1-1-1944

The Artistic Canons In The Teaching Of Anatomy

W. Montague Cobb
Howard University

The Artistic Canons in the Teaching of Anatomy

W. MONTAGUE COBB, M.D., Ph.D.

Reprinted from

JOURNAL OF THE NATIONAL MEDICAL ASSOCIATION

January, 1944, Vol. XXXVI, No. 1, pp. 3-14

The Artistic Canons in the Teaching of Anatomy*

W. MONTAGUE COBB, M.D., Ph.D.
Professor of Anatomy, Howard University

"L'étude de la forme est la synthèse vivante de l'anatomie du mort." Richer

INTRODUCTION

SIMPLIFICATION, condensation and acceleration have become universal key words of the urgent present. The aim of this paper will be to present, with proper background, certain facts and procedures which will teach the beginning medical student or the reviewing physician how to draw satisfactorily accurate outlines of the human figure from in front, from behind and from the side, and how to use such outlines so as to learn more anatomy, more quickly and better. The specific contribution is conceived to be the demonstration that an adequate mastery of the necessary canon of proportions can be easily and rapidly attained by the average professional student and be of invaluable aid not only in the learning of anatomy, but in its retention and application in clinical practice. Although designed for a particular class of beneficiaries, the method should have equal value for all students of human anatomy.

Man learned to draw before he learned to write. Picture writing preceded the invention of letter symbols. A child makes crude pictures before he attempts to write. Pictorial description is more primitive than verbal, and knowledge which has to do with form and structure is more easily gained and longer retained through pictures than through words.

In addition to improving the student's understanding of the human body as a biological machine, a principal objective of dissection is to impart a knowledge of the character and relationships of sub-surface parts which may be applied in the examination and treatment of patients who may be viewed only from the exterior, or interiorly to the limited extent which the roentgen ray, surgical operation or trauma permit; in short, dissection aims to make of anatomical knowledge a living resource which can constantly be translated from cadaver to patient and from patient to cadaver.

One of the greatest difficulties encountered in the teaching of the subject is in getting the student to visualize his anatomy. A man may have completed a satisfactory dissection of a part, be familiar with its textbook description and yet be unable to indicate its attachments or relationships accurately on the skeleton or living subject, or to draw in the part on a suitable outline of the region.

In our experience the constant encouragement of the student in the making of work sketches and diagrams of everything possible has proven a most beneficial practice. If a man really understands a relationship he can draw it and if his comprehension is not clear his attempt to make a diagram will reveal specific points of weakness. As previously described[3], the employment of mimeographed outlines of the several regions of the body amplified by skeletal or other essential detail has been in our laboratory a significant mutual aid to student and teacher both for study and examination. From furnishing outlines of parts to the student it was but a short and natural step to teach him

 This is the second in a series of articles projected for this journal on aids and approaches to the study of anatomy. The first paper was titled, "Master Keys to Anatomy: Preliminary Notes," J.N.M.A., *35:* 75-86, 1943.

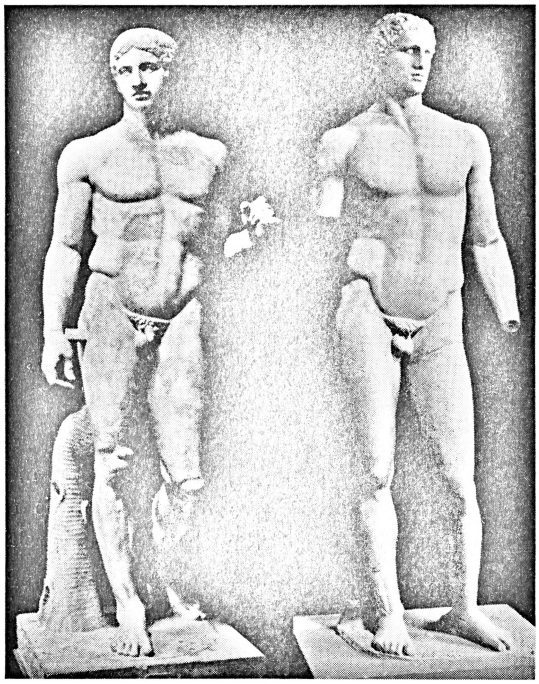

Fig. 1 Fig. 2

Fig. 1—The Doryphorus, or Spear Bearer, by Polycleitos, ca. 440 B. C. This statue was known as "The Canon," because it was considered to embody ideal proportions for the human male. Stature—7½ heads.

Fig. 2—The Agias, by Lysippos, ca. 320 B. C. By reducing the relative size of the head, the figure gains a taller, more slender appearance. Stature—8 heads.

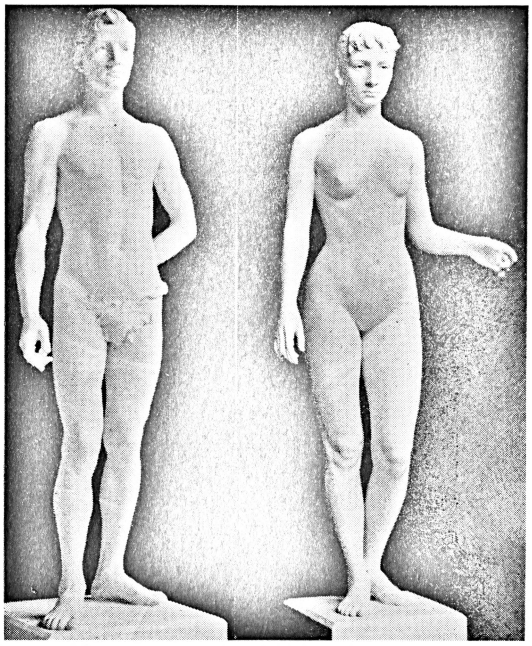

Fig. 3—Dr. Dudley A. Sargent's composite figures of Greater Boston College students of the "gay nineties" made from average measurements. Courtesy Dr. Earnest A. Hooton.

to be able to make his own outlines of the whole body or of any region.

CANONS AND DISSECTION

When a student inculcates anatomy uncovered in dissection by drawing in dissected parts upon an outline of the figure which an artistic canon of proportions has enabled him to prepare, he is making a practical synthesis of knowledge developed at two different periods of history. The canon used was developed by the classical Greeks, while the dissection procedure was the contribution of the European Renaissance.

The Greek sculptors perfected the canons when their art was at its height in the fifth century B. C. Although their portrayals of the human form have never been surpassed, they did not dissect.[21, 24] The excellence of their surface anatomy is attributed to their close association with the gymnasium and study of athletes.

