set just enough to sustain the equilibrium of the body and the weight distributed equally to each leg in gluteal fold, measure around the thigh just below the nates.

GIRTH OF KNEE.—With the knee of the subject straight and the weight of the body equally supported on both legs, measure over the centre of the patella.

GIRTH OF CALF.—With the heels down and the weight of the body supported equally on both feet, the tape should be placed around the largest part of the calf.

GIRTH OF INSTEP.—Measure around the instep at right angles with the top of the foot, passing a point at the bottom of the foot midway between the end of the great toe and back of the heel.

GIRTH OF UPPER ARM.—With the arm of the subject bent hard at elbow, firmly contracting the biceps and held away from the body in a horizontal position, pass the tape around the greatest prominence. If desirable to find the girth of the upper arm when the biceps is not contracted, the arm should be held in a horizontal position and measured around the most prominent part.

GIRTH OF ELBOW.—Taken around the internal condyle of the humerus while the arm of the subject is straight, with the muscles of the forearm relaxed.

GIRTH OF FOREARM.—Taken around the largest part. The fist should be firmly clenched and the palm of the hand turned upward.

GIRTH OF WRIST.—With the hands of the subject open and the muscles of the forearm relaxed, measure between the styloid process and the hand.

BREADTH OF HEAD.—The breadth of head should be taken at the broadest part. In taking the breadth measurements, stand behind the subject.

BREADTH OF NECK.—Taken at the narrowest part with the head of the subject erect and the muscles of the neck relaxed.

BREADTH OF SHOULDERS.—With the subject standing in a natural position, elbows at the sides, shoulders neither dropped forward nor braced backward, measure the broadest part two inches below the acromion processes.

BREADTH OF WAIST.—Taken at the narrowest part.

BREADTH OF HIPS.—Measure the widest part over the trochanters, while the subject stands with feet together, the weight resting equally on both legs.

BREADTH OF NIPPLES.—Taken from centre to centre with the chest in a natural position.

DEPTH OF CHEST.—Taken after a natural inspiration. Place one foot of the calipers on the sternum midway between the nipples, and the other foot on the spine at such a point that the line of measurement is at right angles with the axis of the spinal column. When it is desirable to ascertain the extent of the antero-posterior movement of the chest, measurements may be taken from the same points after the fullest inspiration and after the fullest expiration.

DEPTH OF ABDOMEN.—Place one foot of the calipers immediately above the navel, the other on the spine at such a point that the line of measurement is at right angles to the axis of the spinal column.

LENGTH OF SHOULDER TO ELBOW.—With the arm of the subject bent sharply at the elbow and held at the side, measure from the top of the acromion process to the olecranon. Care should be taken that the measuring rod is parallel with the humerus and not with the external surface of the arm.

LENGTH FROM ELBOW TO FINGER TIP.—With the arm of the subject bent sharply at the elbow and the rod resting on back of arm and hand, measure from the olecranon process to the tip of the middle finger.

LENGTH OF FOOT.—Take the extreme length of foot from the end of the first or second toe to the back of the heel, about one inch from the surface upon which the foot rests.

STRETCH OF ARMS.—With the arms of subject stretched out horizontally so that both hands and shoulders are in a line, with one middle finger and the zero end of the measuring rod pressed against the wall, note the point to which the other middle finger tip reaches.

HORIZONTAL LENGTH.—With the heels of the subject pressed hard against a perpendicular wall, with arms at the sides and body resting naturally on a horizontal plane, measure the distance of the apex of the head from the wall.

CAPACITY OF LUNGS.—The subject after loosening the clothing about the chest and taking a full inspiration, filling the lungs to their utmost capacity, should blow slowly into the spirometer. Two or three trials may be allowed.

EXPIRATORY STRENGTH.—As before, the subject after loosening the clothing about the chest and filling the lungs completely, should blow with one blast into the manometer. Care should be taken that no air is allowed to escape at the sides of the mouth, and that in expelling the air all the muscles of expiration are brought into play.

STRENGTH OF BACK.—The subject, standing upon the iron foot-rest, with the dynamometer so arranged that when grasping the handles with both hands his body will be inclined forward at an angle of 60° , should take a full breath and without bending the knees, give one hard lift, mostly with the back.

