Anthropology, or, The natural history of man : with a comparative view of the structure and functions of animated beings in general / by William Blair, A.M.

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NATURAL HISTORY OF MAN;

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Comparative View

OF THE

STRUCTURE AND FUNCTIONS

OF

ANIMATED BEINGS IN GENERAL.

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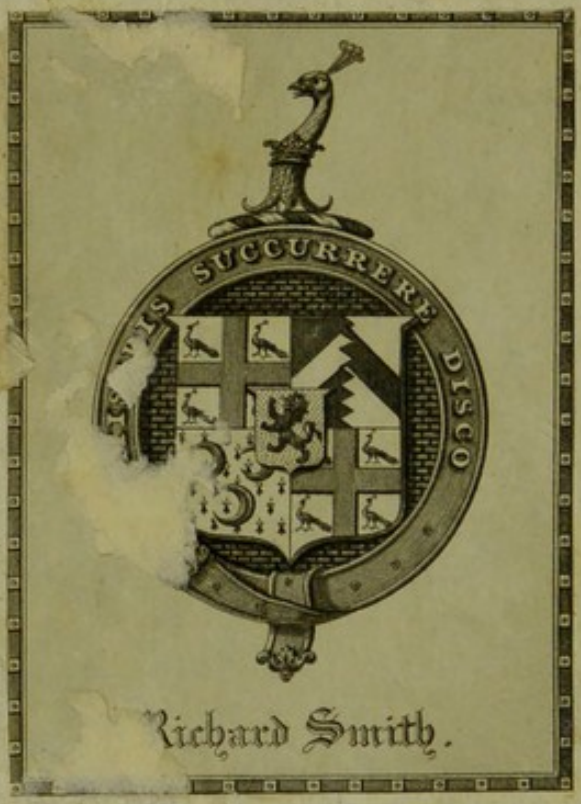

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By WILLIAM BLAIR, A. M.

Member of the Royal College of Surgeons; Fellow of the Medical Societies of London, Paris, and Brussels; Surgeon of the Lock Hospital and Asylum, and of the Bloomsbury Dispensary, &c.

"How little those who enjoy the perfect use of their organs know the comprehensiveness of the blessing, the variety of their obligation!

"How many things must go right, for us to be an hour at ease! How many more, to be vigorous and active?" PALEY'S *Natural Theology*.

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TO THE

NOBILITY, CLERGY, GENTLEMEN,

AND OTHERS,

WHO ATTEND HIS COURSE OF

PHYSIOLOGICAL LECTURES,

THIS SYLLABUS,

PRINTED FOR THEIR USE,

IS MOST RESPECTFULLY INSCRIBED

BY

THE AUTHOR.

PREFACE.

THE most superficial reader of the following pages will perceive, that the Author's sole design has been to facilitate the study of the animal economy, by affording a *text-book* or *syllabus* to the auditors of his PHYSIOLOGICAL LECTURES. Intelligent men of almost every age and country have expressed a wish that the knowledge of human anatomy and physiology could be more easily attained; and that inquisitive persons in general might be presented with sufficiently strong motives for becoming acquainted with their own structure and functions; not, indeed, to encourage domestic quackery, nor to lessen the toils of medical education, but as an highly important branch of natural history, in which every reflecting mind must feel peculiarly interested.

How many circumstances in common life are there, in which such knowledge might prove essentially useful to mankind! And, how much more rational would such a course of study be, than to occupy half the short period of human existence in frivolous or mercenary pursuits! "A private gentleman," (as the late Professor GREGORY has observed,) "will find the history of his own species a more interesting subject, than that of spiders and cockle-shells." And "if men were to claim their right of inquiry into a

subject

subject that so nearly concerns them, the good effects on medicine would soon appear: they would have no separate interest from that of the art: they would detect and expose assuming ignorance, and be the judges or the patrons of modest merit." The chief difficulty is to determine on the best mode of rendering this branch of science both profitable and agreeable, to a mixed assembly of amateurs.

It must be universally allowed that mere verbal description will not suffice for that purpose. The works of Nature herself, the things which form the subjects of our discourse, should be presented to the inspection of students; for otherwise, they will but very imperfectly comprehend the phenomena of Nature. In this exhibition, however, some degree of prudence, delicacy, and election must be observed; since it is possible to disgust and discourage even the most zealous unprofessional inquirers, by the introduction of offensive or ill-prepared objects. Numerous kinds of anatomical preparations, accompanied with large drawings, prints, models, casts, and a living human subject for the muscles, may be exhibited with the happiest effect to the most fastidious and delicate audience. Such, then, are the means by which the Author's successive courses of Lectures have been illustrated.

To scientific persons, lovers of natural history, students in the liberal arts, painters, sculptors, and, in a word, to literary men in general, the author has had the most flattering and repeated proofs that these Lectures are by no means uninteresting: but to medical gentlemen, especially those of the higher classes, he cannot persuade himself to believe they are further

useful, than as a preparatory course of study; since it is a maxim which he has ever inculcated, that anatomy for medical purposes can only be acquired with advantage in the dissecting-room. Anatomical books and lectures undoubtedly have their uses; but, as a foundation for medical knowledge, let there be no dependance placed on any thing without *actual dissections:* let the understanding be aided from day to day, by perpetually and attentively examining the very objects themselves, whose structure and uses are inquired into.

It will be of no importance to his readers to be informed by what coincidences the Author was tempted to become a public Lecturer on the animal economy: suffice it to say, that what was at first designed as an occasional amusement to a few of his friends, (chiefly amateurs of the fine arts,) has imperceptibly grown into the mature state of regular and annual Discourses, addressed to a more promiscuous company of visitors. As to the manner in which this SYLLABUS is executed, the Author cannot but feel it requisite to make some acknowledgment and apology: he is completely aware of its imperfections; but, since an opportunity is afforded him of filling up chasms, and giving a due proportion to the various topics of the Lectures, he hopes what may appear to be a very unfinished performance to readers in general, will not be without its use to those for whom it was too hastily written.

The causes which influenced the Author in producing that considerable difference which appears between some of the outlines of these Discourses, were partly designed and partly accidental. Several of them were

were purposely extended to a greater length than others, in order to gratify the wishes of certain private individuals: and, if time can be procured for the undertaking, it is not improbable that the Author may be hereafter induced to print a few entire Lectures, on the subject of "*Picturesque Anatomy*;" in which it will be his endeavour to supply, for the use of young painters, engravers, and sculptors, such instructions as he has thought would be novel and useful to that class of students. The means by which this branch of science might be effectually acquired, are not always very accessible to the generality of ARTISTS: they are either unreasonably expensive, too remote from the other objects of their pursuit, or by far too difficult of access. At present, therefore, it may be deemed a desideratum, to publish a series of familiar Discourses on PICTURESQUE ANATOMY; in which not only a general account of the science itself shall be given, but the best resources pointed out for obtaining or inspecting appropriate casts, models, engravings, books, anatomical exhibitions, and other appendages of the ARTS.

Great Russell Street, Bloomsbury Square,
October 1803.

CONTENTS.

CORRIGENDA.

Page 18, the 4th line from the bottom, after the word *Creeping*, add 7. *Climbing*.
Page 37, § V. I. For *Mollusca or Testacea*, read *Mollusca either naked or testaceous*.
Page 51, last line, for *the great Toes*, read *each of the great Toes*.
Page 56, after line 2, add VII. *Their Connexion*.
Page 66, after (14), add (15) *Intertransversales Dorsi*, and (16) *Interspinales Lumborum*. (17)
Page 108, line 3, for *gradually* read *voluntarily*.
Page 128, for II. *These at*, read II. *The seat*.
Page 131, line 22, for *many perforations*, read *almost an incredible number of perforations*.

If there be any other typographical errors, the reader is requested to correct them; and to pardon such imperfections or inaccuracies as the author's professional engagements did not allow him to prevent.

ADDITIONAL CORRECTIONS.

In Preface, page viii, line 12, for *very accessible to*, read *attainable by*.
About 50 copies of the work contain likewise the following *Errata*:
Page 155, line 26, for *local affection*, read *a local affection*.
Page 156, line 23, for *rigid limbs*, read *robust limbs*.

ANTHROPOLOGY:

OR, THE

NATURAL HISTORY

OF

MAN.

I will praise thee; for I am fearfully and wonderfully made.

DAVID.

The proper study of mankind is man.

POPE.

(A) INTRODUCTORY OBSERVATIONS.

I. ON the general plan of these Lectures, and the different classes of persons to whom the study of ANTHROPOLOGY may be interesting.

II. The various means of acquiring anatomical and physiological knowledge.

III. Anatomy and physiology for medical purposes, to be learnt in the dissecting-room only.

IV. Of books, designs, and models, to be consulted by artists, amateurs, observers of nature, &c.

V. Picturesque anatomy, allied to painting and sculpture; cultivated by the ancients; revived in the fifteenth century, by *Leonardo da Vinci* and *Michael Angelo*; improved and applied by modern anatomists and academicians; but not usually taught in the schools for medical instruction.

VI. Attention to the LIVING MUSCULAR SUBJECT, particularly enforced; from the consideration of certain errors into which the most celebrated artists have fallen. For example, the muscles have been sometimes represented in cari-

cature, like blown bladders; or they have been all drawn in action, without antagonists at rest; and a proper distinction has not been always preserved between the muscles and their tendons.

VII. An enlarged view of the animal economy leads to the study of vegetable life. The circumstances which distinguish living animals and vegetables from each other, and from inanimate matter, should therefore be carefully examined.

VIII. In this inquiry, we should first consider the phenomena which are common to animal and vegetable systems; then endeavour to ascertain the characteristic marks of living animals; and lastly, we should distinguish man from all other animals.

(B) COMPARISON BETWEEN LIVING ANIMAL AND VEGETABLE SYSTEMS.

§ I. *Properties common to living Animals and Vegetables.*

I. Vegetable, as well as animal bodies, have solid and fluid parts in their composition.

II. They both have an organized structure for the transmission of juices through their substance.

III. Plants as well as animals absorb, perspire, and secrete their fluids, &c.

IV. They both possess the faculty of respiration, *i. e.* of inhaling and exhaling air; which is necessary to their life.

V. They are both subject to irritations and motions from external stimulating causes.

VI. Plants as well as animals require a supply of alimentary or nutritive matter for their existence and support.

VII. Both of them grow from within outwards, and increase till they arrive at a state of maturity.

VIII. They are both capable of sexual intercourse, of impregnation, and of multiplying their species.

IX. Both of them have a power of generating internal heat, and of counteracting the effects of external cold.

X. Vegetables as well as animals resist dissolution and putrefaction, during a state of vitality; but, after death, can do neither.

§ II. *The Difference between perfect Animals and Vegetables.*

I. Most animals have an organized solid structure, intersected by joints, to admit of loco-motion. Vegetables have no similar organs, nor do they enjoy the power of loco-motion.

II. Every animal has a system of muscular, contractile parts, to produce actions in obedience to the will. Vegetables have no such structure, and therefore do not exercise voluntary action.

III. Animals have a system of pulsating tubes, connected with a hollow muscular vessel, for the purpose of propelling their fluids through the body: they have likewise another set of tubes, which do not pulsate, to bring back these fluids to the heart, and thus to complete the circuition. But there are no such circulating vessels or tubes in vegetables; and their juices have only an obscure oscillatory motion within a porous substance, like the ebbing and flowing of the tide.

IV. The respiration of animals is performed by a complicated apparatus, consisting of bones, muscles, air-cells, and vessels; whereas that of plants is performed by the ingress and egress of the air through simple tubes. The former are partly under the control of the will; but the latter are entirely physical and constrained.

V. The nervous irritations produced in animals by the operation of external stimuli, (such as the vibrations of air upon the organ of hearing, the impinging of odours upon the organ of smelling, the action of sapid bodies on the organ of taste, the impulse of light upon the organs of vision, and the impressions of various substances upon the organ of touch,) occasion a multitude of corresponding effects in the system, which are called sensations: besides these, there are likewise in animal bodies other perceptions, either originating spontaneously, or occasioned by the operation of internal stimuli. Now, there are no such effects ever excited upon vegetable systems: but they are altogether passive, in their internal as well as external motions; and can therefore only be classed among unfeeling, necessary beings.

VI. The instinctive or spontaneous election of food; the

organs appropriated for its maceration, dissolution, and assimilation; with the internal processes of chylifaction and sanguification, belong exclusively to animals: so that, in this respect, they differ essentially from plants; which are nourished by a sort of capillary attraction and absorption, without any receptacle, like the mouth, or stomach, or intestines of animals.

VII. The generation of animals, their subsequent growth, and their manner of uniting divided parts, may be thought to bear some analogy to the fecundation, evolution, and renovation of vegetables; but, the organic systems and efficient causes which operate in producing these phenomena are very dissimilar to each other. Besides, all animals shew themselves to be voluntary agents in their sexual intercourse; whereas, the impregnation of plants is wholly incidental, the fecundating effluvium being conveyed and applied to the female by extrinsic means, without any choice or determination on the part of the male.

VIII. The power of resisting cold, heat, and decomposition, is inherent in vegetable as well as animal bodies; and it is this which evinces their vitality, when the other phenomena of life are dormant or apparently extinct. But, the vital principle, upon which that power depends, is evidently most vigorous and permanent in animals: for the human body has been known to endure above 360° of artificial heat, by Fahrenheit's thermometer, without any material inconvenience, and without having its usual temperature greatly augmented: it is also capable of sustaining a very intense degree of cold, for a considerable time, without having its vitality destroyed, or its internal warmth sensibly diminished.

IX. Betwixt *dead* vegetable and animal matter, the principal criterion is, the property possessed by the latter of putrefying with extreme facility, under common circumstances; and of affording in its decomposition several chemical products, which do not present themselves to our notice during the spontaneous dissolution of vegetables.

§ III.

§ III. *The Distinction between Man and other Animals.*

I. Man is endowed with a faculty of expressing his wants, his feelings, and his mental perceptions, through the medium of articulate sounds, and other external signs of ideas. Some classes of animals have the power of modulating their voice and emitting inarticulate noises; but not so as to convey determinate and explicit notions to each other, nor so as to imitate the faculty possessed by human creatures.

II. The rational, moral, and religious principle in man, (which ennobles his nature, exalts him to the class of intelligent beings, and leads him to hope for a future state of existence,) is the chief distinguishing mark of his superiority over all other animals; and in this respect he differs from them much more eminently than in bodily powers or structure. How far the operations of this invisible thinking principle are to be ascribed to a distinct immaterial agent in man, will be a subject of future consideration.

(c) ENUMERATION OF THE COMPONENT PARTS OF THE HUMAN BODY.

These are generally divided into fluids and solids.

§ I. *The Fluids are,*

I. Original.
   1. The chyme. } Not found in the fœtus.
   2. The chyle. }
   3. The blood.

II. Secreted.
   1. Water.
   2. Lymph.
   3. Serum.
   4. Milk.
   5. Saliva.
   6. Pancreatic juice.
   7. Gastric juice.
   8. Enteric juice.
   9. The bile.

10. Seminal fluid.
11. Albumen.
12. Gelatine.
13. Fibrine.
14. Synovia.
15. Fat. } Or animal oil.
16. Marrow. }

III. Excrementitious.

1. Perspiration.
2. Urine.
3. Tears.
4. Mucus. }
5. Cerumen. } Not always in a fluid state.
6. Alvine fæces. }

§ II. *The solid Parts are,*

I. Simple fibres.
II. Membranes.
1. Reticulated.
2. Cellular.
3. Laminated.
III. Vessels.
1. Arteries.
2. Veins.
3. Absorbents.
IV. Muscles.
V. Tendons.
VI. Nerves.
VII. Ligaments.
VIII. Cartilages.
IX. Bones.
X. Glands.
XI. Viscera.
XII. Organs.