Dissection as a fundamental for the advancement of medical knowledge did not receive adequate attention until the early Renaissance, for interesting reasons beyond the scope of present interest. The efforts of the anatomist in establishing the importance of dissection were greatly enhanced by the contributions of the artist.

Unlike the Greeks, most of the great artists of the Renaissance and later sought to improve their art through the study of dissections. Michelangelo, Raphael, Paolo Veronese, Titian, DeMusis, Durer, Holbein, Cranach and Rembrandt were all consultants of the anatomist. The immortal Fabrica of Vesalius was the result of collaboration between him and the distinguished painter, Stephen van Calcar. Leonardo had made over 800 drawings for an anatomical masterwork projected by him and the anatomist, Antonio della Torre.[2, 7, 10, 21]

Artistic craft is still indispensable to the anatomist and while anatomical master works should unquestionably be illustrated by master artists, everyone who needs to know and use human anatomy can profit from knowing how to be his own artist for practical purposes. That is what an elementary knowledge of the artistic canons will facilitate.

HISTORY OF CANONS

"Canons" or formulae of one kind or another for representing the human body in correct pro-

portions, have been used by artists and sculptors since ancient times. The perennial quest seems to have been the determination of absolute beauty in the human figure and the expression of this concept in a set of rules for ideal proportions. In the nature of the case, a 'perfect' canon cannot be devised, but some simple and useful guides have been developed. Efforts in this direction show considerable variety and ingenuity, but often the results have been bizarre, complicated and impractical. The simplest methods have proven best from all standpoints.

Diodorus Siculus recorded that the early Egyptians had more than one canon and claimed the Greeks as their disciples in this matter. It is well known that the Egyptians as far back as 3000 B. C. used a background of squares drawn with red chalk to secure exactness in their mural paintings. Their measuring rod was a royal cubit (20.6 inches), divided into 7 "palms" of 4 "digits" each, but the nature of their canons for the human figure is obscure.[9] Isolated items reported are that they divided the body into 21¼ parts and are believed to have employed both the length of the foot and the length of the middle finger as units of measurement.[18] Others have determined body proportions in terms of the height of the head, the height of the face, the length of the hand, the height of the lip and the height of the nose.

The first written description of a canon was furnished by the Roman architect Vitruvius (ca. 85 B. C.), who stated that the head height should be an eighth of the body length and foot length a sixth. He showed also that the figure of a man with his arms outstretched could be inscribed in a circle and a square, a fact which has become widely known through a famous drawing by Leonardo da Vinci (1452-1519), Fig. 6. The construction of the human figure by formula was carried to its greatest development by Albrecht Durer (1471-1528), who employed different canons at different periods of his career. He used the height of the head and one sixth of the stature as units of measurement. Durer described in detail his ideas on proportions, but after lifelong study admitted he could not define absolute beauty.[5, 25]

The height of the head from crown to chin is the oldest, simplest and best established unit for the determination of body proportions. Polycleitos (ca. 440 B. C.) represented stature or standing

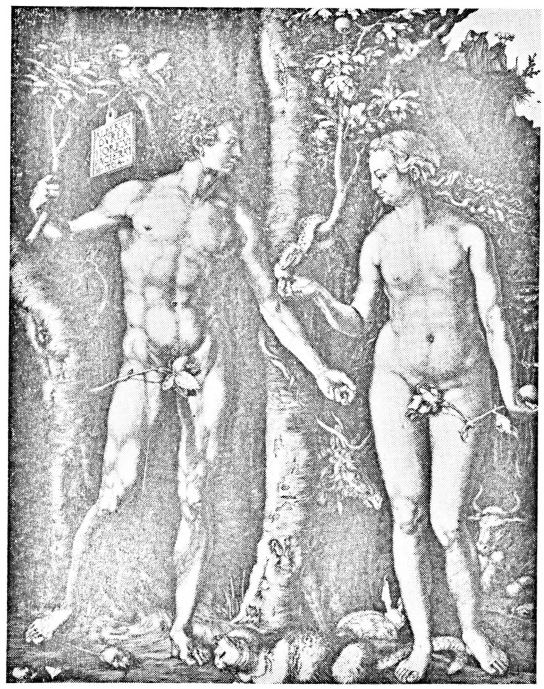

Fig. 4—The Adam and Eva, by Albrecht Durer, 1504. Durer strove to discover laws of proportion which would be an expression of absolute beauty. Toward the end of his life he admitted he did not know what beauty was. This Adam and Eva represent his best effort on the concept of ideal proportions. Engraving, courtesy of Dr. W. Seiferth.

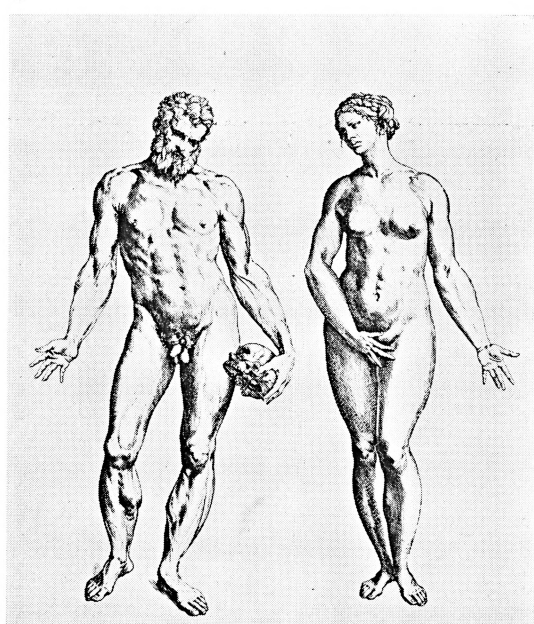

Fig. 5—Male and female figures from the Fabrica of Andreas Vesalius, 1543, illustrating his canon of proportions for representative human beings.