STRENGTH OF LEGS.—The subject while standing on the foot-rest with body and head erect, and chest thrown forward, should sink down, by bending the knees, until the handle grasped rests against the thighs, then taking a full breath, he should lift hard principally with the legs, using the hands to hold the handle in place.

STRENGTH OF CHEST.—The subject with his elbows extended at the sides until the forearms are on the same horizontal plane and holding the dynamometer so that the dial will face outward and the indicator point upward, should take a full breath and push vigorously against the handles, allowing the back of the instrument to press on the chest.

STRENGTH OF UPPER ARMS, TRICEPS.—The subject, while holding the position of rest upon the parallel bars, supporting his weight with arms straight, should let the body down until the chin is level with the bars, and then push it up again until the arms are fully extended. Note the number of times that he can lift himself in this manner.

STRENGTH OF UPPER ARMS, BICEPS.—The subject should grasp a horizontal bar or pair of rings and hang with the feet clear from the floor while the arms are extended. Note the number of times that he can haul his body up until his chin touches the bar or ring.

STRENGTH OF FOREARMS.—The subject, while holding the dynamometer so that the dial is turned inward, should squeeze the spring as hard as possible, first with the right hand then with the left. The strength of the muscles between the shoulders may be tested with the same instrument. The subject, while holding the dynamometer on a level with the chest, should grasp it with handles and pull with both arms from the centre outward.

TOTAL STRENGTH.—The **TOTAL STRENGTH** is purely an arbitrary, and relative, rather than an actual test of strength as its name would indicate. And while confessedly imperfect, it seems decidedly desirable that there should be some method of comparison which does not depend entirely on lifting a dead weight against gravity, or steel springs.

The bodily weight is multiplied by the sum of the “Dip and Pull.” (This is divided by ten simply to prevent too great a number of figures in the calculation.) To this is added the strength of back, the strength of legs, the average of the forearms, and the lung strength. The sum is the Total Strength.

For example, the weight of No. — is 64.6 kilos. The Dip is 11, the Pull 12=23. The Back Strength is 125, the Leg Strength 150, the Forearms 40 and the Lungs 1.4. Or, $64.6 \times 23 \div 10 + 125 + 150 + 40 + 1.4 = 464.9$.

PILOSITY.—Note the amount of hair on the body and limbs, excluding the head, face and pubes.

COLOR OF HAIR.—*Light* (Very Fair, Fair, Light Brown, Brown). *Dark* (Dark Brown, Black Brown, Black). *Red* (Red Brown, Red, Golden).

COLOR OF EYES.—*Light* (Dark Blue, Blue, Light Blue). *Dark* (Light Brown, Brown, Dark Brown, Black). *Mixed* (Gray, Green).

DIRECTIONS FOR TESTING THE REFRACTIVE CONDITION OF THE EYE.

PREPARED BY DR. H. H. SEELYE.

Procure of any optician two pairs of spectacles, one with convex glasses, No. +.75 Dioptric (equal to No. +.48 in the old or English system), and the other with concave glasses, No.—.75 Dioptric. Also obtain a copy of Monoyer’s test letters (a card of Dr. Dennett’s modification of Monoyer’s test type may be procured of Meyrowitz Bros., opticians, 295 and 297 Fourth Ave., New York City), to be hung up at 5 meters distance, and a copy of Green’s astigmatic lines, in the form of a clock face, to be hung up at the same distance.

Test:—Seat the subject at a distance of five meters from the test cards, which should be hung in a good light. Examine each eye separately, keeping the other covered by a card or small book held in front of, but not touching it. Never press the fingers against the closed lid.

There are ten lines of letters on the test card, numbered from .1, .2, .3, etc., up to ten 10ths or 1. If now the subject can read the top line, the smallest letters on the card, with the right eye (R.E.) alone, his vision (V.) is recorded as ten 10ths or 1. (V.R.E.=1.) If he sees nothing clearly above the fifth line from the bottom, but can read that correctly, then V.R.E.=.5. If he cannot read any of the lines, then V.R.E.=0, (*i. e.* less than one-10th). Whatever the vision without glasses may prove to be, *always next* put on the *convex* spectacles and again cover the other eye. If now he can still with the right eye see as well or better than with no glasses at all, and can read the same line as before, he is Hypermetropic (H.) in that eye. For example, if without glasses it was found that V.R.E.=.5, and now after adding the convex glass his V. is improved to .8, the record would be V.R.E.=.5,+H.=.8. But if the vision is neither improved nor made worse by the convex glass, the record will be thus: V.R.E.=.5,+H.=.5. If the convex glass can be used at all without decreasing the vision, no further testing with this card is needed: the subject is hypermetropic in that eye.