The solid parts may again be divided into,

I. Hard, comprehending the bones and cartilages.
II. Soft, including all the other solid parts.

The

The whole science of ANTHROPOLOGY has been commonly reduced to these ten general departments; *viz.*

I. Osteology,	Or, the doctrine of the	Bones.
II. Syndesmology,		Ligaments.
III. Myology,		Muscles.
IV. Membranology,		Membranes.
V. Angiology,		Vessels.
VI. Neurology,		Nerves.
VII. Adenology,		Glands.
VIII. Splanchnology,		Viscera.
IX. Hygrology,		Fluids.
X. Psychology,		Mind.

But, in the present Course of Lectures, a new systematic arrangement or distribution of the organs will be adopted; which may be better suited for conveying physiological information. It is as follows:

(D) CLASSIFICATION OF THE PRINCIPAL ORGANS IN MAN.

§ I. *Organs for Stability.*

I. The bones.
II. The cartilages.

§ II. *Organs for Connexion.*

I. The ligaments.
II. The fasciæ.

§ III. *Organs for Loco-motion.*

I. The muscles.
II. The tendons.
III. The bursæ mucosæ.
IV. The synovial vessels.

All these are instruments of motion:
1. Active.
2. Passive.

§ IV. *Organs for Investment.*

I. Universal.
1. The cellular membrane.
2. The skin.

(a) The cuticle, or epidermis.
(b) The rete mucosum
(c) The cutis vera, or true skin.
} With their appendages: (1) Hair. (2) Wool. (3) Nails.

II. Partial.
1. The linings of cavities.
2. The coverings of viscera.

§ V. *Organs for Digestion.*

I. Primary.
1. The mouth.
2. The salivary glands.
3. The pharynx.
4. The œsophagus.
5. The stomach.

II. Secondary.
1. The duodenum, &c.
2. The liver.
3. The pancreas.
4. The spleen.

§ VI. *Organs for Absorption.*

I. Lacteal.
1. The vessels conveying chyle.
2. The mesenteric glands.
3. The thoracic duct.

II. Lymphatic.
1. The vessels absorbing lymph.
2. The lymphatic glands.

III. Sanguineous.
1. Peculiar veins of the placenta.
2. Peculiar veins of the penis, &c.

§ VII. *Organs for Circulation.*

I. Progressive.
1. The two ventricles of the heart.
2. The arteries in general.

II. Retrograde.

1. The veins in general.
2. The two auricles of the heart.

§ VIII. *Organs for Secretion.*

I. Simple.
1. The secreting surfaces.
2. Follicular membranes.

II. Complicated.
1. The glomerate glands.
2. The conglomerate glands.

§ IX. *Organs for Respiration.*

I. Active.
1. Muscles which expand the chest.
2. Muscles compressing the thorax.

II. Passive.
1. The ribs and sternum
2. The lungs and trachea.

§ X. *Organs for the Voice.*

I. Articulating.
1. The tongue.
2. The lips.
3. The cheeks.
4. The teeth.
5. The bony palate.

II. Modulating.
1. The larynx.
2. The soft palate.
3. The uvula.
4. The nasal cavities.

§ XI. *Organs for Procreation.*

I. Male.
1. The testes.
2. The vesiculæ seminales.
3. The penis.
4. Appendages.

II. Female.
1. The pudenda.
2. The vagina.
3. The uterus.
4. Appendages.

§ XII. *Organs for Perception.*

I. Internal.
1. The cerebrum.
2. The cerebellum.
3. The medulla oblongata.
4. The medulla spinalis.
5. The visceral nerves.

II. External.
1. The cutaneous nerves.
2. The tongue and fauces.
3. The nose.
4. The ears.
5. The eyes.

§ XIII. *Organs for Expression.*

Including,	Relating to,
I. The face.	1. Physiognomy.
II. The skull.	2. Craniognomy.
III. Other parts.	3. Pathognomy.

(E) CLASSIFICATION OF THE PRINCIPAL FUNCTIONS IN ANIMALS.

§ I. *Loco-motion.*

I. General.
1. Walking.
2. Running.
3. Leaping.
4. Swimming.
5. Flying.
6. Creeping. 7. Climbing

II. Partial.
1. Of any member.
2. Of any organ.

Comprehending,
(a) Voluntary
(b) Involuntary
(c) Spontaneous
} Motion.

§ II. *Digestion.*

I. Prehension
II. Mastication
III. Dilution
IV. Deglutition
V. Chymifaction
VI. Chylifaction
VII. Assimilation
VIII. Ejection

} Of alimentary substances.

§ III. *Absorption.*

I. Election
II. Imbibition
III. Propulsion
IV. Appropriation

} Of various liquids,
1. From cavities.
2. From surfaces.

§ IV. *Circulation.*

I. Ventricular
II. Arterial
III. Venous
IV. Auricular

} Action :
1. General.
2. Partial.

§ V. *Secretion.*

I. Capillary
II. Follicular
III. Glandular

} Exhalation or deposition.

§ VI. *Respiration.*

I. Inspiration
II. Expiration
III. Decomposition

} Of the air.

IV. Oxygenation
V. Calorifaction

} Of the blood.

§ VII. *Vociferation.*

I. Articulate. } In the human species.
  1. Speaking.
  2. Whispering.
  3. Ventriloquism.

II. Inarticulate. } In any animal.
  1. Singing.
  2. Mutism.

§ VIII. *Procreation.*

I. Impregnation. } In viviparous animals.
II. Conception.
III. Evolution.
IV. Gestation.
V. Parturition.
VI. Lactation.

§ IX. *Growth and Decrease.*

I. Fœtal state. } Relating to,
II. Infantile. 1. Hard parts.
III. Adolescent. 2. Soft parts.
IV. Pubescent. 3. The male.
V. Virile age. 4. The female.
VI. Mature. 5. Various nations.
VII. Senile.
VIII. Decrepit.

§ X. *Perception.*

I. Active.
  1. In thinking.
    (a) Reviving ideas.
    (b) Comparing ideas.
    (c) Deducing consequences. } (1) Waking.
  2. In willing. } (2) Sleeping.
    (a) Positively.
    (b) Negatively.

II. Passive.
  1. In feeling,
    (a) External impressions.
    (b) Internal impressions.
  2. In desiring,
    (a) The presence of good.
    (b) The absence of evil.

} (1) Waking. (2) Sleeping.

The above classification being in a great degree peculiar to the Author, and being especially adapted for the use of his own auditors, it is not expected that persons in general will fully understand the grounds of his arrangement. But the particular reasons for such a distribution of the mental and corporeal functions, are given in the Author's Lectures: and this hint may perhaps tend to repress the severity of criticism, as well in the present instance as in many others, throughout this Syllabus.

(F) VICQ D'AZYR'S ARRANGEMENT OF THE FUNCTIONS AND ORGANS OF ANIMATED BODIES IN GENERAL.

§ I. *Digestion, of living Bodies*

Which have

I. One or more stomachs, easily distinguishable from the œsophagus and intestinal canal.
  1. In man.
  2. Quadrupeds.
  3. Cetaceous animals.
  4. Birds.
  5. Crustaceous animals.

II A stomach, distinguishable only by certain expansions from the œsophagus and intestinal canal.
  1. Oviparous quadrupeds.
  2. Serpents.
  3. Cartilaginous fishes.
  4. Fishes properly so called.

III. An alimentary canal, not distinguishable into œsophagus, stomach, and intestines.

1. Insects.

1. Insects.
2. Worms.
3. Zoophytes.

IV. Neither stomach nor intestines.
Plants.

§ II. *Nutrition, of living Bodies*

Whose nutritious juices are absorbed

I. By vessels beginning from internal cavities.
1. Man.
2. Quadrupeds.
3. Cetaceous animals.
4. Birds.
5. Oviparous quadrupeds.
6. Serpents.
7. Cartilaginous fishes.
8. Fishes properly so called.
9. Insects.
10. Crustaceous animals.
11. Worms.

II. By vessels opening upon the internal surface.
Plants.

§ III. *Circulation, of living Bodies*

With blood,

I. Having a heart with two ventricles and two auricles.
1. Man.
2. Quadrupeds.
3. Cetaceous animals.
4. Birds.

II. With one ventricle divided into several cavities and two auricles.
1. Oviparous quadrupeds.
2. Serpents.

III. With one ventricle and one auricle.
1. Cartilaginous fishes.
2. Fishes properly so called.

With

With a whitish fluid,

IV. Whose heart is formed of one longitudinal vessel, tuberous and contractile, in which there is a whitish fluid instead of blood.

1. Crustaceous animals.
2. Insects.
3. Worms.
4. In some crustaceous animals there is observed something resembling a heart.

With juices,

V. In which no heart has been yet observed, but only vessels filled with juices of a nature different from that of blood.

1. Zoophytes.
2. Plants.

§ IV. *Respiration, of living Bodies*

Which respire by

I. Lungs free from all adhesion, and spongy.

1. Man.
2. Quadrupeds.
3. Cetaceous animals.

II. Lungs free from all adhesion, vesicular, and muscular.

1. Oviparous quadrupeds.
2. Serpents.

III. Lungs adhering to the ribs, and provided with appendages.

Birds.

IV. Gills of different forms.

1. Cartilaginous fishes.
2. Fishes properly so called.
3. Crustaceous animals.

V. Stigmata or holes in different rings.

1. Insects.
2. Earth-worms.

VI. An opening called trachea, or by external fringes.

Aquatic worms.

VII. Tracheæ.
Plants.
VIII. In which there have been discovered neither stigmata nor tracheæ.
Polypes.

§ V. *Secretion, of living Bodies.*

There are no bodies in which secretions are not carried on.

§ VI. *Ossification, of living Bodies*

Whose skeleton is
I. Internal and osseous.
1. Man.
2. Quadrupeds.
3. Cetaceous animals.
4. Birds.
5. Oviparous quadrupeds.
6. Serpents.
7. Fishes properly so called.
II. Internal and cartilaginous.
Cartilaginous fishes.
III. External and corneous.
1. Perfect insects.
2. Lithophytes.
IV. External and cretaceous.
1. Crustaceous animals.
2. Shell-fish.
3. Madrepores.
4. The greater part of zoophytes.
V. External and ligneous.
Plants.
VI. Which have no skeleton.
1. Insects in their first state.
2. Worms.
3. Polypes.

§ VII. *Generation, of living Bodies*

Which are,

I. Viviparous.
   1. Man.
   2. Quadrupeds.
   3. Cetaceous animals.

II. Oviparous, whether the evolution of the eggs takes place within or without the female.
   1. Birds.
   2. Oviparous quadrupeds.
   3. Serpents.
   4. Cartilaginous fishes.
   5. Fishes properly so called.
   6. Insects.
   7. Crustaceous animals.
   8. Worms.
   9. Plants.

III. Propagated by slips.
   1. Worms.
   2. Polypes.
   3. Plants.

§ VIII. *Irritability, of living Bodies*

Which have,

I. A body muscular or contractile.
   1. Most insects in the first state of their transformation.
   2. Worms.
   3. Polypes.

II. Muscles covering the skeleton.
   1. Man.
   2. Quadrupeds.
   3. Cetaceous animals.
   4. Birds.
   5. Oviparous quadrupeds.
   6. Serpents.

7. Cartilaginous fishes.
8. Fishes properly so called.

III. A skeleton covering the muscles.

1. Perfect insects.
2. Crustaceous animals.

IV. No muscular power, nor spontaneous movements.
Plants.

§ IX. *Sensibility, of living Bodies*

Which have,

I. Nerves and brain easily distinguishable from the spinal marrow.

1. Man.
2. Quadrupeds.
3. Cetaceous animals.
4. Birds.
5. Oviparous quadrupeds.
6. Serpents.
7. Cartilaginous fishes.
8. Fishes properly so called.

II. Nerves and brain scarcely distinguishable from the spinal marrow.

1. Insects.
2. Crustaceous animals.
3. Worms.

III. In which there have not yet been discovered nerves, or brain, nor spinal marrow.

1. Zoophytes.
2. Plants.

(G) SUPPLEMENTARY TABLE TO THAT OF VICQ D'AZYR.

§ I. *Respiration, of living Bodies*

Which have respiratory organs,

I. Diffused through the system.

II. Confined to one place.

III.

III. Situated externally.
IV. Situated internally.
V. In the course of circulation.
VI. Not in the course of circulation.
VII. Within or without the course of circulation at pleasure.
VIII. Without tracheæ.
IX. With tracheæ ramified through the system where the respiratory organs are generally diffused.
X. With tracheæ not ramified through the system where the respiratory organs are confined.
XI. With tracheæ formed by rings.
XII. With tracheæ formed by segments of rings on one side, and a membrane on the other.
XIII. With tracheæ formed by continuous rings, running spirally like a screw.
XIV. With tracheæ admitting air by one entrance.
XV. With tracheæ admitting air by several entrances.
XVI. With tracheæ wholly concealed in the body.
XVII. With tracheæ partly projecting from the body.
XVIII. With tracheæ opening at the head.
XIX. With tracheæ opening at the opposite extremity.
XX. With tracheæ opening upon one side.
XXI. With tracheæ opening upon both sides.

§ II. *Digestion, of living Bodies*

Which have an alimentary canal,
I. Without teeth.
II. With teeth in the mouth.
III. With teeth in the stomach.
IV. With stones or artificial teeth in the stomach.
V. With glands in the mouth for secreting a liquor to be mixed with the food.
VI. With pouches in the mouth where the food is kept and moistened.
VII. With a sac or bag where the food is kept and moistened.

VIII. With a membranous stomach.
IX. With a muscular stomach.
X. With an intermediate stomach.
XI. Without a cœcum or blind gut.
XII. With a cœcum.
XIII. With two cœca.
XIV. With three cœca.
XV. With four cœca.
} These parts, as well as ruminating stomachs and their œsophagus, have antiperistaltic motions.
XVI. With one entrance or mouth.
XVII. With many entrances by absorbents.
XVIII. With many alimentary canals.
XIX. With alimentary canals that branch through the body.
XX. With alimentary canals which distribute the fluids without the aid of a circulating system.

§ III. *Absorption, of living Bodies*

Performed by,

I. Vessels beginning from the alimentary canal.
II. Vessels beginning from the cavities.
III. Vessels beginning from the surface.
IV. Veins in the penis and placenta.
V. Reabsorbents originating from all the parts of the system.

§ IV. *Circulation, of living Bodies*

Which have,

I. No circulating system.
II. A circulating system with one heart.
III. A circulating system with a heart for distributing the blood through the respiratory organs, and an artery for distributing it through the system.
IV. A circulating system with one heart for the respiratory organs, and one for the system, both in one capsule.
V. A circulating system with two hearts for the respiratory organs, and one for the system.

VI.

VI. A circulating system with a pulmonary heart, or a heart for the respiratory organs in the course of circulation.

VII. A circulating system with a pulmonary heart, within or without the course of circulation, at pleasure.

VIII. A circulating system with a heart situated in the breast.

IX. A circulating system with a heart situated near to the head.

X. A circulating system with a heart in the opposite extremity.

§ V. *Nutrition, of living Bodies*

In which the food is prepared by,

I. The alimentary canal.
II. The lacteals.
III. The respiratory organs.
IV. The circulating system.
V. The cellular membrane.
VI. The glands.
VII. Several parts in which it becomes finally assimilated.

§ VI. *Secretion, of living Bodies*

Performed by,

I. Vessels.
II. Exhaling vessels.
III. Excretory organs.
IV. Organic pores.
V. Glands.
VI. All the parts of which the system is composed.

§ VII. *Integumation, of living Bodies*

Having integuments, which are,

I. Scaly.
II. Shelly.

III.