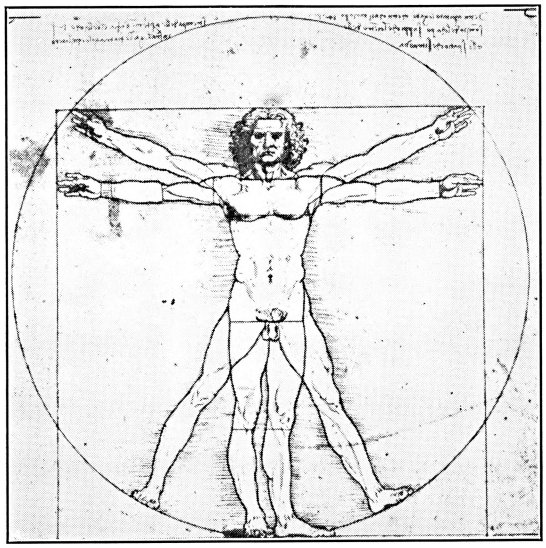

Fig. 6—Figure of a man inscribed in a circle and a square, by Leonardo da Vinci. Arm span equals statute umbilicus is center of circle touching tips of outspread fingers and soles.

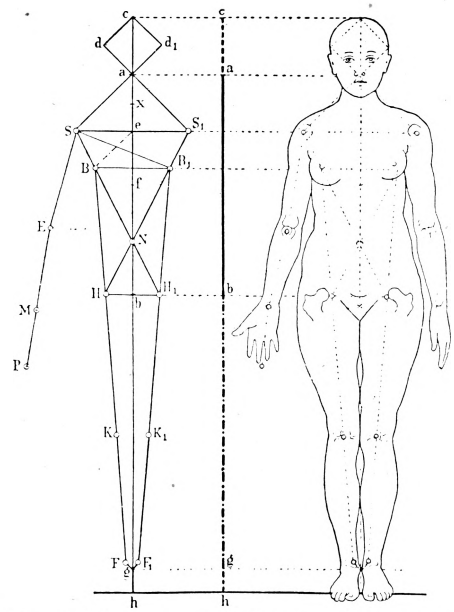

Fig. 7—The canon of Fritsch, after Stratz. Explanation in text.

height as 7½ heads. His famous statue, the Doryphoros, or Spear Bearer, was known as the Canon, because it was considered to embody the correct proportions of the ideal male form, Fig. 1. Lysippos (ca. 320 B. C.) slenderized the Polycleitos canon somewhat, reducing the head so that stature was the equivalent of 8 heads, as manifest in his statue the Agias, Fig. 2.[24] Leonardo used 8 heads, as did Michelangelo (1475-1564), who for giant or kneeling figures occasionally used 9 heads. Durer used 7, 8, 9 and even 10 heads for his figures. The Fabrica of Vesalius (1543) illustrates the canon of proportions by figures of a man and a woman in which the ratio of 8 heads for the stature is represented. In 1676 a complete treatise on the portrayal of the human figure by Jean Cousin was published. Here again 8 heads were used as the height of the figure. The height of the head was prescribed as four times the height of the nose.[4]

The effect of using 8 heads or more for the stature is to increase relatively the length of the limbs and produce a figure taller and more imposing than the average, a consideration of importance to artists. The canon of 7½ heads, however, is applicable to a larger number of persons and is simpler to formularize and easier to draw. Hence it is the one used here.

In his admirable and exhaustive modern series of treatises on artistic anatomy,[13-19] Richer used 7½ heads as the canon of choice. He was followed in this by Arthur Thomson in his "Anatomy for Art Students," first published in 1896,[23] and this multiple has since become widely accepted as standard for general purposes. Perard's handbook[9] is a ready reference in current use.

Before beginning the description of our use of the canon employing the height of the head as the unit of measurement, some distinctly different methods of obtaining representative human figures may be cited, none of which, it will be obvious, are suited for present needs.

The canon of Fritsch is an ingenious scheme for determining key points of the body by a geometric pattern, Fig. 7. This canon is prepared in the following way, the description referring to the lettering in Fig. 7. A vertical line of optional length *ab* is drawn. This represents the distance from lower border of nose to upper symphysis pubis. The line *ab* is then divided into equal

* For the reader's convenience in comparing the several conventions, it may be stated that the height of the figure has been most commonly represented as 7½ to 8 head lengths, 6 to 7 foot lengths, 9 to 10 hand lengths or 4 cubits, the distance from tip of middle finger to tip of elbow.

unit fourths, *ae, ef, fN,* and *Nb.* N falls on the umbilicus. The midline is then extended up a unit fourth to the top of the head, *ac.* From point *e* unit fourths are extended laterally to obtain the positions of the "shoulder joints," *S* and S_1, and half units lateral from point *b* give the hip joints, *H* and H_1. Connecting lines SH_1 and S_1H are then drawn, intersecting at the umbilicus. *Sa* and S_1a are then produced beyond *a,* and *cd* drawn parellel to ad_1, and cd_1 parallel to *ad.* The distance dd_1 is the head breadth. The nipple is at the intersection of *eB,* drawn parallel to *aS,* with SN. The limb proportions are obtained from the resultant figure. Upper arm *SE* is the distance SB_1; forearm *EM,* the distance *BN;* and hand*MP,* the distance *NH.* Thigh *HK,* drawn in continuation of line *BH,* is distance BH_1; and leg *KF,* is distance *BH.* The foot height is half a unit fourth.[22]

Rimmer [20] used the letter "V" as a canon. The male figure up to the shoulders was loosely fitted into the "V", the sides of which were divided into equal thirds. Of these the upper third covered trunk length from top of sternum to pubic symphysis; the middle third, thigh length from symphysis to bottom of patella; and the lower third leg length, from bottom of patella to sole of foot. The limbs of the V were separated at their top by a distance of a third of a side. A simple but incomplete method which even in its inventor's hands yielded figures of peculiar appearance.

The most elaborate and bewildering of the canons was that devised by Hay.[8] It was in essence a rectangular frame representing stature in its length and shoulder breadth in its width, which contained a number of triangles and more or less circular figures. Five of the former had apex between the soles and resembled V's of different heights and five had apex at the crown and appeared as inverted V's of different sizes. In its author's hands the method did not produce an attractive figure and its complexity rendered it wholly impractical.