If it is found that the vision of the right eye equals 1. without glasses, and the addition of the convex glasses blurs the letters, the eye is Emmetropic, that is, the vision is normal (V.R.E.=1.).

If, however, the vision without glasses is less than 1., for instance only .3, and the convex glasses make even that line more indistinct, then put on the *concave* glasses. If now the vision is improved so that a higher line can be read, for instance the eighth from the bottom, the eye is Myopic, or "near sighted," and the record will be V.R.E.=.3,+My.=.8. Or again, if the vision without glasses in the left eye is found to be .7 and then with the concave glasses the top line can be read, the record will stand thus: V.R.E.=.7,+My.=1. After testing each eye separately, place the record of one above the other, for example thus:

$$\begin{cases} \text{V.R.E.}=1. \\ \text{V.L.E.}=.6,+My.=9. \end{cases}$$

This completes the testing for simple hypermetropia, myopia and emmetropia.

After testing the eyes as above, if the vision has not yet been made perfect in either, leave on the proper correcting glass, the convex if there is hypermetropia, or the concave if there is myopia, or use no glass if there is neither; then direct the subject's attention with that eye alone, the other being covered, to the card of radiating black lines. If he sees one or more of the lines running in any direction clearer or blacker than those at right angles to them, he is shown to be astigmatic. Either the perpendicular or the horizontal lines usually appear the blacker to the astigmatic person. If the previous record was V.R.E.=.7 and this defect is found, then it will be V.R.E.=.7,+As. Or, if before it read: V.L.E.=.3,+My.=.6, and astigmatism is found, it will read, V.L.E.=.3,+My.=.6,+As. Astigmatism may exist either alone or in combination with My. or H. If alone we might have a record thus: V.R.E.=.6,+As.; V.L.E.=.4,+As., or if with hypermetropia thus: V.R.E.=.7,+H.=.7,+As.; V.L.E.=.6; +H.=.8,+As.

To recapitulate, in brief; if it is found that V.R.E.=1, then the R.E. is either Emmetropic or Hypermetropic. If emmetropic, the convex glass will markedly impair the vision: if hypermetropic it will not. If the V.R.E.=.9 or less, then the R.E. is either hypermetropic, myopic, astigmatic or amblyopic.

1st. If it is H. the convex glass will not greatly impair the vision.

2nd. If it is My. the concave glass will improve V.

3rd. If it is As. one of the radiating lines is blackest.

4th, If neither of these defects exists and the V. is less than .7 then Amblyopia or partial blindness may be recorded. It may read thus: V.L.E.=.6,+Am.

Caution.—Always try the *convex* glass. Never try the *concave* unless the convex glass blurs the vision.

In the following cases the subject should be recommended to consult an oculist concerning the advisability of wearing glasses: If the vision without any glasses is less than .4 in either or both eyes; if he complains of weak, watery or painful eyes, especially in reading, and any degree of hypermetropia or astigmatism is found to exist.

DIRECTIONS FOR TESTING THE COLOR SENSE.

A reliable set of test worsteds of different colors may be procured for \$1.25 of N. D. Whitney, 129 Tremont St., Boston. Among these will be found three large test skeins colored light green, purple (pink

or rose), and bright red. To make the examination, spread all the worsteds out on a white cloth placed upon a table. First lay the *green* test skein a little to one side of the others, and then tell the subject to throw out of the pile and lay along side of the test skein all the lighter and darker shades of that color, or all the skeins containing a shade of that color in any degree. Avoid naming the color "green" to him. If he throws out only shades of green or light blue his color sense is normal (C.S.N.) and the test is completed. But if in addition he throws out light grays, or any other shade of gray, or light yellows, salmons, or pinks, he is color-blind. If he handles or fumbles over those shades a good deal and hesitates, as if in doubt about them, but yet does not throw them out, he probably has "feeble color sense" (C.S.F.). The examiner in these cases must use his judgment in making a certain amount of allowance for the stupidity of some persons in understanding what is wanted, especially in the young and uneducated.