III. Membranous.
IV. Corneous.
V. Cretaceous.
VI. Ligneous.
VII. Covered with down.
VIII. Covered with hair.
IX. Covered with prickles.
X. Covered with feathers.
XI. Covered with a viscid matter.
XII. Changeable in their colour.
XIII. Changeable in their covering.
XIV. Are changed themselves.

§ VIII. *Irritability, of living Bodies*

In which the irritable principle is effected by,

I. Stimulants invisible.
II. Stimulants unknown.
III. Stimulants unthought of.
IV. The nervous influence.
V. Light.
VI. Heat.
VII. Moisture.
VIII. Electricity.
IX. Salts.
X. Gases.
XI. Bodies that act mechanically.

§ IX. *Motion, of living Bodies*

Performed by,

I. Legs.
II. Wings.
III. Fins.
IV. The tail.
V. Organs which fall not properly under these descriptions.
VI. The springiness of the body, or of some part of it.
VII. Contrivances which fit living bodies for being moved by foreign agents.

§ X. *Habit of living Bodies*

Accommodates, with respect to

I. Respiration.
II. Digestion.
III. Absorption.
IV. Circulation.
V. Nutrition.
VI. Secretion.
VII. Integumation.
VIII. Irritability.
IX. Motion.
X. Transformation.
XI. Generation.
XII. Sleep.
XIII. Death.
XIV. Form.
XV. Size.
XVI. Climate.
XVII. Propensity.
XVIII. The healing of parts that are morbid.
XIX. The renewal of those that are broken off.

§ XI. *Transformation, of living Bodies*

Takes place by,

I. A change of proportion among the parts.
II. A change of their form.
III. Throwing off old parts.
IV. An addition of new ones of a different use, structure, and form.
V. A change of the whole form together.
VI. A change of qualities, propensities, and manners.

§ XII. *Generation, of living Bodies*

Performed by,

I. The temporary union of two sexes.
II. The spontaneous separation of parts.
III. Organs situated in the breast.

IV.

IV. Organs situated in the side.
V. Organs situated near the head.
VI. Organs situated in the opposite extremity.
VII. An intrant organ of the male and a recipient organ of the female.
VIII. An intrant organ of the female and a recipient organ of the male.
IX. The stamina and pistils of flowers.
X. The seminal secretion of the male thrown into the organs of the female.
XI. The seminal secretion of the male sprinkled at the entrance of the female organs.
XII. The seminal secretion of the male thrown upon them from a distance.
XIII. The seminal secretion of the male transported to them by the winds.
XIV. The seminal secretion of the male sprinkled on the embryo after emission.
XV. The seminal secretion of the male dissolved in a fluid secreted by the female before it can rightly perform its office.
XVI. The seminal secretion of the male dissolved in water.
XVII. The seminal secretion of the male dissolved, perhaps, in air; and acting like an aroma.

§ XIII. *Sleep, of living Bodies*

Occasioned by,

I. Quietness.
II. The absence of stimuli.
III. The sameness of stimuli when long continued.
IV. Deficient assimilation.
V. Deficient irritability; which is owing sometimes to the weakness, inattention, or confined powers of the mental principle.

§ XIV. *Death of living Bodies.*

Which happens naturally to some species,

I. After hours.
II. After days.
III. After weeks.
IV. After months.
V. After seasons.
VI. After years.
VII. Not till after centuries.

(H) GENERAL TABLE OF THE CLASSES OF ANIMALS, BY G. CUVIER.

§ I. *Animals with Vertebræ.*

I. Warm blood: a heart, with two ventricles. *Class.*
1. Viviparous: mammiferous - - I. MAMMALIA.
2. Oviparous: no mammæ - - - II. AVES.

II. Cold blood: a heart, with one ventricle.
1. Lungs, sometimes with branchiæ III. AMPHIBIA.
2. Branchiæ, without lungs - - - IV. PISCES.

§ II. *Animals without Vertebræ.*

I. Having blood-vessels.
1. A simple spinal marrow: no articulated members - - - - - - V. MOLLUSCA.
2. A knotted spinal marrow: no articulated members - - - - - - VI. VERMES.
3. A knotted spinal marrow: with articulated members - - - - VII. CRUSTACEA.

II. No blood-vessels.
1. A knotted spinal marrow: with articulated members - - - - - - VIII. INSECTA.
2. No spinal marrow, nor articulated members - - - - - - - - IX. ZOOPHYTA.

(1) GENERAL VIEW OF LIVING BEINGS;

Classed according to the Relations which subsist between the nervous System, the muscular System, the vascular System, and their respective Functions. *By* C. L. DUMAS.

§ I. *First Class.*

I. Man.
II. Mammalia.
III. Birds.
IV. Cetacea.

1. Their nervous or sensitive system:

Having brain and nerves distinct from the spinal marrow; a reunion of these two parts by the origin of nerves; separate nerves, divided, multiplied; with five organs of sense.

2. Phenomena of sensibility and of sense:

Quick sensibility; varied sensations; delicate senses; alternating with sleep and watching.

3. Muscular or moving system:

External muscles covering the skeleton; red fibres, cylindrical, parallel, connected by a cellular tissue; with articulated members.

4. Phenomena of mobility and of motion:

Muscular contractions alternating with dilatation; active irritability; considerable muscular force; leaping, swimming, flying, &c.

5. Vascular or calorific system:

A heart with two auricles and two ventricles; capacious lungs, dilatable, two or more in number, free or adhering to the ribs, spongy, provided with appendages, sanguineous; and a vascular system, extended, developed.

6. Phenomena of the circulation and of heat:

Rapid circulation; pulsations of the heart and arteries, strong and distinct; warm and red blood; frequent respiration, extended, regulated, &c. requiring pure and oxygenated air; intense heat.

7. Rela-

7. Relative state of the other systems :

One or more stomachs, very distinct from the œsophagus and the intestinal canal. A visceral system moderately developed. A lymphatic system comparatively weak. A sexual system very active.

§ II. *Second Class.*

I. Amphibia.

II. Reptiles.

III. Oviparous quadrupeds.

1. Nervous or sensitive system :

Brain and nerves distinct from the spinal marrow; origin of the nerves different; brain small with respect to the size of the nerves; large nerves, extended, strong; five organs of sense.

2. Phenomena of sensibility and sense :

Little sensibility; impressions slow; sensations obscure; sense of touch not delicate; the other senses, especially those of hearing and smelling, more perfect; sleep prolonged.

3. Muscular or moving system :

Muscles external, and covering the skeleton; fibres white, and compact; little cellular texture; members articulated.

4. Phenomena of mobility and motion :

Contractions and dilatations strong, but slow; irritability durable, subsisting long after death; muscular power immense; walking, creeping, swimming.

5. Vascular or calorific system :

Heart with two auricles and one ventricle, the ventricle sometimes divided into several cavities; lungs free, without adherence, formed of cells, muscular; vascular system less developed than in the preceding class.

6. Phenomena of circulation and heat :

Circulation more slow; red blood; temperature but little above that in which they live; respiration unfrequent, unequal, irregular; aptitude to respire long in every species of air.

7. Relative state of the other systems :

Stomach not very distinct from the œsophagus and intestinal canal. Visceral and lymphatic systems predominant. Sexual system limited.

§ III. *Third Class.*

I. Some Amphibia.

II. Fishes.

1. Nervous and sensitive system :

Brain and nerves distinct from the spinal marrow ; nerves large, compared with the brain ; five organs of sense.

2. Phenomena of sensibility and of sense :

Sensibility obtuse ; impressions slow ; senses of hearing and smelling imperfect ; the power and facility of seeing inconsiderable.

3. Muscular and moving system :

Muscles exterior covering the skeleton ; fibres white, compact ; members articulated.

4. Phenomena of mobility and motion :

Contractions and dilatations inconsiderable ; irritability weak ; muscular power limited ; swimming, &c.

5. Vascular or calorific system :

An heart with only one auricle and one ventricle ; branchiæ instead of lungs ; vessels minute ; vascular system languid.

6. Phenomena of circulation and heat :

Circulation slow ; motion of the heart and arteries almost imperceptible ; heat feeble and little above that of the medium ; respiration of little necessity.

7. Relative state of the other systems :

Stomach but little distinguished from the œsophagus and intestinal canal. Visceral and lymphatic systems predominant. Sexual system equivocal.

§ IV. *Fourth Class.*

I. Crustacea.

II. Insects.

1. Nervous and sensitive system :

Brain

Brain and nerves scarcely distinguished from the spinal marrow in some, entirely confounded in others; two little medullary bodies instead of brain; the number of organs of sense uncertain.

2. Phenomena of sensibility and sense:

Sensibility almost none; complete torpor in certain states; sleep protracted; inactivity of the senses.

3. Muscular or moving system:

Muscles external in some; internal in others, being covered by the skeleton; fibres white; members articulated.

4. Phenomena of mobility and motion:

Contractions strong and sometimes rapid; great aptitude for motion.

5. Vascular or calorific system:

Heart having one ventricle without auricles; stigmata or tracheæ instead of lungs; a sort of branchiæ in crustacea; vascular system irregular.

6. Phenomena of circulation and heat:

Circulation vague, slow; blood white; heat feeble; the faculty of living long in impure air.

7. Relative state of the other systems:

Always an imperfect distinction of the stomach. Viscera uncertain. Lymphatic system conspicuous. Sexual system active.

§ V. *Fifth Class.*

I. Mollusca or Testacea.

II. Worms.

1. Nervous or sensitive system:

Brain and nerves scarcely distinct from the spinal marrow in some, entirely confounded in others; a small medullary body in their stead; nervous filaments, detached, which divide them; the number of organs of sense uncertain.

2. Phenomena of sensibility and sense:

Almost devoid of sensibility; torpid; sleep protracted; inactivity of the senses.

3. Muscular or moving system:

Muscles

Muscles without skeleton, or interior muscles covered by the skeleton; fibres white; without articulated members.

4. Phenomena of mobility and motion:

Annular contractions more or less strong, and more or less rapid; creeping, walking, &c.

5. Vascular or calorific system:

No heart, with the exception of some mollusca, which have a heart with one auricle only; a single tube composing the whole vascular system; stigmata instead of lungs.

6. Phenomena of circulation and heat:

Circulation oscillatory; white blood; low degree of heat; the faculty of surviving long in impure air.

7. Relative state of the other systems:

Digestive system consisting of a single tube. Viscera uncertain. Lymphatic system conspicuous. Sexual system active. Reproduction of all parts of the body.

§ VI. *Sixth Class.*

I. Zoophytes.

II. Polypes.

1. Nervous and sensitive system:

No brain; no spinal marrow; nor nerves.

2. Phenomena of sensibility and sense:

Exquisite sensibility, if we may judge by the effect of slight impressions.

3. Muscular or moving system:

No muscles, nor muscular fibres; no articulated members.

4. Phenomena of mobility and motion:

Contractions frequent, rapid, reiterated; irritability quick, susceptible of being excited by the impression of light only.

5. Vascular or calorific system:

No heart, no lungs, nor vessels.

6. Phenomena of circulation and heat:

No circulation; little heat.

7. Relative state of the other systems:

Digestive and visceral system as above. Lymphatic and

and mucous system remaining alone. Reproduction by all parts of the body.

§ VII. *Seventh Class.*

Plants.

1. Nervous or sensitive system :

None.

2. Phenomena of sensibility and sense :

A kind of instinctive sensibility, differing from animal sensibility.

3. Muscular or moving system :

None apparent.

4. Phenomena of mobility and motion :

Irritability; spontaneous motion; moving power very limited.

5. Vascular or calorific system :

No appearance of any heart or vascular system; air and sap vessels; tracheæ.

6. Phenomena of circulation and heat :

Elevation and depression of the sap; a kind of oscillatory circulation; respiration by tracheæ.

7. Relative state of the other systems :

No stomach nor intestines. An external system of nutrition. An extensive lymphatic system. Sexual system active and varied.

(J) ON THE ORDER OF THE PRESENT COURSE OF LECTURES.

The structure and functions of the *human body* form the principal subject of these Lectures. What may be occasionally brought forward on the economy of vegetables and animals in general, must therefore be considered as incidental matter; chiefly designed for illustration, or introduced for the sake of variety.

The full consideration of all the particulars enumerated in the preceding tables, would greatly exceed the intended limits of this course; in which, however, are meant to be described

described and exhibited the organs named at page 15, (D), with an account of their respective operations, as at page 18, (E). And, in order to convey such information in the most agreeable and intelligible manner, it is proposed first to demonstrate the parts concerned, and then to explain their peculiar offices; so that the natural connexion which subsists between the study of ANATOMY and PHYSIOLOGY, may be uniformly preserved.

As the system of bones and cartilages constitutes the prop-work or support of the whole corporeal fabric, we shall commence with this department of the subject: and immediately afterwards will be explained the doctrine of syndesmology, or the structure of the ligaments, &c. We then shall describe the proper instruments of motion; namely, the muscles and their appendages. But, since all these parts, as well as the rest of the body, must have some loose medium of communication, something to unite their minuter portions, and to serve as an outward boundary or vesture; we next shall take a survey of the membranes and common integuments. The consideration of these four classes of organs, will especially merit the attention of painters, sculptors, and amateurs of the fine arts; as they principally comprehend what relates to the study of PICTURESQUE ANATOMY, and require to be illustrated by the living human subject.

In consequence of the renewed actions and perpetual waste of materials in the body, a provision was to be made for its repletion: we are therefore naturally led to contemplate in the next place, the several parts which are subservient to digestion, absorption, and circulation. After these, will be demonstrated, the organs of secretion, excretion, and respiration, with their respective functions: and, as there is an inseparable relation existing between the lungs and the organs of voice, we shall proceed from the one to the other in immediate succession.

The parts and processes of generation, so far as a course of popular Lectures will admit, seem next to call for illustration; after which, the growth and decay of human nature will pre-

sent

sent themselves to notice. There will then remain to be considered, the organs of perception, both internal and external; together with some remarks to be offered on the physiology of the brain and nerves: likewise, according to the usual plan of this course, a few observations will finally be made on the sciences of PHYSIOGNOMY, CRANIOGNOMY, and PATHOGNOMY.

(K) OF THE BONY SYSTEM IN GENERAL.

§ I. *The Assemblage of Bones,*

Denominated a skeleton, is of two kinds:

I. Natural; in which the bones are united by ligaments, &c.
II. Artificial; in which they are connected by art.

§ II. *The Uses of Bones.*

I. To preserve the body erect and firm.
II. To afford attachment for soft parts.
III. To serve as moveable levers.
IV. For the defence of vital organs.

§ III. *Their Composition and Structure.*

I. Fibrous.
II. Lamellated.
III. Vascular.
IV. Sensible.
V. Compact.
VI. Excavated.
VII. Cellular.
VIII. Reticular.
IX. Frangible.
X. Inflexible.
XI. Coloured.

} Varying under particular circumstances, in either sex, and in different stages of life.

§ IV. *Their Classification and Names.*

I. Long bones.
II. Flat bones.

III. Spherical.
IV. Irregular.

Named according to,
1. Their figure.
2. Their situation.
3. Their uses.

§ V. *Peculiar Formation in some Bones.*

I. Epiphyses, or separable } Processes.
II. Apophyses, inseparable }

III. Eminences and depressions.
IV. Cristæ, ridges, and furrows.
V. Cells, sinusses, and foramina.
VI. Canals, notches, and acetabula.
VII. Impressions and rugosities.
VIII. Condyles, heads, and spines.
} Of various names and uses.