Another method involves the use of anthropometric averages for the different parts of the body derived from the measurement of large numbers of individuals. It has always been perceived, of course, that all canons are more or less idealizations and do not purport to represent actual human beings. The versatile artist, Leonbatista Alberti (1404-1472)[25] made use of average measurements in arriving at standards of proportion, as did the anatomist, Siegfried Albinus (1697-1770), for the figures in his famous atlas on bones and muscles engraved by Wandelaar.[1]

Early anthropologists pointed out that different canons for peoples of differing build would have to be based on actual measurements. Quetelet[12] reported the proportions of the body in Belgians based upon the measurements of individuals. In our own time Sargent had statues made of male and female figures based on the average measurements of Greater Boston College students of the "gay nineties" period, Fig. 3. Proportions derived in this way also do not represent any individual human beings. Their value is scientific rather than artistic and lies in their basis upon actual measurements. The most ambitious project embodying the knowledge of the centuries in this connection is the remarkable series of 74 bronzes representing the races of mankind in the Field, now Chicago, Museum of Natural History, by sculptress Malvina Hoffman. She brought to this work an excellent artistic background well reinforced by dissection, and circled the globe for racial types, basing the figures on anthropometric measurements.[6]

FRAME AND TEN POINTS

We proceed now to the directions for preparation and use of the figures as developed in our laboratory. When outlines are being made, skeleton and living model must be constantly consulted. Mounted skeletons are available in all anatomical laboratories and students can always serve as models for each other.

Frame. A rectangle 7½ heads in length and 2 heads in breadth, in which cross bars are drawn at head and half head intervals, serves as the frame in which all three views of the figure, anterior, posterior and lateral, are drawn, Fig. 8. Depending upon the size of figure desired, any dimension may be used for the unit head height. In our laboratory, for work on letter-size paper, a scale of one inch to the head is used. For the larger figures which each student prepares, four or five inches have been found convenient lengths for the unit head.

Six Primary Points, Fig 8. The anterior view of the figure is drawn first. The initial step is the insertion of the outline of the head and six primary