If the subject is found to be color-blind, next lay down the purple or rose-colored test-skein, in place of the green, in order to determine the nature of the defect. Now tell him to throw out all the different shades of that color. If he only throws out pinks and light reds and shades approaching these he is only partly color-blind. (P.C.B.) But if he throws out decidedly bluish purples, blues, violets, greens, or grays, he is completely color blind. (C.C.B.) Completely red blind if he throws out the blues, violets, etc., or green blind if the grays or greens.

No further testing is needed, but as a matter of curiosity and to prove the result, the red test skein may next be tried in the same way. If he matches with it browns or greens and grays he is completely color-blind. Dark brown or green if red blind, and light brown or green if green blind.

It is not important to record whether the complete color-blindness is red or green blindness. The following classes may be recorded:—Color sense normal=C.S.N.; Color sense feeble=C.S.F.; Partial color-blindness=P.C.B.; Complete color-blindness=C.C.B.

Color-blind individuals should be warned against engaging in any occupation where this defect would prove dangerous or inconvenient.

DIRECTIONS FOR TESTING THE CONDITION OF THE EARS.

Use an ordinary watch and a tuning fork, letter A. or C., as tests. Seat the subject with his right side toward you, and then while the room is perfectly quiet, see how far off he can hear the watch tick.

Having previously learned by a few experiments what is the furthest distance at which the tick can be heard by normal ears, make that number of inches the denominator of a fraction, and the hearing distance of each person examined thereafter the numerator. Having found the normal distance (=H.D.) to be, for instance, about sixty inches, and that of the subject now examined to be, say forty inches, his record for the right ear would then be: H.D.R.E.= $\frac{40}{60}$. If it had been $\frac{60}{60}$ or 1, the ear would be normal. $\frac{80}{60}$ would show an abnormally acute sense of hearing. If the watch could only be heard while in *contact* with his ear, it would be recorded: H.D.R.E.= $\frac{0}{60}$. If not heard at all, then H.D.R.E.= $\frac{0}{60}$. Next test the left ear in the same way. Voice sounds in talking will often be easily heard by persons quite deaf to the watch tick, so the latter is not always a reliable practical test.

Suppose we have found H.D.R.E.= $\frac{40}{60}$, H.D.L.E.=1, this implies some deafness in the right ear, and the tuning fork will now help us to decide whether the cause lies in some defect of the auditory nerve or internal ear, or in the external or middle ear or Eustachian tube. Strike the fork against some solid substance, and then place the end of the handle against or between the subject's front teeth. If both ears are normal he will probably seem to hear the ringing of the fork equally well in both ears. But if there is a defect in one ear he will either seem to hear it louder or more feebly in the affected ear. If, as in the case we are examining, the fork is heard best in the deaf ear, this tells us that the deafness is due to some defect in the more external parts of the organ, and it can probably be corrected by appropriate treatment. But if it is heard best in the good ear, it goes to prove that the defect in the other ear is more deeply seated and cannot probably be greatly benefited by treatment. This effect of the tuning fork is contrary to what would ordinarily be expected, and it is often a matter of surprise to a deaf person to find that he hears with his teeth apparently better on the deaf side.

We may now add to our record in this case: T.F. best R.E. If it had been heard equally well in both ears we would record: T.F.=N. (or normal). Where the defect in hearing is at all marked a specialist in ear diseases should be consulted.

Our record in a normal case might be thus: H.D.R.E.=1, H.D.L.E.=1, T.F.=N.; or in an abnormal case it might be thus: H.D.R.E.=1, H.D.L.E.= $\frac{0}{60}$, T.F. best in R.E. This would imply that the subject was so deaf in the left ear as not to be able to hear the

watch tick at all, and the fork held between the teeth could be heard best in the good ear, consequently his trouble is probably seated in the deeper structures of the ear, or in the nerve itself, and treatment would not be expected to help him greatly. The tuning fork need not be tried unless the watch tick shows some defect in hearing.

TO EXAMINE THE LUNGS AND HEART.

Procure a Camman's Binaural Stethoscope. Before the subject tries any of the strength tests, let him be seated, and while the breathing and circulation are easy apply the stethoscope to various parts of the chest. The faint respiratory murmur heard everywhere will soon become familiar, and any unusual sounds should be noted as abnormalities. These may be crackling, bubbling or whistling sounds of varying intensity. Or the respiratory murmur may be abnormally loud or entirely absent. Note whether these sounds change or disappear with deep breathing after violent exercise.