§ VI. *Their Articulations and Connexions.*

I. Moveable, called DIARTHROSIS; and comprehending five species.
1. By a deep ball and socket articulation, admitting of rotatory motion: *Enarthrosis.*
2. By a superficial ball and socket articulation, likewise admitting of rotatory motion: *Arthrodia.*
3. By a hinge-like articulation, allowing of lateral motion, or of flexion and extension: *Ginglymus.*
4. By a pivot-like connexion, when one bone slides or rolls across another: *Trochoides.*
5. By a very obscure degree of motion, in any direction: *Amphiarthrosis.*

II. Immoveable connexion; named SYNARTHROSIS.
1. By seams, and serrated or saw-cut edges: *Sutura.*
2. By smoother margins: *Harmonia*, or *Schindelysis.*
3. By a nail-like fixture: *Gomphosis.*

III. Mediate connexion; called SYMPHYSIS.
1. By the intervention of cartilage: *Synchondrosis.*

2. By

2. By means of intervening muscle : *Syssarcosis.*
3. By the interposition of membrane : *Syneurosis.*
4. By the intervention of ligament : *Syndesmosis.*
5. By osseous connexion : *Synostosis,* or *Anchylosis.*

§ VII. *Their Number and Subdivisions.*

The total number of bones in middle-aged human subjects, is generally about two hundred and fifty ; and they are reduced to three principal departments :

	N°.
I. In the head are sixty-three bones ; including,	
1. Those of the skull or cranium - -	8
2. Of the face, with both jaws - -	14
3. Of the internal ears - - -	8
4. Within the mouth and throat - -	33
II. In the trunk are fifty-five bones ; including,	
1. Those of the chest or thorax - -	27
2. Of the spinal column or back-bone - -	24
3. Those which form the pelvis - -	4
III. In the extremities, are one hundred and thirty-two ; including,	
1. Both the upper limbs, viz.	
(a) The shoulders and arms - - -	10
(b) The hands and fingers - - -	58
2. Both the lower limbs, viz.	
(a) The thighs and legs - - -	8
(b) The feet and toes - - -	56
Total	250

§ VIII. *Varieties which occur in the Skeleton.*

I. In the fœtal or imperfect skeleton.
II. Between the male and female subject.
III. In natives of different quarters of the globe.
IV. Among adult persons of the same nation.

Several of these peculiarities will be considered in the subsequent Lectures on PARTICULAR BONES, on OSTEOGENY, PHYSIOGNOMY, and CRANIOGNOMY.

(L DESCRIPTION OF THE CARTILAGES IN GENERAL.

§ I. *Their common Properties.*

I. Indistinctly fibrous.
II. Very dense, and without cells.
III. Pearl coloured, or whitish.
IV. Obscurely sensible.
V. Not evidently vascular.
VI. Highly elastic.
VII. Very flexible.
VIII. Having a polished surface.
IX. Generally adhering to bone.

§ II. *The Uses of Cartilage.*

I. To supply the defects of bony structure.
II. To unite some contiguous bones to each other.
III. To prevent the ill effects of concussion and friction.
IV. To facilitate the motion of joints by their lubricity.
V. As a nidus, for the deposition of ossific matter.

§ III. *Classification of the Cartilages.*

I. Articular and inter-articular cartilages.
  1. Investing all the moveable joints.
  2. Loosely connected with several joints.
II. Cartilages supplying the want of bone.
  1. At the extremity of the nose.
  2. Forming the external ear.
  3. Lengthening the ribs and sternum.
  4. Composing the larynx and trachea.
  5. Tipping the long bones of children.
  6. Extending the limits of flat bones.
  7. Forming the patella, &c. in the fœtus.
III. Cartilages uniting the surfaces of contiguous bones.
  1. Interposed between the bones of the pelvis.
  2. Between the vertebræ of the spinal column.
  3. Uniting the epiphyses of young children.

(M) OF THE PERIOSTEUM, PERICHONDRIUM, AND MARROW.

§ I. *The Periosteum.*

I. Its situation.

1. Investing the bones externally.
2. Lining the bones internally.

II. Its structure.

1. Filamentous.
2. Compact.
3. Laminated.
4. Vascular.
5. Nervous.

III. Its uses.

1. To transmit or sustain the minute branches of nerves and vessels passing into the cavities and surfaces of bones.
2. To afford attachment to some tendons and muscles, &c.
3. To obviate the effects of friction between the soft and hard parts.
4. To connect certain bones and their epiphyses to each other.

§ II. *The Perichondrium.*

I. Its situation.

II. Its structure.

III. Its uses.

With respect to the cartilages, it bears an affinity to the *Periosteum*. A similar membrane, named *Peridesmium*, covers the ligaments; and likewise forms the *vaginæ* of tendons.

§ III. *The Marrow.*

I. Its situation.

1. In the cavities of long bones.
2. In the cells of flat bones.
3. Deposited within a peculiar membrane.

II. Its uses.

1. Pro-

1. Probably for nutriment, and to render the bones lighter.
2. Does it prevent brittleness?

(N) INQUIRY INTO THE FORMATION AND GROWTH OF BONES AND CARTILAGES.

I. Is bone formed by the condensation or compaction of periosteum?

II. Are bones originally composed of gelatinous matter, which first gradually assumes the consistence of cartilage, and then that of bone?

III. Is ossification performed by the compressing force of arteries, muscles, and other surrounding parts?

IV. Are not bones generated by the deposition or secretion of osseous matter from the blood-vessels?

V. Relation of facts tending to establish the latter opinion, and to prove that callus is likewise deposited in the same manner.

VI. The growth of bones and cartilages, &c. to be reconsidered in a subsequent lecture.

(O) PARTICULAR DESCRIPTION OF THE SKELETON.

§ I. *The Bones of the Head, and their Peculiarities.*

I. Of the adult skull-bones in general.
  1. Divided into two principal classes.
    (a) The cranium, or brain-case.
    (b) The face, including the jaws.
  2. Figure of the skull.
    (a) Oviform above.
    (b) Flat laterally.
    (c) Narrowest at its fore and hinder parts.
  3. Its tables.
    (a) External.
    (b) Internal.
    (c) Diploe between them.
  4. Its surfaces.

(a) Smooth on its upper surface, or *calvaria.*

(b) Irregular at its basis, and where muscles are attached.

(c) Having foramina for the transmission of vessels and nerves.

(d) Ramifying channels imprinted by arteries, &c.

(e) Depressions interiorly, for the lodgment of the brain.

(f) Seams or sutures for the junction of certain bones.

Proper sutures.

(1) The coronal.

(2) The sagittal.

(3) The lambdoidal.

(4) The squammous, called false or spurious.

Common sutures.

(5) The ethmoidal.

(6) The sphenoidal.

(7) The transverse.

(8) The zygomatic.

II. Enumeration of the bones of the cranium.

1. The os frontis.
2. Two ossa parietalia,
   Verticis,
   Sincipitis,
   Bregmatis.
3. Two ossa temporum.
4. The os occipitis,
   Memoriæ,
   Basilare,
   Nervosum.
5. The os ethmoides,
   Cribriforme.
6. The os sphenoides,
   Multiforme,
   Cuneiforme,
   Pterygoideum,
   Vespertiliforme.

7. Ossa triquetra,
   Triangularia,
   Wormiana.
   } Supernumerary bones.

III. Enumeration of the bones of the face.

1. Two ossa nasi.
2. Two ossa unguis,
   Lachrymalia.
3. Two ossa malarum,
   Jugalia,
   Zygomatica.
4. The maxillaria superiora.
5. Two ossa palatina.
6. Two ossa spongiosa,
   Turbinata,
   Conchæ.
   } Inferiora.
7. The vomer.
8. The maxilla inferius,
   Mandibula.

IV. Enumeration of the bones in the mouth and throat.

1. The teeth.
   (a) Four incisores.
   (b) Two cuspidati.
   (c) Four bicuspides.
   (d) Four molares.
   (e) Two sapientiæ.
   } In each jaw.
2. The tongue-bone.
   Os hyoïdes,
   Bicorne.
   } Connected with the larynx, &c.

V. Enumeration of the internal ear-bones.

1. The malleus.
2. The incus.
3. The stapes.
4. The orbiculare.
   } In each ear.

§ II. *The Bones of the Trunk, and their Peculiarities.*

I. Of the trunk in general.

1. Its form and resemblances.

(a) Above, it resembles a truncated cone.
(b) Below, is seen an irregular bason, placed obliquely.
(c) Behind, a sigmoid jointed column, broadest at its base.
(d) Before, and (e) Laterally. } An interspace from the ribs to the pelvis.

2. Divisions into
(a) The thorax or chest.
(1) The costæ or ribs.
(2) The sternum or breast-bone.
(b) The spinal column or vertebræ.
(c) The pelvis or haunches, &c.

3. Connexions and uses.
Various.

II. Enumeration of the bones of the thorax.

1. The ribs, of two kinds.
(a) Seven true ribs, above.
(b) Five false ribs, below. } On each side.

2. The breast-bone or sternum.
Consisting of two or three portions.

III. Enumeration of the bones of the spine.

1. Seven cervical vertebræ.
(a) The upper bone, named atlas.
(b) The second, called dentatus, axis, or epistropheus.

2. Twelve dorsal vertebræ.

3. Five lumbar vertebræ.

IV. Enumeration of the bones of the pelvis.

1. The os innominatum: comprising,
(a) The os ilii, seated above, and laterally.
(b) The ischium, below.
(c) The pubis, before. } On each side.

2. The os sacrum, made up of five consolidated pieces,
3. The coccyx, } Or, rump bones.
Frequently composed of several portions.

§ III. *The Bones of the Extremities, and their Peculiarities.*

I. Their common properties.

1. Pendent.
2. Multiform.
3. Adapted for extensive motion.
4. Divisible into two classes:
   - (a) Superior
   - (b) Inferior

   } Extremities.

II. Enumeration of the bones of the upper extremities.

1. The shoulders: consisting of,
   - (a) The clavicle, Collar-bone.
   - (b) The scapula, Omoplata.

   } On each side.
2. The arms: composed of,
   - (a) The upper arm: viz.
     - Os brachii, Humeri.

     } On each side.
   - (b) Lower arm: viz.
     - (1) The radius, Focile minus.
     - (2) The ulna, Focile majus, Cubitus.

     } On each side.
3. The hand: viz.
   - (a) The carpus, or wrist: viz.

Upper row.

- (1) The os scaphoides, or naviculare.
- (2) Os lunare.
- (3) Os cuneiforme, pisiforme, or lenticulare.
- (4) Os orbiculare, or rotundum.

Lower row.

- (5) Trapezium, or cubiforme.
- (6) Os trapezoides, or pyramidale.
- (7) Os magnum, or capitatum.
- (8) Os unciforme.

} In each wrist.

(b) The metacarpus, or post-brachiale: viz.

A long bone opposed to,

(1) The thumb.
(2) The fore finger.
(3) The middle finger.
(4) The ring finger.
(5) The little finger.

} Forming the middle of each hand.

(c) The finger bones, or phalanges, opposed to the metacarpus, viz.

(1) Two bones for the thumb.
(2) Three for each of the fingers.

} To each hand.

(d) Two ossa sesamoidea, on the joints of the thumb.

III. Enumeration of the bones of the lower extremities.

1. The thigh, *i. e.*

Os femoris. One to each side.

2. The leg, consisting of,

(a) The tibia.
(b) The fibula,
Peronæus.
(c) The patella,
Rotula.

} In each leg.

3. The foot: viz. on each side:

(a) The tarsus, or instep: *i. e.*

First row.

(1) Astragalus.
(2) Os calcis.

Second row.

(3) Os naviculare, or scaphoides.
(4) Os cubiforme, or cuboides.
(5) Three cuneiformia.

(b) The metatarsus: viz.

Five longitudinal bones, corresponding to the metacarpal, and forming the centre of the foot.

(c) Phalanges of the toes, resembling those of the fingers.

(d) Two sesamoidal bones for the great toes.

(P) CONCLUDING REMARKS ON THE HUMAN SKELETON.

The account which is given of the bony system in this Course of Lectures, being principally intended to illustrate one of the branches of the animal economy, it would be useless to enter into a very exact detail of the *minutiæ* of osteology: such a description, when carried to its utmost extent, is too often deemed tedious and uninteresting even to medical students, whose pursuits render a particular detail more necessary.

The parts of our present subject which especially call for attention, are those that tend to elucidate the action of muscles, the course of large blood-vessels and nerves, the situation of important viscera, or the sciences of PHYSIOGNOMY and CRANIOGNOMY; the latter of which, indeed, are almost entirely founded on the structure of the skeleton.

To every artist who aims at eminence in his profession, some knowledge of the bones is indispensable; but this knowledge is more especially requisite for painters, engravers, and sculptors, who represent unclothed figures, or who would rival the works of the ancients. "Nature has so contrived the human body," says a writer on PICTURESQUE ANATOMY, "that the external parts cannot be well understood without a just idea of the internal ones, even of those which are buried in the centre of the body; I mean, the bones or skeleton, which are the foundation and frame whereon the whole fabric is built; and to which, as a basis, all the other parts are mediately or immediately referred."

The parts of the skeleton in a living subject, which principally exhibit themselves to the eye of an observer, are,

I. The exterior protuberances and depressions on the skull, the face, the jaw, and the neck.

II. The general figure and spinous processes of the vertebral column; with the curvatures of the ribs, the clavicles, the ossa innominata, and the sacrum.

III. The mobility of the scapula and patella, presenting various appearances in different attitudes; with the projecting

trochanters

trochanters and condyles in the thigh bones, the changeable positions of the radius, ulna, and hands; the ridges of the tibia, the eminences which form the ancles, and the arched figure of the metatarsal bones.

IV. *Leonardo da Vinci* has remarked, that it is peculiarly necessary for painters and sculptors to have an exact knowledge of the joints in general: because the length of all the limbs is increased in bending, and diminished in extending; besides, he says very justly, that the form of the joints becomes altered during action.

To enter particularly into the consideration of these phenomena, would be anticipating what belongs, more properly, to the Lectures themselves; and what cannot, perhaps, be fully understood without exemplification. We therefore proceed to give a summary account of the next class of organs; namely, those which connect the solid parts to each other.

(Q) OF THE LIGAMENTS AND FASCIÆ.

§ I. *Their Structure.*

Ligaments are,

I. Whitish membranes.
II. Of a tendinous composition.
III. Sometimes elastic and cartilaginous.
IV. Exceedingly tough and strong.
V. Slightly sensible during health.
VI. Sparingly supplied with vessels.
VII. Generally connecting bones to each other.

§ II. *Their Varieties.*

They may be divided into,

I. Elastic ligaments.
II. Inelastic ligaments.
III. Capsular ligaments.
IV. Round ligaments.
V. Crucial ligaments.
VI. Annular ligaments.

VII.

VII. Vaginal ligaments.
VIII. Broad ligaments.
IX. Ligamentous expansions, sometimes called Fasciæ or aponeuroses.

§ III. *Their Uses.*

I. To connect moveable bones or cartilages.
II. To unite immoveable bones and epiphyses.
III. To suspend cumbrous parts, especially in quadrupeds.
IV. To prevent the efflux of synovia and mucus.
V. To supply deficiencies of bony structure.
VI. To retain or bind down long tendons, passing over some of the joints.
VII. To afford attachment for several muscles and tendons.
VIII. To prevent the lapse of certain organs and viscera from their natural situations.

(R) ON THE ORGANS OF LOCO-MOTION IN GENERAL.

§ I. *Preliminary Observations.*

Strictly speaking, all those parts which in any way contribute to produce or facilitate our bodily motions, might be named ORGANS OF LOCO-MOTION; but for the sake of rendering our descriptions less embarrassing and easier to be remembered, they have been subdivided into three classes: viz. those for affording STABILITY to the system; those for the purpose of CONNEXION; and lastly, those for the exercise of voluntary, involuntary, and spontaneous MOTION. As the two former have already been described, it now remains for us to speak of the MUSCLES, TENDONS, BURSÆ MUCOSÆ, and SYNOVIAL VESSELS; which constitute our third class of organs.