CONSTRUCTION AND USES OF ANTERIOR VIEW OF FIGURE

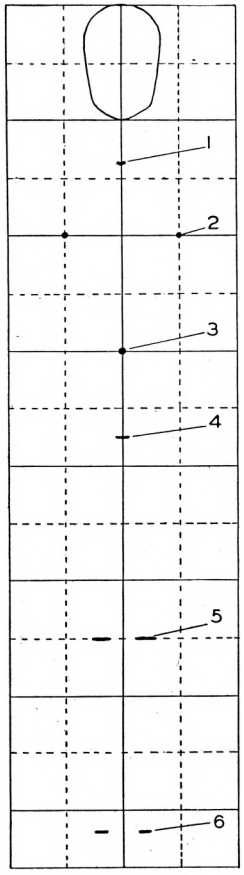

FIG. 8

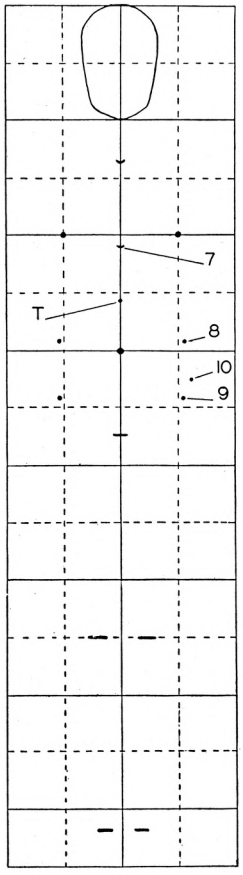

FIG. 9

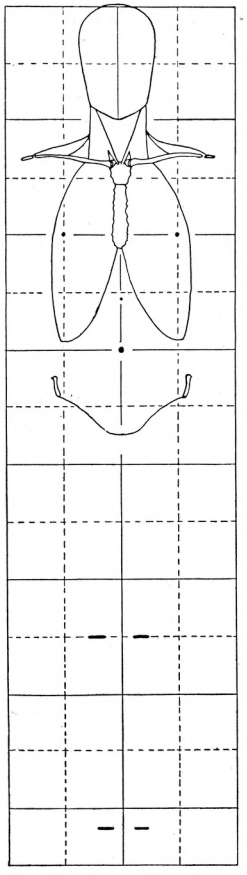

FIG. 10

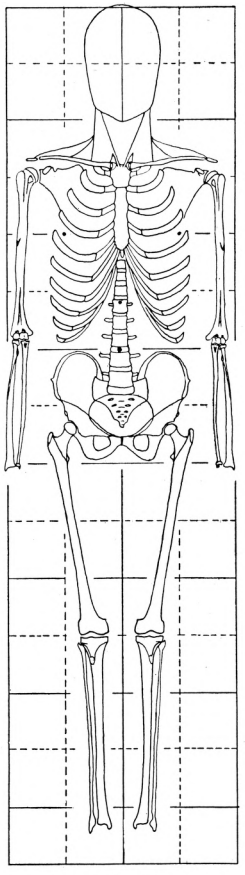

FIG. 11

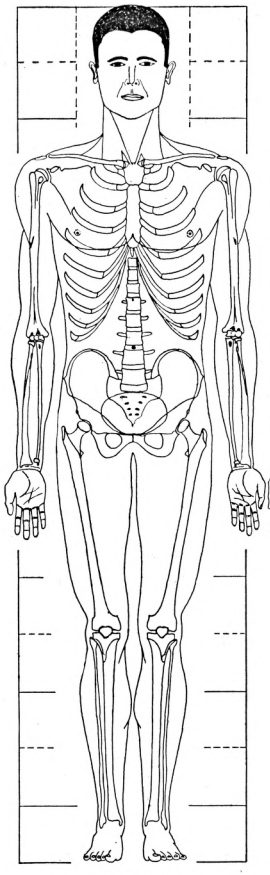

FIG. 12

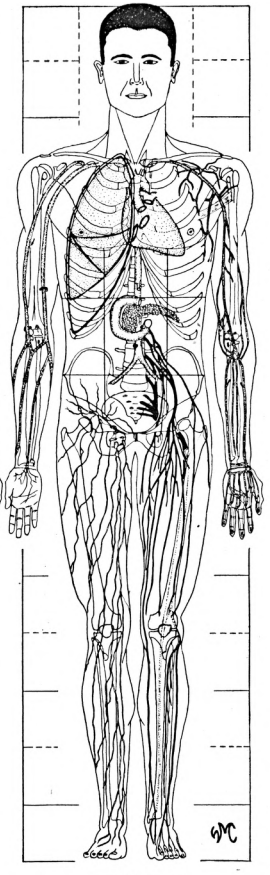

FIG. 13

Fig. 8—Basic frame, 7½ heads long—2 heads broad; and six primary points: (1) suprasternal notch, 1⅜ heads from top; (2) nipples, 2 heads (1 head apart); (3) umbilicus, 3 heads; (4) symphysis, 3¾ heads (middle); (5) knee joint, 5½ heads; (6) medial malleolus 7⅕ heads. Fig. 9—Four secondary points, derived from primary points 1-4: first mark level of transpyloric plane midway between suprasternal notch and symphysis; (7) sternoxiphoid junction, same distance above transpyloric plane as umbilicus is below it; (8) subcostal margin, slightly above umbilicus and outside nipple line; (9) anterior superior iliac spine, slightly below midpoint between umbilicus and symphysis and just lateral to nipple line; (10) tubercle of iliac crest, slightly above midpoint between umbilicus and symphysis, and lateral to ant. sup. il. spine. Fig. 10—First inscription. Added in the following convenient order are: sternum, acromial tips, sternomastoid and trapezius muscles, subcostal margins, lateral outlines of thorax, anterior portions of iliac crests and inguinal ligaments, respectively. Fig. 11—Second inscription. Skeleton of thorax, spine, pelvis and limbs is next drawn in. Fig. 12—Third inscription. The figure is outlined around the skeleton. Hands and feet are added. Fig. 13—Demonstration inscription. From the outline of Figs. 12, 15 and 18, unlimited tracings of particular regions may be made, for review of specific features. Drawn in above to illustrate such review are superficial veins (right upper), arterial supply (left upper), superficial lymphatics (right lower), nerve supply (left lower); heart and valves, right lung and pleura, abdominal regions, duodenum, pancreas and abdominal aorta.

CONSTRUCTION AND USES OF POSTERIOR AND LATERAL VIEWS

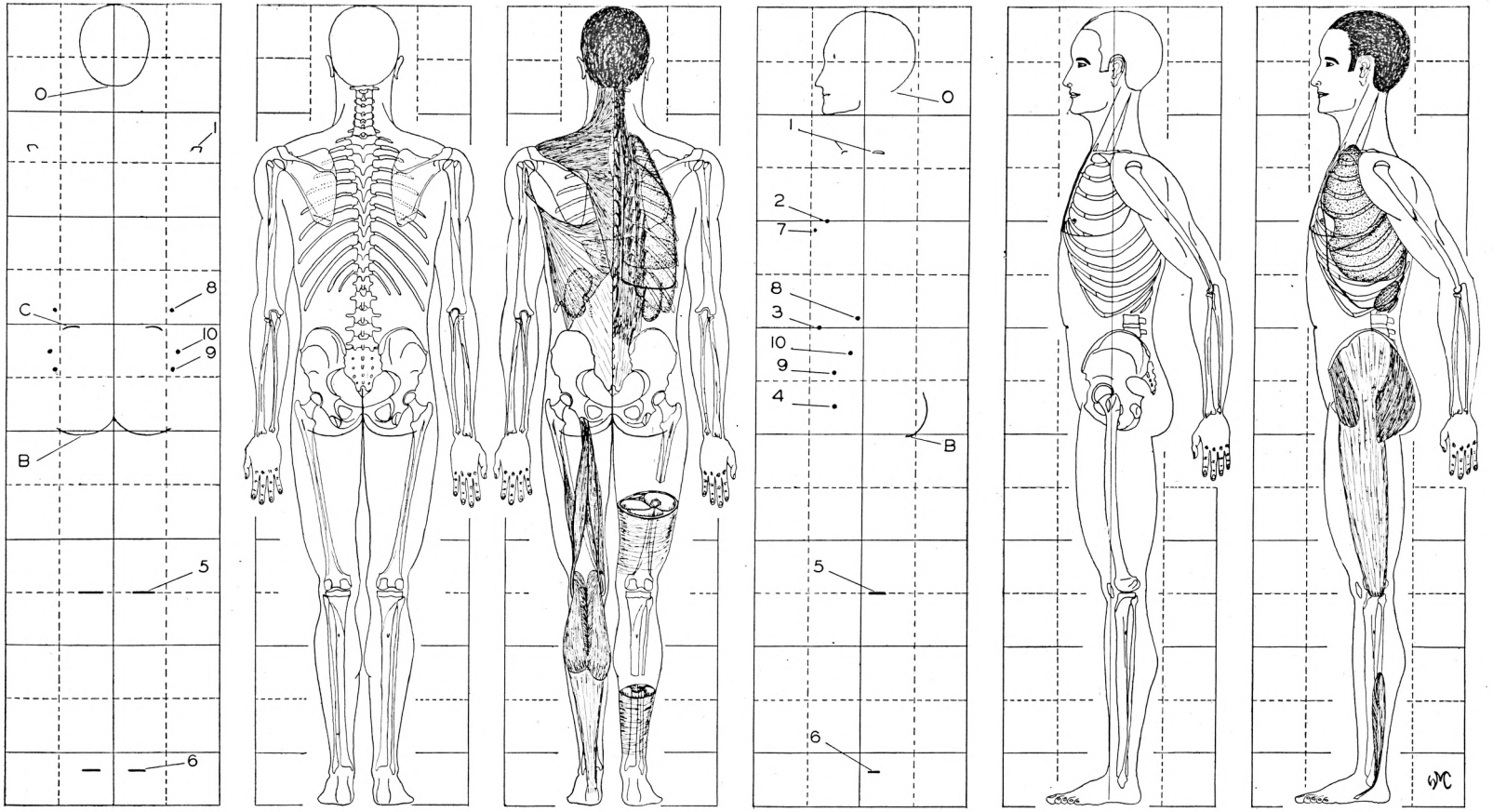

FIG. 14 FIG. 15 FIG. 16 FIG. 17 FIG. 18 FIG. 19

Fig. 14—Primary landmarks, Nos. 1-4 of anterior view and two new points, inferior level of occiput, ¾ heads, and fold of buttock 4 heads from top. Fig. 15—First inscription. Scapulae, neck contours and skeleton are drawn in as described in text. Fig. 16—Outline of figure is completed and demonstration inscriptions added showing: trapezius, latissimus, sacrospinalis, hamstring and gastrocnemius muscles, lower lungs and pleurae, liver, kidneys, popliteal fossa and investing fasciae and compartments of right lower extremity. Fig. 17—Vertical alignment of previously determined primary points. No new points are needed for lateral view. See text. Fig 18—Essential skeletal inscription and outline of Figure. Fig. 19—Demonstration inscriptons showing lung and pleura, gluteus maximus, spleen, tensor fascia latae, iliotibial band and peroneus brevis.

points, so called because they are fundamental landmarks whose position must be memorized. From these all other landmarks may be derived.

Figure 8 illustrates an acceptable contour for the head, although variability is such that a living counterpart could be found for almost any shape, so long as maximum breadth did not exceed three-fourths of the head height.