Next listen to the heart sounds. Place the stethoscope over the apex of the heart, one inch below and to the right or inner side of the left nipple. Both sounds should be heard most distinctly here. Then place the instrument two inches above this spot and listen. Then place it two inches below the centre of the top of the sternum, or breast bone, and listen in this vicinity. Any abnormal heart sounds are apt to be heard most distinctly at one of these points. In organic heart disease rough grazing or blowing sounds are heard with one or both of the normal heart sounds. Take no notice of an arterial murmur heard loudest under the outer half of each collar bone, which often closely resembles an abnormal heart murmur, especially after violent exercise.

If all the heart sounds are natural, then let the subject take the arm tests of pulling up or dipping, and immediately after let him be seated again, and then listen to see if the heart and lung sounds are still natural, though intensified by the exertion just made. Also note any irregularity in the rhythm of the heart sounds or any intermission in the beat or great increase of rapidity. There may be such, as functional disturbances, without any organic disease. When the breathing and heart sounds seem abnormal advise consulting a physician.

ANTHROPOMETRIC APPARATUS.

The ESSENTIAL APPARATUS for securing these statistics, and their approximate cost are :

Fairbanks's scales,	\$18.00
Measure for heights,	9.00
" " breadths,	4.00
Calipers for depths,	3.50
Back and Leg Dynamometer.	30.00
Hand Dynamometer,	15.00
Lung Dynamometer,	15.00
Lung Spirometer,	17.00
Tapes,	1.00

ALSO

A Record book,	\$8.00
A Stethoscope,	3.00
Set of colored worsteds,	1.25
Cards for Eye Tests,	1.00
Two Pairs of Spectacles,	3.00
Tuning Fork,	.35

The SCALES may be procured at any of the agencies of A. & T. Fairbanks. St. Johnsbury, Vt. The graduated wooden MEASURES can be obtained of Tiemann & Co., New Chambers St., New York. or of Watts Bros., 178 Washington St., Boston; and the DYNAMOMETERS also of the same parties. TAPES can be procured of George M. Eddy, 351 Classon Ave., Brooklyn, N. Y. Thomas Groom & Co., State St., Boston, can furnish RECORD BOOKS. N. D. Whitney, 129 Tremont St., Boston, can furnish COLORED WORSTEDS, and the CARDS FOR EYE TESTS are to be obtained at Meyrowitz Bros., 297 Fourth Ave., New York.

PRACTICAL DIRECTIONS FOR USING THE
Developing Apparatus
IN THE PRATT GYMNASIUM, AMHERST COLLEGE.

BY DR. H. H. SEELYE.

GENERAL DIRECTIONS.

Ten or twenty minutes exercise daily is sufficient for any special development that may be desired. The best time is either before or after the regular class exercise.

Perform each exercise *slowly*, and only so long as to induce a slight feeling of fatigue in the part it is desired to develop. Just before closing, the exercise may be performed rapidly.

Every new exercise should be indulged in very moderately at first, the amount and severity being increased a little every day or two. Use only light weights in the boxes at first, and gradually add to them afterwards. Each day employ in succession all the different means for developing a given part, when a little tired of one machine or exercise going to another and then to a third and so on, and later returning to those used at first.

See that the left side of the body gets as much or a little more exercise than the right, so as to avoid an unequal development.

That a given set of muscles are being most exercised may be known by the fatigue and pain felt in that part after prolonged exertion. A slight amount of aching is all that is desired.

A brief sponge or shower bath after exercising followed by a dry rub is healthy and invigorating.

Don't get discouraged or negligent, because you don't see speedy results. Pluck, time and perseverance will accomplish a great deal.

In the following directions the capital letters in parenthesis correspond to the same letters painted in red on each piece of apparatus referred to.

TO ENLARGE AND STRENGTHEN THE NECK.

Turn the head from side to side, rotating it as rapidly and as far as possible. Stop when a little tired.

Use "Neck Machine" (*C*) 1st. Light weight at beginning. Face machine, stand erect, head strap at back of head. Draw the head slowly back as far as possible. Hold it there for a few seconds. Bow head forward and repeat as above, holding head back a little longer each time. Then repeat the exercise rapidly and continue till slightly tired. Increase the weight every few days.

2nd. Back to machine, stand erect, headstrap around forehead. Bow the head till chin touches chest, stooping a little forward at the same time. Retain a few seconds and repeat slowly and rapidly, as in 1st exercise.