§ II. *The Nature and Composition of Muscles.*

I. They are composed of soft, fleshy, ductile fibres.
II. Connected by intervening reticular membrane.

III.

III. May be subdivided into numerous bundles or fasciculi.
IV. Are neither tubular nor vesicular, but solid threads.
V. Generally of a red colour in warm-blooded animals.
VI. Highly vascular, and supplied with absorbents.
VII. Exquisitely sensible, but not equally so.
VIII. Contractile or irritable when stimulated.
IX. Commonly divisible into three portions: viz.

1. The head or origin. } Tendinous and inirritable.
2. The tail or insertion. }
3. The belly or middle. Fleshy and irritable.

§ III. *The Nature and Composition of Tendons.*

I. They are firm and strong chords, attached to muscles.
II. Whitish, and slightly vascular.
III. Obscurely sensible, with very few nerves.
IV. May be expanded or unravelled into membrane; either

1. Naturally, or } Forming aponeuroses and fasciæ.
2. Artificially. }

§ IV. *Of Bursæ Mucosæ and Synovial Vessels.*

I. Bursæ mucosæ, are,
1. Membranous sacculi or bags.
2. Connected with certain ligaments, tendons, and bones.
3. Secreting an albuminous matter.
4. To obviate the ill effects of friction.

II. Synovial vessels, are,
1. A fimbriated apparatus.
2. Seated within moveable joints.
3. Depositing an unctuous, glairy fluid.
4. To facilitate motion and prevent abrasion.

§ V. *The Names and Classification of Muscles.*

I. According to their uses.
II. Their comparative bulk.
III. Their similitude.
IV. Number of parts.

V. Their composition.
VI. The direction of their fibres.

§ VI. *Their various Attachments.*

I. To bone.
II. To periosteum.
III. To cartilage.
IV. To perichondrium.
V. To ligament.
VI. To membrane.
VII. To tendons.
VIII. To fleshy substance.
IX. To integuments.
X. To each other.

§ VII. *Phenomena of muscular Action.*

I. During their contraction, or active state.
  1. Shortening,
  2. Swelling,
  3. Tension,
  } Of the muscular fibres.

II. During their relaxation, or passive state.
  1. Lengthening,
  2. Subsiding,
  3. Softening,
  } Of the muscular fibres.

§ VIII. *Divisions of muscular Motion.*

I. Voluntary, or proceeding from an act of the will.
II. Involuntary, *i. e.* in direct opposition to the will.
III. Spontaneous, *i. e.* without consciousness or volition.

§ IX. *The Causes of muscular Action.*

I. Mental stimuli.
  1. Controllable.
  2. Uncontrollable.
  3. Unconscious.
  } Mediate.

II. Physical stimuli.
  1. Mechanical.

1. Mechanical.
2. Chemical. } Immediate.
3. Unknown.

Query. May there not be a rapid transmission or diffusion of some invisible fluid (probably the galvanic or electric fluid) through the substance of the nerves, and by their means to the muscles themselves, in every case of muscular action? What are the known relations which subsist between the muscles and nerves?

§ X. *The Effects of muscular Action,*

May be considered with regard to,

I. The minute imperceptible operations of the blood-vessels and absorbents; during the phenomena of circulation, secretion, nutrition, growth, &c.

II. The various functions of different viscera and organs.

III. The external actions of animals, in

1. Running.
2. Walking.
3. Leaping.
4. Swimming.
5. Flying.
6. Creeping.
7. Climbing.
8. Their partial motions.

Wherein may be observed,

(a) Their muscular force.
(b) Approximation.
(c) Celerity.
(d) Precision.
(e) Duration.
(f) Irregularity.
(g) Combined actions.

} (1) In health. (2) In disease.

(s) ENUMERATION AND DESCRIPTION OF THE MUSCLES;

To be exemplified as far as possible on the living subject, and by various models, drawings, or casts of the muscles in action.

§ I. *The Number and Distribution of the Muscles.*

I. The number of muscles.

In the human body are found to be so great a variety and intricacy of muscular structure, that a student in anatomy may almost be discouraged at hearing that there is no less a number of distinct muscles than 448. To medical gentlemen, and especially to surgeons, there is an indispensable necessity for their entering very particularly into the examination of these organs; but, for a popular view of the subject, it will be sufficient to name all of them, and then to describe the external muscles, together with those internal ones which perform a conspicuous part in the animal economy. For the benefit of young artists, however, (many of whom have been accustomed to attend these Lectures,) I shall take some pains in illustrating the doctrine of muscular motion on the living subject, and of displaying some accurate representations of the muscles, taken from nature.

II. Distribution of the muscles.

The difficulty of learning the names, situation, and uses of the muscles, will in a great measure vanish, when we shall have arranged them under their respective classes and regions. One of the chief objects in the study of myology is, to know what are the uses of the particular muscles, what actions they perform under given circumstances. Now, in order to discover the action of any particular muscle, we have only to inquire what are its attachments, or where it is connected? We are therefore to make that inquiry the main subject of attention; and in our endeavours to clear up this point, it will be proper to consider the muscles,

First, With respect to their ORIGIN.

Secondly, With regard to their INSERTION.

Thirdly, With relation to their USES.

Some of the muscles have no immediate connexion or attachment to the bony system, and others are attached by only one of their extremities: of this kind are the heart, the stomach, the œsophagus, the bowels, the tongue, the womb,

the

the bladder, the iris, &c. But, as all these muscular parts relate to one or other of the functions which will hereafter be separately considered, we need not make them an object of our present examination. The muscles of the larynx, the genitals, the nose, the eye, and internal ear, will likewise be described in our account of those organs, during some of the future Lectures.

Nearly all the muscles in the body exist in pairs. Those which co-operate in their uses, are called *congeneres*: and those which act in opposition to each other are named *antagonistæ*. A very large number of them have a denomination which at once indicates their mode of acting; as *flexors*, *extensors*, *elevators*, *depressors*, *supinators*, *pronators*, *abductors*, *adductors*, *corrugators*, *compressors*, *dilators*, *constrictors*, *attollents*, *retrahents*, *indicators*, *erectors*, &c. This kind of distribution of the muscles is well calculated to assist the recollection of students: I shall therefore throw them, as much as possible, into such an arrangement as may tend to facilitate the knowledge of their uses, as well as of their situations. But, it must be remembered that all the muscles which have two moveable points of attachment, will also have two modes of action, in different directions, according as either their origin or insertion may remain fixed.

§ II. *Enumeration of the Muscles, distributed into Classes; with their principal Synonyma.*

I. Muscles of the epicranium.

1. Occipito-frontalis,
   Epicranius,
   Digastricus capitis.
2. Corrugator supercilii,
   Verus frontalis.

II. Muscles of the eyelids.

1. Orbicularis palpebrarum.
2. Levator palpebræ superioris,
   Aperiens palpebrarum rectus.
3. Depressor palpebræ inferioris.

III. Muscles of the eye-ball.
  1. Straight muscles.
    (a) Levator oculi,
        Rectus superior,
        Superbus.
    (b) Depressor oculi,
        Rectus inferior,
        Humilis.
    (c) Adductor oculi,
        Rectus internus,
        Bibitorius.
    (d) Abductor oculi,
        Rectus externus,
        Indignabundus.
  2. Oblique muscles,
      Amatorii.
    (a) Obliquus superior,
        Longissimus oculi,
        Trochlearis.
    (b) Obliquus inferior,
        Brevissimus oculi.
IV. Muscles of the ear.
  1. External ear.
    (a) Common muscles.
      (1) Attollens aurem,
          Superior auris.
      (2) Anterior auris.
      (3) Retrahens aurem,
          Posterior auris.
    (b) Proper muscles.
      (1) Helicis major.
      (2) Helicis minor.
      (3) Tragicus.
      (4) Anti-tragicus.
      (5) Transversus auris.
  2. Internal ear.
    (a) Laxator tympani,

Externus

Externus mallei,
Obliquus auris,
Anterior mallei.

(b) Tensor tympani,
Internus auris,
Internus mallei.

(c) Stapedius.

V. Muscles of the nose, cheeks, and lips.

1. Proper to the nose.
Constrictor alæ nasi,
Compressor naris,
Transversalis.

2. Of the cheeks and lips.

(a) Situated above.

(1) Levator anguli oris,
Caninus,
Levator labiorum communis.

(2) Levator labii superioris alæque nasi,
Dilator alæ nasi,
Incisor pyramidalis.

(3) Levator labii superioris proprius,
Incisivus lateralis.

(4) Depressor labii superioris alæque nasi,
Incisivus medius.

(b) Situated below.

(1) Depressor anguli oris,
Triangularis.

(2) Depressor labii inferioris,
Quadratus.

(3) Levator labii inferioris,
Levator menti,
Incisivus inferior.

(c) Situated outwards.

(1) Buccinator,
Retractor anguli oris.

(2) Zygomaticus major,
Distortor oris,
Risorius.

(3) Zygo-

(3) Zygomaticus minor.

(d) Common to both lips.

Orbicularis oris,

Constrictor labiorum,

Osculator,

Sphincter.

VI. Muscles of the lower jaw.

1. On the side of the face.

(a) Temporalis,

Crotaphites.

(b) Masseter.

2. Concealed by the jaw.

(a) Pterygoideus internus,

——— major.

(b) Pterygoideus externus,

——— minor.

VII. Muscles near the front of the neck.

1. Platysma myoides,

Musculus cutaneus,

Latissimus colli,

Quadratus genæ.

2. Sterno-cleido-mastoideus,

Mastoideus.

VIII. Muscles of the throat and tongue.

1. Muscles which pull the throat down.

(a) Sterno-hyoideus.

(b) Sterno-thyroideus.

(c) Omo-hyoideus,

Coraco-hyoideus.

2. Muscles to move the throat upwards.

(a) Mylo-hyoideus.

(b) Genio-hyoideus.

(c) Stylo-hyoideus.

(d) Digastricus,

Biventer maxillæ inferioris.

3. Muscles which move the cartilages of the larynx.

(a) Hyo-thyroideus,

Thyreo-hyoideus.

(b) Crico-thyroideus.
(c) Arytenoideus transversus,
——— major.
(d) Arytenoideus obliquus,
——— minor.
(e) Crico-arytenoideus posticus.
(f) Crico-arytenoideus lateralis.
(g) Thyreo-arytenoideus.
(h) Thyreo-epiglottideus.
(i) Aryteno-epiglottideus.

4. Muscles for the palate and pharynx.
(a) Azygos uvulæ,
Levator uvulæ.
(b) Levator palati mollis,
Salpingo-staphilinus,
Sphæno-staphilinus,
Sphæno-palatinus,
Pterygo-staphilinus,
Petro-salpingo-staphilinus.
(c) Circumflexus palati,
Tensor palati mollis,
Palato-salpingus,
Staphilinus externus,
Pterygo-staphilinus,
Sphæno-salpingo-staphilinus,
Musculus tubæ Eustachianæ.
(d) Stylo-pharyngeus.
(e) Palato-pharyngeus,
Salpingo-pharyngeus,
Thyreo-staphilinus,
Thyreo-pharyngo-staphilinus.
(f) Constrictor isthmi faucium,
Glosso-staphilinus.
(g) Constrictor pharyngeus superior,
Cephalo-pharyngeus,
Pterygo-pharyngeus,
Mylo-pharyngeus,

Glosso-pharyngeus,
Pterygo-syndesmo-staphilino-pharyngeus.

(h) Constrictor pharyngeus medius,
Hyo-pharyngeus,
Syndesmo-pharyngeus,
Cephalo-pharyngeus,
Chondro-pharyngeus.

(i) Constrictor pharyngeus inferior,
Thyreo-pharyngeus,
Crico-pharyngeus,
Crico-thyreo-pharyngeus.

(j) Vaginalis gulæ,
Œsophagus.

5. Muscles which move the tongue.

(a) Stylo-glossus.

(b) Hyo-glossus,
Basio-chondro-cerato-glossus.

(c) Genio-glossus,
Polychestus,
Genio-hyo-glossus.

(d) Lingualis,
Basio-glossus.

IX. Muscles situated upon the thorax.

1. On its anterior part.

(a) Pectoralis major.

(b) Pectoralis minor,
Serratus minor anticus.

(c) Subclavius,
Subclavianus.

(d) Serratus magnus,
Serratus major anticus.

2. Between the ribs and within the chest.

(a) Intercostales externi.

(b) Intercostales interni.

(c) Levatores costarum,
Supra-costales.

(d) Depressores costarum,
Sub-costales.

(e) Sterno-

(e) Sterno-costalis,
Triangularis sterni.

3. On the fore part of the neck, close to the vertebræ.

(a) Longus colli.

(b) Rectus internus capitis major,
Rectus capitis anticus longus.

(c) Rectus internus capitis minor,
Rectus capitis anticus brevis.

(d) Rectus capitis lateralis,
Transversalis anticus primus.

4. On the posterior part of the trunk.

(a) First layer.

(1) Trapezius,
Cucullaris.

(2) Latissimus dorsi,
Aniscalptor.

(b) Second layer.

(1) Serratus posticus inferior.

(2) Serratus posticus superior.

(3) Rhomboideus major.

(4) Rhomboideus minor.

(5) Splenius capitis,
Splenius colli.

(c) Third layer.

(1) Spinalis dorsi,
Transversalis dorsi.

(2) Longissimus dorsi,
Cervicalis descendens.

(3) Sacro-lumbalis,
Accessorius.

(4) Complexus,
Biventer cervicis,
Trigeminus.

(5) Trachelo-mastoideus,
Mastoideus lateralis,
Complexus minor.

(6) Levator scapulæ,

Musculus patientiæ,
Angularis.

(d) Fourth layer.

(1) Semi-spinalis dorsi,
Transverso-spinalis dorsi,
Semi-spinalis externus.

(2) Multifidus spinæ,
Semi-spinalis internus.

(3) Semi-spinalis colli,
Transverso-spinalis colli,
Spinalis cervicis.

(4) Transversalis colli,
Transversalis cervicis.

(5) Rectus capitis posticus major.

(6) Rectus capitis posticus minor.

(7) Obliquus capitis superior,
Obliquus capitis minor.

(8) Obliquus capitis inferior,
Obliquus capitis major.

(9) Scalenus anticus,
Scalenus primus.

(10) Scalenus medius,
Scalenus secundus.

(11) Scalenus posticus,
Scalenus tertius.

(12) Inter-spinales colli,
Spinalis colli minoris.

(13) Inter-transversales colli,
Transversalis colli minoris.

(14) Inter-spinales dorsi,
Spinalis dorsi minoris.

(15) Inter-transversales lumborum,
Transversalis lumborum minoris.

X. Muscles connected with the abdomen.

1. Upon the anterior parts of the belly.

(a) Obliquus descendens externus,
Obliquus major.

(b) Ob-

(b) Obliquus ascendens internus,
Obliquus minor.
(c) Transversalis,
Transversus abdominis.
(d) Rectus abdominis.
(e) Pyramidalis.

N. B. To point out and describe,
I. The linea alba.
II. Linea semilunaris.
III. Sheath of the rectus.
IV. The umbilicus.
V. Abdominal ring.
VI. Spermatic chord.
VII. The crural arch.
VIII. Regions of the abdomen.

2. Muscles within the cavity of the abdomen.
(a) Diaphragma.
(b) Quadratus lumborum,
Lumbaris externus.
(c) Psoas parvus.
(d) Psoas magnus,
Lumbaris internus.
(e) Iliacus internus.

3. Within the pelvis.
(a) Obturator internus,
Marsupialis,
Bursalis.
(b) Coccygeus.

4. Muscles of the anus.
(a) Sphincter ani,
——— externus.
(b) Levator ani,
——— internus.

5. About the male organs of generation.
(a) Dartos.
(b) Cremaster.

(c) Erector penis,
Ischio-cavernosus.
(d) Accelerator urinæ,
Ejaculator seminis.
(e) Transversus perinæi,
Transversalis urethræ.