The six points may then be added as follows: (1) suprasternal notch, 1⅜ heads from top of the frame; (2) nipples, 2 heads from top and 1 head apart; (3) umbilicus, 3 heads from top; (4) upper level of the symphysis pubis, 3¾ heads, in the middle of the body; (5) knee joint, 5½ heads from top; and (6) medial malleolus, 7⅕ heads from top.

Four Secondary Points, Fig. 9. These are derived from the first four of the six primary points. In locating (7) sterno-xiphoid junction, the level of the transpyloric plane (Addison) is determined first. This is indicated by a dot midway between suprasternal notch and symphysis pubis. As the transpyloric plane lies also approximately midway between sternoxiphoid junction and umbilicus, the former is now added by a mark the same distance above the transpyloric plane as the umbilicus is below it. The three remaining secondary points lie, respectively: (8) subcostal margins, slightly above the umbilicus and outside the nipple lines; (9) anterior superior iliac spines, slightly below the midpoint between umbilicus and symphysis and outside the nipple lines; and (10) tubercles of iliac crests slightly above and lateral to anterior superior spines.

INSCRIPTIONS

First Inscription, Fig. 10. The head contour and ten points are the sole landmarks needed for outlining the entire figure. There can be, of course, no fixed rule for the order in which the several structures are drawn in. The order presented has been found logical and convenient.

First drawn in is the outline of (1) the sternum for which the inserted points, suprasternal notch and sternoxiphoid junction, serve as landmarks. An articulated skeleton should serve as a model for outline of the characteristic form of the bone.

Next are added (2) the flat tips of the acromial processes. These should be placed just inside the sides of the rectangular frame and slightly above suprasternal notch. A position level with or somewhat below the notch would not be without duplicate in living individuals.

The clavicles (3) are now drawn in between the clavicular notches of the manubrium and the acromial processes. These bones should be represented as thin laterally at their flattened acromial ends and thickened medially at their prismatic sternal ends. Space should be left between sternal end and manubrium for the interarticular disk.

The sternocleidomastoid (4) and trapezius (5) outlines follow, this insertion being aided by observation of the living model and consultation of text or atlas plates. Sternal and clavicular attachments of sternomastoid and clavicular insertion of trapezius will be accurately shown and anterior and posterior cervical triangles automatically defined.

The subcostal margin (7) is next defined by lines slightly convex downward connecting the subcostal points and sternoxiphoid junction.

The outline of the thorax is completed by (8) lines beginning just inside the lateral limit of the sternomastoid which curve outward so as to pass outside the nipple and join the infracostal margin at the subcostal points.

Lines connecting the tubercles of the iliac crests and the anterior superior spines and continuing to the pubic crest indicate (9) the anterior portions of the iliac crests and (10) the inguinal ligaments, respectively. The ligament lines should be curved downward near their termination medially so as to represent the 'shelving parts' pressed downward by the spermatic cords.

This completes what we call the first inscription. It is recommended that additional skeletal parts be added next.

Second Inscription, Fig. 11. Again the order in which the several parts are added is optional. The ribs (11) are easily drawn in upon the outline of the thorax by landmarks already present. The first rib joins the manubrium just beneath the clavicle which is bound to the rib cartilage by the costo-clavicular ligament. The angle of Louis at the manubrio-gladiolar junction marks the level of the second rib. The nipple being in the fourth interspace indicates the positions of the fourth and fifth ribs, and the lower end of the gladiolus, the seventh rib. It is a simple matter of spacing to insert third rib between second and fourth, and

eighth, ninth and tenth below the seventh, to the cartilage of which the cartilages of eight, nine and ten are joined. Eleventh and twelfth ribs need not be indicated in the front view of the figure.

The costo-chondral junctions follow a line convex medialward which from a position close to the sternum at the first rib, curves gradually outward until only the tip of the tenth rib is visible at the infracostal margin.

The obliquity of the ribs from above downward and medialward and of the costal cartilages from below upward and medialward should be accurately portrayed because of the importance of these relationships to an understanding of the actions of the external and internal intercostal muscles in respiration.

Anteriorly visible parts of the vertebral column (12) are now conveniently added. The transpyloric plane marks the level of the first lumbar vertebra, the subcostal margin the level of the third, the umbilicus the disc between third and fourth lumbar or the fourth itself, the cristal tubercle the fifth lumbar and the anterior superior spine a level just below the sacral promontory.

Next, looking at the articulated skeleton, scapula, humerus and radius and ulna (13) are drawn, followed by the remainder of the innominate, and femur, tibia and fibula.*

In outlining the bones correct proportions and principal prominences such as tubercles and epicondyles of humerus and trochanters and epicondyles of femur are all one need attempt to portray. Lower end of humerus should be on a level with or below the subcostal margin and the wrist joint at or below the level of the fourth head from top. Primary points have already furnished levels of knee and ankle joints. Lateral malleolus must be lower than medial.

Third Inscription, Fig. 12. This consists of the outlining of the figure proper around the skeleton and the addition of facial features and such muscles as are conspicuous surface features, like the pectoralis major, rectus abdominis and sartorius. The hand should extend downward 3/4 heads. Finger lengths and flexure creases should be determined from one's own hand.

* Commercial articulated skeletons do not too closely approximate the relationships of the bones in the living. Supplementary inspection and palpation of subcutaneous bony parts in a subject and an unarticulated skeleton are of important aid here.

In outlining correctly the coutour of any region, attention must be concentrated on subcutaneous bony parts and the form and attachments of underlying muscles, making repeated consultation of living model, dissection and atlas for this purpose. The accuracy of observation thus required is a large part of the educational value of the use of the canon.

POSTERIOR VIEW

Landmarks, Fig. 14. Only six primary landmarks are necessary to draw the figure from behind and four of these have already been used in the anterior view. The two new marks are the inferior level of the occiput at 3/4 heads and the fold of the buttock at 4 heads from top. The superior margins of the acromial processes (1 3/8 heads), the lower limits of the rib cage (2 7/8 heads, just outside the nipple lines), the knee joints (5 1/2 heads), and the medial malleoli 7 1/5 heads) have all been determined previously. Limb proportions are also the same as anteriorly.

First Inscription, Fig. 15. The somewhat circular outline of the cranium is drawn first and the contour of the neck as formed by the sternomastoid and trapezius muscles added. This contour again, is the same as from in front.