3rd. Left side to machine, head band around right side of head. Bow the head over towards right shoulder. Retain, and repeat slowly and rapidly, as in last exercise.

4th. Right side to machine, reverse exercise 3rd.

TO CORRECT A TENDENCY TO PROJECT THE NECK FORWARD.

Repeat exercise No. 1 more frequently and longer than the others. With head strap at back of head, walk backward as far as possible with body erect. Repeat. In ordinary walking step slowly, body erect, elbows, shoulders and neck held stiffly back, with chin retracted and eyes directed forwards and downwards about 30 feet in front.

TO REMEDY ROUND OR STOOPING SHOULDERS.

In walking step slowly, holding the elbows, shoulders and head back, and the chin down and retracted. Avoid leaning over the table in studying and writing.

Use 1st. "The Chest Weights" (*K*). Face machine, brace first with one foot and then the other, arms extended forwards from the shoulders. Pull arm outwards and backwards as far as possible, elbows stiff. Hold thus for a few seconds. Repeat slowly till weary. Same exercise with each arm singly, alternating. Increase the weights every few days.

2nd. Chest Expander (*E*). Face machine standing a little back from it. Grasp handles above the head. Fill the lungs. Pull arms downwards outwards and backwards as far as possible. Hold a few moments. Empty the lungs. Repeat slowly till slightly weary.

3rd. "Floor Pulleys" (*O*). Face machine, standing quite far back. Very light weights at first. Pull arms upwards and backwards as far as possible, elbows stiff. Hold a few moments and repeat slowly till weary.

For heavier exercise use the Travelling Rings and Swingiug Rings.

TO INCREASE THE SIZE OF THE CHEST AND THE CAPACITY OF THE LUNGS.

Practice daily holding the breath as long as possible, with the lungs full, chest thrown outwards, and shoulders backwards. Try five or six times at one sitting, increasing the period from thirty seconds at first to two minutes after a month's practice.

Practice Running each day. Begin with two or three laps and run slowly at first, and increase the rapidity and distance daily; continuing till considerably out of breath.

Use 1st. "The Capacity Spirometer" (*Y*) daily. Try three or four times at one sitting, increasing the capacity a little every few days.

2nd. "Chest Expander" (*E*). Face machine standing a little back. Grasp handles with arms above the head. Take a deep full breath and hold it while drawing the arms down to the side of hips with elbows bent. Now empty the lungs, and then fill them again while the arms are passing upwards to the first position. Hold the breath and return arms to side of hips as at first, but keep the elbows stiff and arms extended at each side. Empty lungs and repeat these movements very slowly till a little tired. Then repeat the same motions with arms extended out in front, lowering the hands to the front of the hips.—Next stand with back to machine and two or three feet in front of it, keeping one foot in advance of the other and alternating them. Grasp handles with arms upward and backward. Pull them down to the sides of hips. Now fill the lungs, and then let the arms fly backward and upward as far as possible. Holding the breath, bend forwards and again pull the arms downwards and forwards to the sides and a little in front of the hips. Now empty the lungs and again fill them, and then repeat the same motions slowly. Continue till slightly exhausted.

The "Chest Weights" (*K*) or any of the "Pulley Weights" may be used on the same general principles.

3rd. "Quarter Circle" (*F*) or "Sliding Inclined Plane" (*H*). Keep the chest full of air and thrown outwards while lying on the back and pulling the bar downward to the hips. Fill the lungs on the upward movement. Repeat slowly till a little tired.

4th. Use "Inclined" (*M*) and "Upright Parallels" (*U*) with lungs inflated.

TO STRENGTHEN AND ENLARGE THE ARM.

1st. For the Upper Arm.—Take any exercise which alternately flexes and extends the elbow. Pulling motions develop the “biceps” muscle on the upper and front part of the arm, and pushing develops the “triceps” on the opposite side.

For the “biceps” use the “chest weights” (*K*), “chest expander” (*E*), “inclined planes” (*F* & *H*), and any of the “pulley weights,” and especially the “rowing machine” (*R*). For the triceps use the “dipping machine” (*T*), and “inclined” (*M*) and “upright parallel bars” (*U*), also Boxing and the “striking bag” (*I*).

For heavier work, practice on the horizontal bar, rings, and climbing rope and ladders for the biceps, and on the parallel bars for the triceps.