6. About the female organs of generation.
(a) Erector clitoridis,
Ischio-cavernosus.
(b) Sphincter vaginæ,
Constrictor cunni.

XI. Muscles of the superior extremity.

1. Situated on the scapula.
(a) Supra-spinatus,
Super-scapularis.
(b) Infra-spinatus.
(c) Teres minor.
(d) Teres major.
(e) Deltoides.
(f) Coraco-brachialis,
Perforatus casserii.
(g) Sub-scapularis.

2. Situated on the os humeri.
(a) Biceps flexor cubiti,
Biceps internus brachii,
Coraco-radialis.
(b) Brachialis internus.
(c) Triceps extensor cubiti,
Gemellus,
Brachiæus externus,
Anconæus major, externus, et internus.
(d) Anconæus,
Anconæus minor.

N. B. To describe the fascia or tendinous expansion which covers the fore-arm.

3. Situated on the cubit or fore-arm.

(a) Muscles arising chiefly from the inner condyle.

(1) Pronator radii teres,
Pronator obliquus.

(2) Palmaris longus,
Ulnaris gracilis.

(3) Flexor carpi radialis,
Radialis internus.

(4) Flexor carpi ulnaris,
Ulnaris internus.

(5) Flexor digitorum sublimis,
Perforatus,
Flexor secundi internodii digitorum.

(6) Flexor digitorum profundus,
Perforans,
Flexor tertii internodii digitorum.

(7) Lumbricales,
Fidicinales,
Flexor primi internodii digitorum.

(8) Flexor longus pollicis,
Longissimus pollicis.

(9) Pronator radii quadratus,
Pronator brevis,
Pronator transversus.

(b) Arising chiefly from the outer condyle.

(1) Supinator radii longus,
Supinator major.

(2) Extensor carpi radialis longior, } Radialis
(3) ———————— brevior, } externus.

(4) Extensor carpi ulnaris,
Ulnaris externus.

(5) Extensor digitorum communis,
Digitorum tensor.

(6) Extensor metacarpi pollicis,
Extensor primi internodii,
Abductor longus pollicis.

(7) Extensor primi internodii,
Extensor secundi internodii,

Extensor

Extensor minor pollicis.

(8) Extensor secundi internodii,
Extensor tertii internodii,
Extensor major pollicis.

(9) Indicator,
Extensor digiti primi,
Extensor indicis proprius.

(10) Extensor minimi digiti,
Auricularis.

(11) Supinator radii brevis,
Supinator minor.

(c) Muscles seated on the hand.

1) Abductor pollicis manus,
Abductor brevis.

(2) Adductor pollicis manus.

(3) Flexor brevis pollicis,
Flexor primi et secundi ossis pollicis.

(4) Flexor ossis metacarpi,
Opponens pollicis.

(5) Palmaris brevis,
Palmaris cutaneus.

N. B. To describe the palmar fascia arising from the small tendon of the palmaris longus.

(6) Abductor indicis manus.

(7) Abductor minimi digiti.

(8) Adductor minimi digiti.

(9) Flexor parvus minimi digiti.

(10) Interossei externi, tres.

(11) ——— interni, quatuor.

XII. Muscles of the lower extremity.

1. Situated on the pelvis.

(a) Pectinalis,
Pectinæus.

(b) Triceps femoris, comprehending

Adductor longus,
——— brevis,
——— magnus,
} Femoris.

(c) Ob-

(c) Obturator externus,
Rotator femoris extrorsum.
(d) Glutæus maximus.
(e) ——— medius.
(f) ——— minimus.
(g) Pyriformis,
Iliacus externus.
(h) Geminus, Gemellus. } Superior et inferior.
(i) Quadratus femoris.

N. B. To describe the fascia lata, which invests the lower extremity.

2. Muscles situated on the thigh.
(a) Tensor vaginæ femoris,
Membranosus,
Fascialis aponeurosis.
(b) Rectus femoris,
Gracilis anterior.
(c) Vastus externus.
(d) ——— internus.
(e) Cruralis,
Femoræus.
(f) Sartorius,
Longissimus femoris.
(g) Gracilis,
Gracilis interior,
Rectus internus.
(h) Semi-tendinosus,
Semi-nervosus.
(i) Semi-membranosus.
(j) Biceps flexor cruris.
(k) Poplitæus.

3. Situated on the leg.
(a) Gastrocnemius externus, Gemellus. (b) Gastrocnemius internus, Soleus. } Extensor tarsi magnus.
(c) Plantaris,

(c) Plantaris,
Tibialis gracilis,
Extensor tarsi minor.
(d) Tibialis posticus.
(e) Peronæus longus,
——— posticus,
——— primus.
(f) Peronæus brevis,
——— anticus,
——— secundus.
(g) Peronæus minimus.
(h) Tibialis anticus.
(i) Extensor longus digitorum pedis,
Peronæus tertius.
(j) Extensor proprius pollicis pedis,
Extensor longus pollicis.
(k) Flexor longus digitorum pedis,
Perforans,
Profundus.
(l) Flexor longus pollicis pedis.

4. Situated on the foot.
(a) Flexor digitorum accessorius,
Massa carnea Sylvii.
(b) Flexor brevis digitorum pedis,
Perforatus,
Sublimis.
(c) Extensor brevis digitorum pedis.
(d) Lumbricales pedis.
(e) Flexor brevis pollicis pedis.
(f) Adductor pollicis pedis.
(g) Abductor pollicis pedis.
(h) Abductor minimi digiti pedis.
(i) Flexor brevis minimi digiti.
(j) Interossei externi, quatuor.
(k) ——— interni, tres.
(l) Transversalis pedis.

N. B. To describe the plantar aponeurosis. § III.

§ III. *Enumeration of the Muscles, with their respective Attachments.*

N. B. All the muscles distinguished by an asterisk are single; the rest are in pairs, or exist in a greater number.

I. *Occipito-frontalis, attached to,

1. The superior ridge of the occipital bone.
2. All the upper part of the cranium.
3. The skin of the forehead and eyebrows.

II. Corrugator supercilii, attached to,

1. The internal angular process of the os frontis.
2. The junction of the os nasi with the forehead.
3. A small part of the orbit of the eye.
4. The eyebrow and fibres of the occipito-frontalis.

III. Orbicularis palpebrarum, attached to,

1. The edge of the bony orbit.
2. The palpebræ and ciliæ.
3. Nasal process of the superior maxillary bone.
4. Part of the occipito-frontalis and corrugator supercilii.

IV. Levator palpebræ superioris, is attached to,

1. The bottom of the orbit, near the optic foramen.
2. By a broad expansion, into the upper eyelid.

V. Depressor palpebræ superioris, attached to,

1. The inferior edge of the orbit, in common with the orbicularis.
2. The lower eyelid, intermixing with the orbicularis.

VI. Levator oculi, attached to,

1. Bottom of the orbit, above the foramen opticum.
2. The superior and fore part of the tunica sclerotica.

VII. Depressor oculi, attached to,

1. Bottom of the orbit, below the foramen opticum.
2. The inferior and fore part of the sclerotic coat of the eye.

VIII. Adductor oculi, attached to,

1. The orbit, between the obliquus superior and depressor.
2. Opposite the inner angle of the eye.

IX. Abductor oculi, attached to,

1. The bony partition between the foramen opticum and lacerum.

2. The globe, opposite the outer canthus.

X. Obliquus superior, attached to,

1. Edge of the foramen opticum, between the levator and adductor; directing its course toward the root of the nose.

2. Passes with its round tendon through a cartilaginous ring or pulley, affixed to the under and inner part of the superciliary ridge of the os frontis; whence it turns backward, and is inserted into the lateral and posterior part of the eyeball.

XI. Obliquus inferior, attached to,

1. Edge of the orbit, between the nasal duct and inferior orbitary fissure.

2. Into the sclerotica, between the abductor muscle and optic nerve.

XII. Attollens aurem, attached to,

1. The tendon of occipito-frontalis, over the fascia of the temporal muscle.

2. Upper part of the ear, opposite the anti-helix.

XIII. Anterior auris, attached to,

1. Posterior part of the zygoma.

2. The back of the helix, opposite the concha.

XIV. Retrahens aurem, attached to,

1. Outer and back part of the root of the mastoid process of the os temporis.

2. Back of the ear, opposite the septum which divides the scapha and concha.

XV. Helicis major, attached to,

1. The anterior acute part of the helix.

2. The cartilage of the helix above the tragus.

XVI. Helicis minor, attached to,

1. The lower and fore part of the helix.

2. The crus helicis, near the fissure in the cartilage opposite the concha.

XVII. Tragicus, attached to,

1. The outer and middle part of the concha, near the tragus.

2. The point of the tragus.

XVIII. Anti-tragicus, attached to,

1. The internal part of the cartilage which supports the anti-tragus.

2. The tip of the anti-tragus, as far as the bottom of the anti-helix.

XIX. Transversus auris, attached to,

1. The prominent part of the concha on the back of the ear.

2. The inner part of the helix.

XX. Laxator tympani, attached to,

1. The spinous process of the sphænoid bone, inside the Eustachian tube.

2. Entering the tympanum, it is inserted into the long process or handle of the malleus.

XXI. Tensor tympani, attached to,

1. The cartilaginous extremity of the Eustachian tube, within the tympanum, bending round the ligamentous ridge, as over a pulley.

2. The neck of the malleus, above the little process, as far as its handle.

XXII. Stapedius, attached to,

1. The bony pyramid at the bottom of the tympanum, near the cells of the mastoid process.

2. Emerging from the apex of the pyramid, through a small hole, is inserted into the posterior side of the neck of the stapes.

XXIII. Constrictor alæ nasi, attached to,

1. The superior maxillary bone, near the lower edge of the orbit, whence it runs transversely.

2. The cartilaginous extremity of the nose, connecting itself with the levator labii superioris alæque nasi, and with the occipito-frontalis above.

XXIV. Levator anguli oris, attached to,

1. The upper jaw, above the canine tooth and below the inferior edge of the orbit.

2. The fibres of the orbicularis oris at the angle of the lips.

XXV. Levator labii superioris alæque nasi, attached to,

1. The orbitar and nasal process of the superior maxillary bone.

2. The upper lip and orbicularis oris.

3. Outer part of the ala nasi.

XXVI. Levator labii superioris proprius, attached to,

1. The under edge of the orbit, above the incisor teeth.

2. The middle of the upper lip.

XXVII. Depressor labii superioris alæque nasi, attached to,

1. The outer part of the socket of the front teeth, behind the orbicularis oris.

2. The root of the cartilage of the nostril or ala nasi.

3. The substance of the middle portion of the upper lip.

XXVIII. Depressor anguli oris, attached to,

1. The basis and outer edge of the chin, between the buccinator and zygomaticus major, to which it unites.

2. The commissure or angle of the mouth.

XXIX. Depressor labii inferioris, attached to,

1. The fore part of the chin, under the last-named muscle.

2. Middle of the under lip, intermixing with the orbicularis.

XXX. Levator labii inferioris, attached to,

1. The socket of the lateral incisor.

2. The integument at the centre of the chin and orbicularis inferior.

XXXI. Buccinator, attached to,

1. The coronoid process of the lower jaw.

2. Near the pterygoid process of the sphænoid bone.

3. The corner of the mouth, uniting with the orbicularis.

XXXII. Zygomaticus major, attached to,

1. The os malæ, near the zygomatic suture.

2. Angle of the lip, and to the contiguous muscles.

XXXIII. Zygomaticus minor, attached to,

1. The cheek bone, above the last-named muscle.

2. The commissure of the mouth and levator anguli oris,

XXXIV. *Orbicularis oris, attached to,

1. The angles of the mouth, entirely surrounding it, and constituting

constituting the thicker portion of the lips; often giving off a separate slip of muscle, called *nasalis labii superioris*, which is inserted into,

2. The inferior part of the nose, and middle of the upper lip.

XXXV. Temporalis, attached to,

1. A semicircular ridge in the lateral and inferior parts of the parietal bone.

2. The squammous edge of the temporal bone.

3. The external angular process of the os frontis.

4. The temporal process of the sphænoidal bone.

5. An aponeurosis which covers the muscle itself.

6. Around the coronoid process of the lower jaw, and along its fore part to the last dens molaris; having first collected its radiated portions, and passed under the zygomatic arch.

XXXVI. Masseter, attached to,

1. The inferior edge of the os malæ and zygomatic process.

2. The outside and coronoid process of the lower jaw.

XXXVII. Pterygoideus internus, attached to,

1. The internal plate of the pterygoid process of the sphænoid bone.

2. The os palati between the plates of the pterygoid process.

3. The bottom and internal part of the lower jaw near its angle.

XXXVIII. Pterygoideus externus, attached to,

1. The outer plate of the external pterygoid process and to the adjoining maxillary bone.

2. The root of the temporal process of the sphænoid bone.

3. The neck of the condyloid process, and capsular ligament of the lower jaw.

XXXIX. Platysma myoides, attached to,

1. The cellular membrane over the deltoid and pectoral muscles.

2. The side of the lower jaw and adjacent skin.

XL. Sterno-cleido-mastoideus, attached to,

1. The upper edge of the sternum and fore part of the clavicle,

2. The

2. The mastoid process, and by a detached fascia into the os occipitis.

XLI. Sterno-hyoideus, attached to,

1. The upper and inner edge of the sternum, the clavicle, and cartilage of the first rib.

2. The base of the os hyoides.

XLII. Sterno-thyroideus, attached to,

1. Inner and upper part of the sternum, &c. under the last muscle.

2. The rough inferior edge of the thyroid cartilage.

XLIII. Omo-hyoideus, attached to,

1. Superior costa of the scapula, near the semilunar notch and coracoid process.

2. Passing round the throat, into the side of the base of the os hyoides.

XLIV. Mylo-hyoideus, attached to,

1. The whole inner part of the lower jaw.

2. Lower margin of the basis of the os hyoides.

XLV. Genio-hyoideus, attached to,

1. A rough protuberance behind the symphysis of the chin.

2. The basis of the os hyoides.

XLVI. Stylo-hyoideus, attached to,

1. The middle of the styloid process of the os temporis.

2. The os hyoides at the junction of its basis and cornu.

XLVII. Digastricus, attached to,

1. The fossa at the root of the mastoid process of the os temporis.

2. Perforating the last-named muscle, it is affixed to the os hyoides.

3. Turning upwards, is then inserted into a rough sinuosity at the lower and anterior edge of the chin.

XLVIII. Hyo-thyroideus, attached to,

1. The base and horn of the os hyoides.

2. Lower rough edge of the thyroid cartilage.

XLIX. Crico-thyroideus, attached to,

1. The lateral and fore part of the cricoid cartilage.

2. Inferior part of the thyroid cartilage and its inferior cornu.

L. Ary-

L. *Arytænoideus transversus, attached to,

1. The arytænoid cartilage on one side.
2. Across the arytænoid cartilage on the other side.

LI. Arytænoideus obliquus, attached to,

1. The root of the arytænoid cartilage on one side.
2. The upper part of the opposite arytænoid cartilage.

LII. Crico-arytænoideus posticus, attached to,

1. The back of the cricoid cartilage.
2. Posterior part of the base of the arytænoid cartilage.

LIII. Crico-arytænoideus lateralis, attached to,

1. The broadest part of the cricoid cartilage.
2. Side of the basis of the arytænoid cartilage.

LIV. Thyreo-arytænoideus, attached to,

1. The under and back part of the thyroid cartilage.
2. The fore and upper part of the arytænoid cartilage.

LV. Thyreo-epiglottideus, attached to,

1. The head of the thyroid cartilage.
2. The edge of the epiglottis.

LVI. Arytæno-epiglottideus, attached to,

1. The upper and lateral part of the arytænoid cartilage.
2. The side of the epiglottis.

LVII. *Azygos uvulæ, attached to,

1. The posterior extremity of the suture which joins the palate bones.
2. The tip of the uvula.

LVIII. Levator palati mollis, attached to,

1. The point of the petrous portion of the os temporis.
2. The membranous and bony parts of the Eustachian tube.
3. The sphænoidal bone.
4. The velum pendulum palati, and root of the uvula.