Scapula, innominate and vertebral column are key skeletal parts inserted next. The vertebral border of the scapula lies slightly more than a quarter head lateral to the midline; the superior angle is a little lower than the acromion; the inferior angle lies at about the level of the nipples (2 heads from top); and the inferior margin of the glenoid fossa, its most lateral part, does not extend beyond the medial border of the acromion.

For the innominate the positions of anterior superior iliac spine and cristal tubercle are old landmarks. The summit of the iliac crests extends to about 1/8 head below the umbilical level (3 heads from top) and lies just lateral to a perpendicular from the inferior angle of the scapula. The posterior superior iliac spine lies at a level between anterior superior spine and cristal tubercle and a little over 1/8 head from the midline. A curved line connecting these points outlines the iliac crest. Posterior inferior iliac spine lies at about the level of anterior superior spine. Ischial spines lie a little below midway between anterior superior spines and upper symphysis. Ischial tuberosities extend downward almost to the fourth head. The

lower border of the obliquely placed acetabulum lies at symphysial level, the upper limit just over half the distance upward to anterior superior spine. The innominate from behind may now be completely outlined.

Vertebral spines are easily placed. Superior angle of scapula lies opposite second dorsal spine and inferior angle opposite the seventh or eighth. Posterior superior iliac spine is opposite second sacral spine and posterior inferior spine opposite third sacral.

Other levels are given by landmarks from the anterior view:

Suprasternal notch_____disc between 2nd and 3rd dorsal vertebrae.

Sternal angle_____disc between 4th and 5th dorsal

Sternoxiphoid junction disc between 9th and 10th dorsal

Transpyloric plane___1st lumbar

Subcostal plane_____3rd lumbar

Umbilical plane_____disc between 3rd and 4th lumbar

Transtubercular plane, 5th lumbar

Second Inscription, Fig. 16. With the aid of living model and anterior drawing, the outline of the figure may now be completed without difficulty as the contours of the posterior silhouette are similar to those of the anterior aspect.

LATERAL VIEW

Alignments, Fig. 17. No new landmarks are needed for the drawing of the lateral view of the figure. All that is necessary is the correct vertical alignment of selected familiar landmarks.

The midline should pass just in front of ear hole, slightly anterior to acromial tip, behind subcostal margin, just behind summit of iliac crest, through posterior part of greater trochanter, between patella and femur and slightly in front of ankle joint.

Nipple and umbilicus should be about $\frac{3}{8}$ heads and $\frac{7}{16}$ heads in front of midline, respectively. Proper tilt of pelvis is obtained by placing anterior superior iliac spine and pubic spine (symphysial point) in same vertical line. These points should be placed just behind the perpendicular dropped from the nipple.

Inscription, Fig. 18. All additional requisite points may be obtained from the anterior and posterior drawings. Living subject and skeleton must serve as models in completion of the lateral outline as of the other views.

INSCRIPTIONS AD LIBITUM

In our plan the students' outlines of the three views of the figure are corrected by the staff as they progress and are inked when finally approved. The inked drawings are ready for any use. These uses can and should cover the body as a whole and all regions. By tracing, direct or by the punched-hole method, the student can make as many copies as he wishes of his original figure or any part of it.

In Figs. 13, 16 and 19 are shown a number of inscriptions, each illustrating a different use of the outline by the student for review. In Fig. 13 there have been sketched on the four outlines of the extremities, respectively, arterial supply, superficial veins, superficial lymphatics and nerve supply. On the thorax the positions of the heart and its valves and right lung and pleura have been outlined. On the abdomen the conventional planes and regions have been indicated on the basis of landmarks already on the figure, and duodenum, pancreas and abdominal aorta drawn in.

To Fig. 16 have been added trapezius, latissimus and sacrospinalis muscles and outlines of lower lungs and pleurae, liver and kidneys. On the lower extremities, hamstrings and gastrocnemius demarcating popliteal fossa, on the left, and investing fasciae and fascial compartments, on the right, are shown.

On the lateral outline, Fig. 19, lung, pleura, spleen, tensor fascia latae, gluteus maximus and iliotibial band have been drawn in.

These examples suffice to show how the anatomy of any region or part may be drilled or reviewed in any detail desired with a speed, thoroughness and accuracy not otherwise possible. Contrast, for instance, the efficiency and economy of effort involved in reviewing the blood supply of the upper limb by drawing a picture of the vessels and their ramification, with pure memorization of subclavian, axillary, brachial, radial and ulnar arteries and their branches.

BENEFITS OF METHOD

The man who acquires a grasp of principles which will enable him to draw upon a blank sheet

of paper correct outlines of the human body from in front, behind and the side, and fill in any region with such detailed anatomy as he desires, confers upon himself significant benefits.

He gains a valuable measure of confidence, always a prime virtue in the physician, from the demonstrable sureness of his knowledge of anatomy.

He acquires a ready means for constant checking of the anatomy at his command so that it may be maintained as complete as possible. Gaps in information or confusion in relationships appear promptly and forcefully upon the attempt to draw a part and make the student his own best mentor for location and correction of deficiencies.

The reinforcement of simultaneous study of skeleton, cadaver and living subject with the habit of pictorial reproduction, compels the continuous exercise and development of powers of accurate and detailed observation, faculties of the utmost importance in all branches of medical practice.

The graphic method coordinates and simplifies facts which unfortunately are often regarded and presented as separate provinces of gross anatomy, such as osteology and topography. Our students begin work on their basic outlines of the figure at the start of the course. In the drawing in of the skeleton, all bones, subcutaneous bony parts, bony prominences and their surface relations have been identified. The landmarks for the planes and regions of the abdomen and the surface relations of the sternum, ribs, scapula and vertebrae have been indicated. Thus in the opening days of the course the student has covered by the work of his own hand, general osteology and topography, which he must constantly review and augment with soft parts and their relationships as dissection proceeds.

Most people, medically trained or not, recognize the abnormal or extreme in human proportions but find it difficult to describe or interpret them. Mastery of a simple canon of proportions provides a definite frame of reference for the scientific description of the innumerable variations encountered in human beings, particularly as these relate to age, size, sex, race and constitutional type.

Finally, the carry-over value of the habit of making correct drawings of anatomical structures into the clinical years of the curriculum and into subsequent practice cannot be overestimated. It provides one with a ready tool for the accurate recording of symptoms and pathology. Here and there the greater value of a picture over words is coming to be utilized in clinical routines, e.g., the established practice of using chest outlines in tuberculosis institutions for the indication of lung pathology. There is no limit to the useful applications of such practice in all regions.