2nd. For the Forearm, Hand and Wrist.—Use any exercise requiring hard grasping or turning the hand. Tennis playing, Indian Club swinging, twirling Dumb-bells, Piano playing, etc. are all good. Use the “Finger Machine” (*S*) with light weights, exercising each finger separately and then the whole hand till tired. Squeeze the “Hand Dynamometers” daily as hard as possible for five or six times. Hit the “Striking Bag” (*I*) with clenched fist. Wind up the weight on the “Wrestling Machine” (*X*) by a hand and wrist motion only.

TO DEVELOP AND STRENGTHEN THE ABDOMINAL MUSCLES AND WAIST.

Any exercise which bends the body forward or twists it to either side. Mowing with a scythe, balancing as on a tight rope, rowing, wrestling, boxing, bowling, and swinging Indian clubs are all good. Lie on the back and with knees stiff raise the feet up as high as possible. Repeat.

“Inclined Abdominal Machine” (*A*). At first make inclination considerable, and later lower it gradually till it reaches the horizontal. Lie on back, and repeatedly bring the body to the sitting posture, keeping feet under the support. Next lie down and grasp the bar above the head, pull it down as far as possible, and when it is in front of the hips come to the sitting posture. Repeat.

Again lying down, raise the body to the sitting posture while holding the bar at arm’s length above the head. Repeat. Gradually increase the weight.

“Floor Abdominal Machine” (*Ab*), to be used in the same way as above.

“Upright Parallel Bars” (*U*). Face the strap on either side, grasp the high pulley handle above the head, and pull it down while bowing the body forward over the strap. Repeat.

“Wall Abdominal and Stool” (*Aa*). Sit on stool placed two or three feet from the bar on the wall. Place toes under the bar. Bend body slowly backwards to the horizontal position and then recover. Repeat slow and fast.

“Horizontal Bar.” Circle it, hang with legs bent L shape.

“High Pulleys” (*P*) and “Chest Weights” (*K*). Each machines and with both hands pull ropes downward. Side to machine, with one hand pull ropes across abdomen or behind back. Wrestling Machine (*X*), Peristaltic Machine (*G*), Sitting Abdominal Machine (*W*).

TO STRENGTHEN A WEAK BACK.

Use 1st “Floor Pulley Weights” (*O*). Face machine standing a little back. Draw the handles from the floor to the sides of the chest straightening the body at the same time. Repeat. Then after straightening the body continue the pulling with the hands till they are carried above and behind the head as far as possible, with the body bending backward. Hold there for a few seconds, then repeat slowly till tired. Gradually increase the weights.

“Lifting Machine” (*L*), or lift weights from the floor without bending the knees. Increase slowly.

“Rowing Machine” (*R*). Pull with back more than with arms or legs.

“Upright Parallel Bars” (*U*). Back to the strap, face to high pulley, feet under the floor brace. Grasp the handle of high pulley with both hands, and pull it downwards and backwards till it stops behind the head, and at the same time bend the body back as far as possible over the strap. Repeat slowly till tired.

The “Chest Weights” (*K*) may be used quite similarly.

TO ENLARGE AND STRENGTHEN THE THIGHS.

Practice fast walking and running, throwing the heels high up behind; also skating, kicking, horse-back riding, and lifting weights from the floor with the knees bent. Stoop down with knees bent and then rise to the erect posture, and repeat till tired. Stoop down

resting on one knee bent and holding the other leg out straight in front, and again coming to standing position.

Use 1st. "Peristaltic Machine" (*G*) slowly.

2nd. "Rowing Machine" (*R*), push and pull with the feet chiefly.

3rd. "Inclined Leg Machine" (*B*). Lie on back, feet against lower brace, legs flexed, grasp side handles, push the sliding platform up by straightening the legs. Repeat. Then use the upper brace for the feet in same way till tired.

"Floor Pulley Weights" (*O*). Face machine, put one heel in handle. Draw the foot and handle backward and upward. Repeat till tired. Toe in handle, side to machine draw foot across other leg. Back to machine, draw foot forward and upward. Light weights.

TO ENLARGE AND STRENGTHEN THE CALVES, LEGS AND ANKLES.

Practice walking so as to bring pressure against the soles and toes, especially up hill walking. Run on the toes, not touching the heels. Hop on one foot and then on the other till tired. Jumping and dancing are good. Stand erect on the floor and raise the body on the toes fifty to five hundred times; increase the number daily.