LIX. Circumflexus palati, attached to,

1. The spinous process of the sphænoid bone.
2. The membranous beginning of the Eustachian tube.
3. Running along the pterygoideus internus, and passing over the hook of the internal pterygoid process, it then is affixed to the velum pendulum palati, and to the semilunar edge of the os palati.

LX. Stylo-pharyngeus, attached to,

1. The root or basis of the styloid process.

2. The side of the pharynx and back of the thyroid cartilage.

LXI. Palato-pharyngeus, attached to,

1. The middle of the soft palate, around the entrance of the fauces.

2. The edge of the upper and back part of the thyroid cartilage.

LXII. Constrictor isthmi faucium, attached to,

1. The side and root of the tongue.

2. The middle of the soft palate, and root of the uvula.

LXIII. Constrictor pharyngeus superior, attached to,

1. The cuneiform process of the os occipitis.

2. The pterygoid process of the sphænoid bone.

3. Both jaws, near the posterior dentes molares.

4. The root of the tongue and palate.

5. The middle of the pharynx at its entrance.

LXIV. Constrictor pharyngeus medius, attached to,

1. The apex and cornu of the os hyoides.

2. The middle of the cuneiform process of the os occipitis.

3. The back and middle part of the pharynx.

LXV. Constrictor pharyngeus inferior, attached to,

1. The outside of the wing of the thyroid cartilage.

2. The cricoid cartilage, near the crico-thyroideus muscle.

3. Around the beginning of the œsophagus or gullet.

LXVI. Vaginalis gulæ, is attached to

The membranous tube of the œsophagus, like a sheath, having its muscular fibres chiefly in a longitudinal direction.

LXVII. Stylo-glossus, attached to,

1. The extremity of the styloid process and its ligament.

2. The root, side, and interior substance of the tongue.

LXVIII. Hyo-glossus, attached to,

1. The base, the horn, and cartilage of the os hyoides.

2. The side of the tongue, near the last-named muscle.

LXIX. Genio-glossus, attached to,

1. The inside of the symphysis of the lower jaw.

2. The

2. The tip, middle, and root of the tongue.

3. The basis of the os hyoides, near its horn.

LXX. Lingualis, attached to,

1. The root of the tongue, laterally, running between the stylo and genio-glossus, to the

2. Tip of the tongue, with a part of the stylo-glossus.

LXXI. Pectoralis major, attached to,

1. The cartilages of the fifth and sixth ribs.

2. Nearly the whole length of the sternum.

3. Part of the clavicle, at its sternal extremity.

4. By two broad tendons to the outside of the groove in the humerus for lodging the long head of the biceps, forming the anterior border of the hollow in the axilla.

LXXII. Pectoralis minor, attached to,

1. The upper edges of the third, fourth, and fifth ribs.

2. The apex and inside of the coracoid process of the scapula.

LXXIII. Subclavius, attached to,

1. The cartilage of the first rib.

2. The lower part of the clavicle.

LXXIV. Serratus magnus, attached to,

1. Three upper false ribs and all the true ones, except the first, by pointed fleshy digitations.

2. The whole basis of the scapula, by which it is covered.

LXXV. Intercostales externi, attached to,

1. The inferior acute edge of each rib, passing obliquely forward, along the costal interspace from the spine to near the cartilages of the ribs.

2. The upper obtuse edge of each rib, as far back as the spine.

LXXVI. Intercostales interni, attached to

The intercostal spaces, after the same manner as the external layer, but running from before backwards, from the sternum to the angle of each rib.

LXXVII. Levatores costarum, attached to,

1. The transverse processes of eleven dorsal vertebræ and one cervical.

2. The back part and outside of the subjacent extremities of the ribs.

LXXVIII. Depressores costarum, attached to,

1. The upper part of the ribs near their junction with the transverse processes of the vertebræ.

2. The corresponding portion of the ribs above.

LXXIX. Sterno-costalis, attached to,

1. The ensiform cartilage, laterally, and middle bone of the sternum.

2. Cartilages of the third, fourth, and fifth ribs, by triangular slips.

LXXX. Longus colli, attached to,

1. The bodies of three upper dorsal vertebræ, laterally, and the transverse processes of four lowermost cervical vertebræ.

2. Anterior part of the second vertebra of the neck.

LXXXI. Rectus internus capitis major, attached to,

1. The points of the five inferior cervical vertebræ.

2. The cuneiform process of the occipital bone.

LXXXII. Rectus internus capitis minor, attached to,

1. The fore part of the first cervical vertebra.

2. The root of the condyloid process of the occipital bone.

LXXXIII. Rectus capitis lateralis, attached to,

1. The transverse process of the atlas, near its extremity.

2. The side of the cuneiform process of the os occipitis.

LXXXIV. Trapezius, attached to,

1. The superior transverse line of the occipital bone, down to the mastoid process.

2. The ligamentum nuchæ, affixed to the five upper spinous processes of the cervical vertebræ.

3. The two inferior spinous processes of the vertebræ of the neck, and the two upper ones of the back. Likewise,

4. By a converging mass of fibres, into the posterior extremity of the clavicle, the acromion scapulæ, and nearly the whole length of its spine or middle ridge.

LXXXV. Latissimus dorsi, attached to,

1. The posterior part of the spine of the ilium.

2. The middle of the sacrum, loins, and back, and to several of the inferior ribs. Then,

3. Obliquely ascending from below, and advancing laterally from above, till it gets over the lower angle of the scapula, and arrives at the axilla, its muscular fibres are collected, twisted, and folded, to concur in forming the armpit; whence it goes to be inserted into the inner edge of the groove of the os humeri, uniting its tendon with that of the teres major.

LXXXVI. Serratus posticus inferior, attached to,

1. The spinous processes of the three lower dorsal and four upper lumbar vertebræ, under the former muscle.

2. Four inferior ribs, near their cartilages.

LXXXVII. Serratus posticus superior, attached to,

1. The spinous processes of three lowermost cervical vertebræ, and two superior dorsal, covering the splenius.

2. The second, third, and fourth ribs, by fleshy digitations.

LXXXVIII. Rhomboideus major, attached to,

1. Spinous processes of the four upper dorsal vertebræ.

2. All the basis of the scapula below its spine or ridge.

LXXXIX. Rhomboideus minor, attached to,

1. Three lower spinous processes of the vertebræ of the neck, and to the ligamentum nuchæ.

2. The basis of the scapula, from its spine to its superior angle.

XC. Splenius, attached to,

1. Five lower spinous processes of the cervical vertebræ, and two upper ones of the back.

2. The ninth and tenth vertebræ of the back.

3. Upper part of the mastoid process and transverse ridge of the os occipitis.

4. Transverse processes of three or four upper vertebræ of the neck.

XCI. Spinalis dorsi, attached to,

1. The spinous processes of two upper vertebræ of the loins, and four lower dorsal.

2. Spinous processes of the 6th, 7th, 8th, 9th, 10th, and 11th upper dorsal vertebræ.

XCII. Longissimus dorsi, attached to,

1. The side and spinous processes of the os sacrum, the posterior ridge of the ilium, the roots of the transverse processes of the inferior lumbar vertebræ.

2. Transverse processes of the dorsal vertebræ, the lower edges and heads of all the true ribs, except the two inferior; and at the upper part of this muscle, a fleshy portion joins the cervicalis descendens.

XCIII. Sacro-lumbalis, attached to,

1. The lateral part and superior spines of the os sacrum, the external labium and crista of the ilium, by a tendon common to this muscle, and the longissimus dorsi.

2. The transverse processes of the lumbar vertebræ, and eleven of the ribs, running from below upwards. Some thin slender slips of flesh passing over the ribs have been denominated *musculus accessorius sacro-lumbaris*; while other fleshy slips, above these, have been called *cervicalis descendens*.

XCIV. Complexus, attached to,

1. The transverse processes of seven upper dorsal and four lower cervical vertebræ.

2. The inferior edge of the protuberance in the middle of the occipital bone. A distinct portion of this muscle has been named *biventer cervicis* by ALBINUS.

XCV. Trachelo-mastoideus, attached to,

1. The transverse processes of three superior dorsal, and five inferior cervical vertebræ.

2. The back part of the mastoid process of the os occipitis.

XCVI. Levator scapulæ, attached to,

1. Five uppermost transverse processes of the neck.

2. Superior angle of the scapula, and the edge of its basis.

XCVII. Semi-spinalis dorsi, attached to,

1. The

1. The transverse processes of the 7th, 8th, 9th, and 10th dorsal vertebræ.

2. Four spinous processes belonging to the upper vertebræ of the back, and the last of the neck.

XCVIII. Multifidus spinæ, attached to,

1. The side of the sacrum, back part of the ilium, the transverse and oblique processes of the lumbar vertebræ, the transverse processes of the dorsal vertebræ, and four lowermost transverse processes of the neck.

2. The spinous processes of the vertebræ of the loins, back, and inferior six of the neck.

XCIX. Semi-spinalis colli, attached to,

1. The transverse processes of six upper vertebræ of the back.

2. Five inferior spinous processes of the cervical vertebræ.

C. Transversalis colli, attached to,

1. Five of the upper transverse processes of the dorsal vertebræ.

2. The transverse processes of the cervical vertebræ.

CI. Rectus capitis posticus major, attached to,

1. The second vertebra of the neck, at its transverse process.

2. The lower occipital ridge, near the *rectus capitis lateralis.*

CII. Rectus capitis posticus minor, attached to,

1. A small protuberance in the back of the atlas.

2. Inferior part of the occipital ridge, near the great foramen.

CIII. Obliquus capitis superior, attached to,

1. The transverse process of the atlas.

2. The inferior occipital ridge, behind the mastoid process.

CIV. Obliquus capitis inferior, attached to,

1. Spinous process of the second vertebra of the neck.

2. Transverse process of the atlas.

CV. Scalenus anticus, attached to,

1. Transverse processes of the 4th, 5th, and 6th cervical vertebræ.

2. Upper side of the first rib, near its cartilage.

CVI. Scalenus medius, attached to,

1. The seven transverse processes of the cervical vertebræ.

2. The upper and exterior part of the first true rib.

CVII. Scalenus posticus, attached to,

1. Transverse processes of the 5th and 6th cervical vertebræ.

2. Upper edge of the second rib, near the spine.

CVIII. Inter-spinales colli, attached to

The spinous processes of five inferior cervical vertebræ, on each side.

CIX. Inter-transversales colli, attached to

The inferior transverse processes of the cervical vertebræ, and the uppermost of the back; six muscles on each side.

CX. Inter-spinales dorsi, attached to

The spinous processes of all the dorsal vertebræ.

CXI. Inter-transversales dorsi, attached to

The transverse processes of all the dorsal vertebræ.

CXII. Inter-spinales lumborum, attached to

All the spinous processes of the lumbar vertebræ.

CXIII. Inter-transversales lumborum, attached to

All the transverse processes of the lumbar vertebræ.

CXIV. Obliquus descendens externus, attached to,

1. The lower edges of the eight inferior ribs; intermixing its fibres with those of the serratus magnus, pectoralis major, intercostals, and latissimus dorsi; meeting its fellow in the middle of the abdomen, at the *umbilicus* and *linea alba*; and joining the flat tendon of the inner oblique muscle, at the *linea semilunaris*.

2. Running down to be implanted into the crista of the ilium and pubis; between which it is bounded by a ligamentous margin, named the crural arch or *Poupart's ligament*; and near the lower part of its tendon there is a fissure or oval opening, called *abdominal ring*, for the transmission of the *spermatic chord* in males, or the *round ligament* in females.

CXV. Obliquus ascendens internus, attached to,

1. The

1. The whole circular edge of the ilium; the three lower spinous processes of the lumbar vertebræ, and to the sacrum; by a tendon in common with the serratus posticus and latissimus dorsi.

2. Ascending obliquely upwards, and spreading itself in a radiated direction, to meet its fellow at the linea alba, &c. and by detached fibres to the pubis, the ensiform cartilage, and six inferior ribs.

CXVI. Transversalis, attached to,

1. The inner surface of seven lower ribs; the transverse processes of four lumbar vertebræ, and the last of the back; the whole spine of the ilium internally; mixing with the tendon of the external and internal oblique muscle, at its lower part.

2. Nearly the whole of the linea alba, from the xiphoid cartilage downwards.

CXVII. Rectus abdominis, attached to,

1. The lower extremity of the sternum, on its outside; three inferior true ribs, and the first false one; being intersected by three or four tendinous bands, and completely enclosed within a sheath formed by the *aponeurosis* of the transversales and oblique muscles.

2. To the inner and upper labium of the os pubis, near its symphysis.

CXVIII. Pyramidalis, attached to

The upper edge of the pubis; abruptly converging into a pointed extremity above, which is partly enclosed within the vagina of the rectus, and joins its fellow in the linea alba.

CXIX. *Diaphragma, attached to,

1. The ensiform cartilages; seven lower ribs on each side; forming an arched convex surface above, and concave below, across the whole body.

2. By several insertions, to the anterior parts of the lumbar vertebræ, which generally unite in two fleshy bellies or crura.

CXX. Quadratus lumborum, attached to,

1. The posterior part of the crista ilii.

2. Trans-

2. Transverse processes of the lumbar vertebræ; the last rib; and side of the lowest dorsal vertebræ.

CXXI. Psoas parvus, attached to,

1. The sides of the last dorsal and first lumbar vertebræ, passing down with the psoas magnus.

2. The brim of the pelvis, near the edge of the acetabulum, at the junction of the ilium and pubis.

CXXII. Psoas magnus, attached to,

1. The last dorsal vertebra, the sides and transverse processes of all the lumbar vertebræ, by distinct muscular slips; running down over the ilium and under Poupart's ligament, towards the fore part of the head of the os femoris, uniting itself with the tendon of the internal iliac muscle.

2. The anterior part of the little trochanter.

CXXIII. Iliacus internus, attached to,

1. The inner labium of the crista ilii, the lowermost lumbar vertebræ, the upper half of the concavity of the ilium, and lateral portion of the sacrum; collecting its radiated fibres under Poupart's ligament, and uniting with the tendon of the psoas magnus.

2. Above, behind, and below the little trochanter of the thigh-bone.

CXXIV. Obturator internus, attached to,

1. The internal surface of the obturator ligament, and the inner edge of the foramen thyroideum, forming a tendon which passes out of the pelvis at the ischiatic notch.

2. The cavity of the root of the great trochanter, by an attachment in common with the gemini.

CXXV. Coccygeus, attached to,

1. The inside of the spinous process of the ischium.

2. The whole lateral part of the os coccygis.

CXXVI. *Sphincter ani, attached to,

1. The point of the coccyx, the transversus perinæi, and accelerator urinæ.

2. The skin and fat surrounding the anus, as far as the tuberosity of the ischium.

CXXVII. *Levator ani, attached to,

1. Internal

1. Internal part and middle of the symphysis pubis, to the upper margin of the thyroid foramen, and the membrane which covers the obturator internus and coccygeus muscles; as far as the spinous process of the ischium, and into the sacro-sciatic ligament.

2. Surrounding the verge of the anus, to the apex of the os coccygis, the accelerator muscles, neck of the urinary bladder, prostate gland, and part of the vesiculæ seminales; resembling an inverted cone or funnel in the distribution of its fibres.