RETROSPECT AND SYNTHESIS

Medical as well as human history is replete with instances where tragedy has resulted from the failure of application of earlier discoveries, witness the deaths from medieval pestilences which might have been considerably reduced by the hygienic devices of the early Cretans.

In this year 1943 in which the four hundredth anniversary of the publication of Vesalius' Fabrica, the foundation stone of modern anatomy, is being celebrated, the observation is unavoidable that many early assets for the presentation and understanding of anatomy, potentially as valuable today as when first introduced, have been lost from the modern curriculum.

Teachers have long agreed that the subject should be presented as living anatomy, yet the anatomy of modern texts is strictly 'dead'. How inferior in this respect are the plates of today's texts and atlases to the animated portrayals of skeletal and muscular systems in the classics of Vesalius and Albinus.

Anatomy as taught in our current medical schools represents the product of specific historical factors and not the optimal in educational procedure. The way is still open for improvements. We are not aware of previous formal efforts to exploit the past to the profit of the present in the manner attempted here.

In the preceding discussion of this series[3] we pointed out that in the exposition of any phase of anatomy it was most valuable to make use of any well suited allied discipline. In this case a tool has been borrowed from art. The classical Greeks perfected this tool in the fifth century B.C. It was in no way connected with dissection or intrinsic interest in anatomical relationships. The goal of the artist was a formula for proportions which would express ideal beauty. For many centuries his quest continued and in the early Renaissance many great artists frequented the dis-

sections of the anatomist to better their art.

The artists absorbed a great deal of anatomy as their work reflects and they have paid their debt to the anatomist by becoming his traditional master illustrator. The anatomist, on the other hand, absorbed less from the artist, and down the years has tended to lose much of what he did incorporate, as the formal and cadaverous realism of modern text-plates attest.

In this paper the integration of a very early and elementary tool of the artist into what is currently the most important phase of the anatomist's work, teaching, has been described in such manner it is hoped, as to make obvious abundant advantages. We believe that no one who develops correctly the habit of drawing his anatomy will ever give it up.

RESUME

The illustrations best summarize this paper. The first group of four sets of figures shows in the Doryphorus and Agias, canons evolved in a polytheistic culture for the expression of ideal proportions as an objective concept, without religious or other motivation. The Adam and Eve of Durer is a product of a period dominated by the Christian Church. It represents not only the goal of ideal proportions in the Greek sense, but the effort toward perfection inspired by the dogma that God created man in his own image. The figures of Vesalius are presented as representative human beings by the man who established anatomy on a sound scientific basis. His aim cannot be considered to have been more than to indicate the appearance and proportions of the normal healthy body without artistic or religious bias. Sargent's statues are an example of the construction of the figure according to the factual basis of average measurements of the several parts of the body determined from a large number of individuals.

The figures of Leonardo and Fritsch, as of collateral interest, typify the efforts of men in different periods to find geometric relationships for human proportions.

In the diagrams of Figs. 8-19, the manner in which the ancient artistic device of the canon may be adapted in the twentieth century to the purposes, abilities and advantage of medical student, clinician or other student of anatomy is demonstrated.

REFERENCES

1. Albinus, B. S. 1719. Tabulae sceleti et musculorum corporis humani, cum explanatio.
2. Castiglioni, A. 1941. A history of medicine. (E. B. Krumbhaar, Transl.) Alfred A. Knopf, New York, N. Y. 1013 pp.
3. Cobb, W. M. 1943. Master keys to anatomy: preliminary notes. *J.N.M.A. 35:* 78-86.
4. Cousin, J. 1676. La vraye science de la pourtraicture. J. Le Be, Paris, 40 1.
5. Durer, A. 1528. Vier Bucher von menschlicher Proportion. Hieronymous Formschneider, Nuremburg.
6. Field, H. 1933. The races of mankind. Anthropology, Leaflet 30, Field Museum of Natural History. 40 pp.
7. Garrison, F. H. 1921. History of medicine. W. B. Saunders Co., 3rd Ed. 942 pp.
8. Hay, D. R. 1851. The geometric beauty of the human figure defined. Wm. Blackwood & Sons, London. 67 pp.
9. Hayes, W. C. 1941. Daily life in ancient Egypt. *Nat. Geog. Magazine, 80:* 506-507.
10. McMurrich, J. P. 1930. Leonardo da Vinci, the anatomist. Williams & Wilkins Co., Baltimore. 265 pp.
11. Perard, V. 1928. Anatomy and drawing. Kingsport Press, Kingsport, Tenn.
12. Quetelet, A. 1871. Sur les proportions du corps humain. Livre premier in "Anthropomètrie ou Mesure des différentes facultés de l'homme." C. Muquardt, Bruxelles. pp. 10-168.
13. Richer, P. 1890. Anatomie artistique. Description des formes exterieures du corps humain au repos et dans les principaux mouvements. E. Plon, Noubrit et cie. Paris. 270 pp. 110 pl.
14. Richer, P. 1893. Canon des proportions du corps humain. 8° Librairie Delagrave, Paris.
15. Richer, P. 1895. Physiologie artistique de l'homme en mouvement. Octave Doin, Paris. 335 pp. 6 pl.
16. Richer, P. 1902. L'art et la medecine. Gaultier, Magnier et Cie. Paris. 562 pp.
17. Richer, P. 1903. Du role de l'anatomie dans l'art. Honore Champion, Paris. 25 pp.
18. Richer, P. 1903. Introduction a l'étude de la figure humaine. Gaultier, Magnier et Cie. Paris. 190 pp.
19. Richer, P. 1906. Nouvelle anatomie artistique du corps humain. Plon-Nourrit et Cie. Paris. 177 pp.
20. Rimmer, W. 1884. Art Anatomy. K. Paul, Trench & Co., London.
21. Singer, C. 1926. The evolution of anatomy. Alfred A. Knopf, New York, N. Y. 209 pp.
22. Stratz, C. H. 1928. Die Schönheit des weiblichen Körpers. Ferdinand Enke, Stuttgart. 41st Ed. 508 pp.
23. Thomson, A. 1896. Anatomy for art students. Clarendon Press, Oxford. 1st Ed. 459 pp.
24. Walters, H. B. 1922. The art of the Greeks. Methuen & Co., Ltd. London. 2nd. Ed. 277 pp.
25. Wölfflin, H. 1926. Die Kunst Albrecht Durers. F. Bruchmann, Munich. 5th Ed. 407 pp.