Use "Bicycle Machine" (*Q*), pressing the treads with the toes only.

"Inclined Leg Machine" (*B*), push with the toes instead of the flat foot.

"Foot Machine and Stool" (*N*). Adjust the ball, putting it low at first. Sit on stool, place feet in the straps and work them as on the pedals of a sewing machine. Continue till tired, and a little longer each day.

TO INCREASE THE BODIDY WEIGHT.

Exercise all the muscles moderately for a short time daily. Do not become greatly fatigued. Take a short spray bath, with moderately cool water, two or three times a week. Avoid excessive mental exercise, study or worry. Do things quietly and moderately and not with a rush. Lie down and rest, or sleep for half an hour after dinner and supper if possible. Do not study soon after eating. Practice deep breathing and holding the breath, to exercise the diaphragm and stomach.

Retire early at night and sleep as long as possible. If sleepless from brain work, eat a few graham crackers before retiring, to draw the excess of blood from the brain to the stomach. Then bathe the head and back of neck with cold water, and if necessary the feet also and rub them briskly till red and dry.

Eat slowly and freely, thoroughly chewing the food. Choose especially the following varieties of food. If any of them causes indigestion take less of that one.

Sugars, syrups, and all sweet things. Fats, fat meats and soups. Sweet vegetables of all kinds. Corn-starch, tapioca and all puddings, cakes, candies and nuts, tea, coffee, chocolate and cocoa diluted with much milk and well sweetened. Cream and new milk. Butter, eggs and condiments. All other foods may be indulged in to the extent of the inclination.

Chewing gum daily before eating and between meals increases the flow of saliva, and so aids the digestion of fat making foods. It also indirectly stimulates the secretion of the digestive juices of the stomach.

TO REDUCE EXCESSIVE BODILY WEIGHT.

Exercise vigorously and long, while warmly dressed, so as to induce profuse and prolonged perspiration. Finish with a warm or hot bath to wash away the old secretions and to induce fresh activity of the skin. Then rub dry in a warm room. Running and fast walking while warmly clothed are beneficial. Turkish baths when possible. Avoid taking too much sleep. Keep the bowels moving freely. Take Epsom or Rochelle salts if necessary.

Restrict the diet and eat moderately.

Avoid the following: Fats, sugar and starchy foods. All sweet things, syrups, candies, raisins, sweet potatoes, tapioca, rice, beets, parsnips, olives, custards, cream, ice-cream, pure milk, cake, puddings, nuts, pork, bacon, chocolate and cocoa.

Take sparingly: Potatoes, soups without fat, tea and coffee with little or no sugar and milk, veal, lamb, ham, tongue, mackerel, herring, sardines, oysters, clams, eggs, condiments, sweet fruits, pies, butter, beans, cheese, sour milk, and buttermilk.

Eat more freely: Lean beef or mutton not fried, chicken, turkey, dried beef, smoked salmon, fish in general, acid fruits, such as apples,

grapes, peaches, lemons, oranges, etc., jelly, stale bread, toast, oatmeal, oatmeal and graham crackers, turnips, celery, lettuce, pickles, peas, cabbage, and skim milk.

HINTS ON TRAINING FOR AN ATHLETIC CONTEST.

When a man contemplates entering upon a course of training to bring himself "into condition" for an athletic contest, he should first consider well his own natural powers and physical ability to successfully cope with his probable antagonists. If he is satisfied with these, he should at the beginning aim to so far surpass the estimated powers of his most dreaded opponents as to be able to beat them by a large margin at least two or three weeks before the contest. *He should feel the assurance of success before the struggle begins.* The object of a course of training is to get rid of flabby flesh and superfluous fat, and to change them into hard, lean, active muscles capable of enduring a prolonged and vigorous strain. To accomplish the former object the directions given in the preceding section, "To Reduce Excessive Bodily Weight," should be rigidly followed out. The second aim will be gained by vigorously exercising each day the particular sets of muscles to be especially brought into play in the contest itself; not striving however to "break the record" every day, but rather making only every third or fourth day a "brace day." With fair natural abilities, conscientious curbing of the appetites, intelligent dieting and persevering exercise, backed by an indomitable will and a determination and expectation of winning, the man may consider himself as "trained" and "in condition" for a successful contest.