CXXVIII. *Dartos, attached to

The whole of the skin and subjacent cellular membrane of the scrotum, forming a double muscular bag for the testes, according to WINSLOW.

CXXIX. Cremaster, attached to,

1. The fibres of the oblique and transverse muscles of the abdomen, near the ring, and about Poupart's ligament.

2. The surface of the tunica vaginalis testis.

CXXX. Erector penis, attached to,

1. The inner edge of the ramus ischii, from the tuberosity upwards, accompanying the crus penis to the symphysis pubis.

2. The membrane which encloses the corpora cavernosa penis, nearly as far as the place of their junction.

CXXXI. Accelerator urinæ, attached to,

1. The sphincter ani and membranous part of the urethra, down to the bulb and cavernous substance.

2. The middle line of the bulb, which it surrounds, in conjunction with its fellow.

CXXXII. Transversus perinæi, attached to,

1. The fatty membrane on the tuberosity of the ischium, running transversely over the interosseous ligament of the pubis.

2. The posterior part of the urethra, the accelerator urinæ, and the sphincter ani where it covers the bulb.

CXXXIII. Erector clitoridis, attached to,

1. The inner part of the tuberosity of the ischium.

2. The crus and body of the clitoris.

CXXXIV. *Sphincter vaginæ, attached to,

1. The verge of the anus and sides of the vagina.

2. The body and crus of the clitoris.

CXXXV. Supra-spinatus, attached to,

1. The basis scapulæ, above the spine, the superior ridge, and the spine itself; passing under the acromion, and adhering to the capsular ligament.

2. The upper surface of the great tuberosity on the head of the humerus.

CXXXVI. Infra-spinatus, attached to,

1. The hollow of the scapula, below its spine, as far as the inferior angle; and to the capsular ligament of the humerus.

2. The upper and middle part of the protuberance of the os brachii.

CXXXVII. Teres minor, attached to,

1. The inferior angle and edge of the scapula; the capsular ligament, and,

2. Back part of the great tuberosity of the os humeri.

CXXXVIII. Teres major, attached to,

1. The inferior angle of the scapula, and the rough portion of its edge or costa.

2. The ridge of the inner side of the groove in the humerus, below the insertion of the latissimus dorsi.

CXXXIX. Deltoides, attached to,

1. The acromion scapulæ, half the clavicle, the lower margin of the spine of the scapula, and the anterior portion of the os humeri; by various distinct penniform fleshy slips, converging to form a strong flat tendon, which is inserted into,

2. The rough protuberance on the outside of the os brachii, above its middle.

CXL. Coraco-brachialis, attached to,

1. The coracoid process of the scapula, under the short head of the biceps.

2. Below the middle of the os brachii, internally.

CXLI.

CXLI. Sub-scapularis, attached to,

1. All the inner surface of the scapula, by numerous penniform portions, which unite near the neck of that bone.

2. Into the lesser or internal tuberosity at the head of the humerus.

CXLII. Biceps flexor cubiti, attached to,

1. The neck of the scapula, above its glenoid cavity, by a very long tendinous extremity, which passes over the head of the os humeri, through the capsular ligament, and in its descent goes out of the joint within the bony groove,

2. To the coracoid process of the scapula, with the coracobrachialis muscle, by a short, thick, tendinous extremity, distinct from the former, to which it unites in its descent above the middle of the arm.

3. To the posterior edge of the tubercle of the radius, sending off (before its lowermost insertion) towards the inner condyle an aponeurotic expansion, which embraces and binds down all the muscles of the fore-arm.

CXLIII. Brachialis internus, attached to,

1. All the inferior and fore part of the humerus, under and on each side the biceps, from the root of the deltoid muscle.

2. Before and into the coronoid process of the ulna.

CXLIV. Triceps extensor cubiti, attached to,

1. The under edge of the scapula, near its neck, between the sub-scapularis and teres major, by a long head.

2. Below the posterior part of the great tuberosity of the humerus, by a shorter head, under the insertion of the teres minor.

3. To the middle and inner side of the os brachii, by the shortest head of the three, almost as far down as the joint; where they all unite, and cover the back part of the arm, to be implanted into,

4. The olecranon ulnæ, and capsular ligament of the elbow.

CXLV. Anconæus, attached to,

1. The lower portion of the outer condyle of the humerus.

2. The ridge at the back and external part of the ulna, below the olecranon.

CXLVI. Pronator radii teres, attached to,

1. The internal condyle of the humerus, and coronoid process of the ulna, descending obliquely to the

2. Posterior ridge, and middle part of the radius.

CXLVII. Palmaris longus, attached to,

1. The inner condyle of the humerus, stretching towards the middle of the fore-arm, and quickly ending in a very long slender tendon.

2. The annular ligament of the wrist, and to a triangular membranous expansion on the palm of the hand, which is affixed to the roots of the fingers, and sends off divisions to form canals for their tendons.

CXLVIII. Flexor carpi radialis, attached to,

1. The internal condyle of the humerus, and upper end of the ulna, by a many-headed tendon, adhering to several adjacent muscles; then, passing along the radius, and under the annular ligament, within a peculiar groove, it is implanted by a thin tendon into,

2. The metacarpal bone of the thumb or of the fore-finger.

CXLIX. Flexor carpi ulnaris, attached to,

1. The inner condyle of the humerus, part of the olecranon ulnæ, and nearly the upper half of this bone.

2. The pisiform and unciform bones.

CL. Flexor digitorum sublimis, attached to,

1. The inner condyle of the os humeri; the upper internal parts of the radius and ulna; and to the interosseous ligament; terminating in four tendons as the muscle descends, to pass under the annular ligament.

2. The anterior and upper part of the second phalanx of each finger, being previously slit for the reception of the tendons belonging to the flexor profundus vel perforans.

CLI. Flexor digitorum profundus, attached to,

1. The internal and upper part of the ulna, by a deeper origin than the former muscle; to the whole surface of the interosseous

interosseous ligament; terminating in four tendons, before it runs under the ligamentum carpi ulnare; which then pass through the slits of the above-mentioned tendons of the sublimis, and are inplanted into,

2. The fore and upper part of the third phalanx of the fingers.

CLII. Lumbricales, attached to,

1. The outsides of the four tendons of the flexor profundus, at the top of the palm of the hand.

2. The outsides of the tendons of the interossei muscles, near the middle of the second phalanges, in the back of the fingers.

CLIII. Flexor longus pollicis, attached to,

1. The radius, below its tubercle; the internal condyle of the humerus; the interosseous ligament; descending by a long slender tendon, under the ligamentum carpi, to be inserted,

2. Into the very point, or last phalanx, of the thumb.

CLIV. Pronator radii quadratus, attached to,

1. The lower and inner part of the ulna, by a broad fleshy insertion, which runs transversely towards,

2. The anterior and inferior part of the radius.

CLV. Supinator radii longus, attached to,

1. The external ridge of the os brachii above the outer condyle.

2. Above the styloid process of the radius.

CLVI. Extensor carpi radialis longior, attached to,

1. The os brachii, a little below the last-named muscle.

2. Passing under the annular ligament, upon the back of the wrist, to the root of the metacarpal bone of the forefinger, &c.

CLVII. Extensor carpi radialis brevior, attached to,

1. The external ridge of the os brachii, above the outer condyle.

2. Basis of the metacarpal bone of the middle finger.

CLVIII. Extensor carpi ulnaris, attached to,

1. The outer condyle of the humerus, near the anconeus, and to the upper half of the external edge of the ulna.

2. Passing through a ligament near the cuneiform bone, is inserted into the outside of the base of the metacarpal bone of the little finger.

CLIX. Extensor digitorum communis, attached to,

1. The outer condyle of the os brachii, running down the middle of the back part of the fore-arm, where it is subdivided into four tendons; three of which pass under the annular ligament, and the fourth, going to the little finger, runs through a particular ringlet in the same ligament.

2. To the basis of the first phalanx of each finger; then, advancing to the head of the phalanx, each tendon is split into two portions, which reunite at the second phalanx, and is finally inserted into the third.

CLX. Extensor metacarpi pollicis manus, attached to,

1. The middle and posterior part of the ulna, below the anconeus; to the posterior and middle part of the radius, and into the ligament between those bones.

2. To the root and back of the first metacarpal bone of the thumb, and to the os trapezium, sometimes by three or four tendons.

CLXI. Extensor primi internodii, attached to,

1. The ulna, a little below the last muscle, and to the interosseous ligament.

2 Posterior part of the first phalanx of the thumb.

CLXII. Extensor secundi internodii, attached to,

1. The ulna and interosseous ligament rather higher than the last-named muscle, passing down towards the lower end of the radius, through a groove at its inner and back part.

2. To the last bone of the thumb.

CLXIII. Indicator, attached to,

1. The ridge of the ulna, at its posterior and middle part, and to the interosseous ligament, uniting with the tendon of the common extensor.

2. To the basis of the first phalanx, and into the second phalanx of the fore-finger.

CLXIV.

CLXIV. Extensor minimi digiti, attached to,

1. The outer condyle of the os brachii, accompanying the extensor digitorum communis, and passing along a peculiar channel under the annular ligament.

2. To the second joint of the little finger.

CLXV. Supinator radii brevis, attached to,

1. The external condyle of the os brachii.

2. The outer and upper part of the ulna.

3. The interosseous ligament, passing obliquely over the head and under the tubercle of the radius, to be inserted into,

4. The ridge at the inner and lower part of the radius, making an acute angle with the pronator teres.

CLXVI. Abductor pollicis manus, attached to,

1. The ligamentum carpi annulare, and os scaphoides.

2. The outside of the root of the first bone of the thumb.

CLXVII. Adductor pollicis manus, attached to,

1. Nearly the whole of the metacarpal bone of the middle finger.

2. Its fibres contracting to a point, are implanted into the head of the first phalanx of the thumb.

CLXVIII. Flexor brevis pollicis, attached to,

1. The os magnum and os trapezium, by a double insertion, being divided by the tendon of the flexor longus pollicis manus.

2. The sesamoid bones and first phalanx of the thumb.

CLXIX. Flexor ossis metacarpi pollicis, attached to,

1. The annular ligament, and os scaphoides, lying under the abductor pollicis.

2. The under and fore part of the metacarpal bone of the thumb.

CLXX. Palmaris brevis, attached to,

1. The annular ligament and palmar aponeurosis.

2. The skin and fat lying upon the abductor of the little finger, and into its metacarpal bone.

CLXXI. Abductor indicis manus, attached to,

1. The os trapezium, and first bone of the thumb.

2. Back

2. Back part of the first bone of the fore-finger.

CLXXII. Abductor minimi digiti, attached to,

1. The annular ligament and cuneiform bone.

2. Upper part and extremity of the metacarpal bone of the little finger.

CLXXIII. Adductor minimi digiti, attached to,

1. The cuneiform bone, and ligament of the wrist.

2. Outside and lateral part of the metacarpal bone of the little finger.

CLXXIV. Flexor parvus minimi digiti, attached to,

1. The ligamentum carpi, and cuneiform bone.

2. The anterior and inner part of the superior end of the first phalanx.

CLXXV. Interossei externi, attached to,

1. The ligaments of the carpal bones, by double heads, and to the metacarpal bones of the fingers externally.

2. Posterior part of the tendinous expansion of the extensor digitorum communis, and to the lumbricales.

CLXXVI. Interossei interni, attached to,

1. The sides and back part of the metacarpal bones of the fingers.

2. The tendons of the common extensor and lumbricales.

CLXXVII. Pectinalis, attached to,

1. The fore part of the pubis, above the thyroid hole.

2. Linea aspera of the femur, below the little trochanter, between the upper insertion of the vastus internus and the lower attachment of the adductor brevis.

CLXXVIII. Triceps adductor femoris, properly consisting of three distinct muscles, viz.

(a) Adductor longus, attached to,

1. The upper and fore part of the pubis.

2. Middle of the linea aspera of the thigh bone.

(b) Adductor brevis, attached to,

1. The pubis, near its symphysis, below the long adductor.

2. The upper part of the linea aspera, between the pectineus and long adductor.

(c) Adductor

(c) Adductor magnus, attached to,

1. The symphysis pubis and ramus ischii, lower than the short adductor.

2. The whole of the linea aspera and back of the inner condyle of the thigh bone, adhering by a fascia to the vastus internus.

CLXXIX. Obturator externus, attached to,

1. The obturator ligament, and edge of the foramen thyroideum; contracting its fleshy fibres into a tendon, which bends its course behind the neck of the os femoris towards the great trochanter.

2. The fossa between the two trochanters.

CLXXX. Gluteus maximus, attached to,

1. The posterior half of the spine of the ilium, the outer side of the sacrum and coccyx, and into the sacro-sciatic ligament.

2. The great trochanter and upper part of the linea aspera.

CLXXXI. Gluteus medius, attached to,

1. The anterior half of the spine of the ilium, under the former muscle.

2. The outer and back part of the great trochanter.

CLXXXII. Gluteus minimus, attached to,

1. The middle of the external surface of the ilium.

2. The fore and upper part of the trochanter major.

CLXXXIII. Pyriformis, attached to,

1. The 2d, 3d, and 4th pieces of the sacrum by distinct fleshy origins, passing downwards below the notch of the ilium.

2. To the upper part of the cavity on the inside of the root of the greater trochanter.

CLXXXIV. Gemini, attached to,

1. The spinous process of the ischium, and to the outer end of the tuberosity, by two separate origins or heads; which, uniting, are inserted into,

2. The cavity on the inner side of the root of the trochanter major, close to the tendon of the obturator internus.

CLXXXV. Quadratus femoris, attached to,

1. The transverse line running from under the acetabulum to the lower part of the tuberosity of the ischium.

2. The rough ridge between the greater and lesser trochanters.

CLXXXVI. Tensor vaginæ femoris, attached to,

1. The fore and upper spinous process of the ilium, between the sartorius and gluteus medius.

2. To the inside of the *fascia lata femoris*; which surrounds all the muscles of the lower extremity, and forms membranous vaginæ to several of them, being likewise connected to the edge of the ilium, to Poupart's ligament, the os sacrum, linea aspera, head and crista of the tibia, and to the superior part of the fibula externally.

CLXXXVII. Rectus femoris, attached to,

1. The upper and lower spinous process of the ilium, and to the anterior part of the acetabulum and capsular ligament of the os femoris, by two separate tendons.

2. The patella and tubercle of the tibia; being connected laterally to the vasti muscles, and below to the cruralis.

CLXXXVIII. Vastus externus, attached to,

1. The root of the trochanter major and upper part of the linea aspera, connecting itself to the outer edge of the cruralis as it descends.

2. To the patella, capsular ligament of the knee, and head of the tibia.

CLXXXIX. Vastus internus, attached to,

1. The fore part of the root of the little trochanter, and all the linea aspera, accompanying the cruralis down to the inner condyle of the femur.

2. The interior edge of the patella and head of the tibia.

CXC. Cruralis, attached to,

1. The fore part of the thigh bone, from the little trochanter, and closely connected on each side to the vasti muscles.

2. Upper edge of the patella behind the rectus femoris, with which it forms a common tendon.

CXCI.

CXCI. Sartorius, attached to,

1. The inferior part of the anterior superior spinous process of the ilium, passing obliquely downwards across the inside of the thigh, and then between the tendons of the gracilis and adductor magnus, to be implanted into,

2. The head of the tibia, near its tubercle, internally.

CXCII. Gracilis, attached to,

1. The anterior part of the pubis, by the side of the adductor brevis.

2. Inside the head of the tibia, under the sartorius.

CXCIII. Semi-tendinosus, attached to,

1. The tuberosity of the ischium behind the semi-membranosus, and touching the biceps flexor cruris.

2. Inside the head of the tibia, below its tuberosity, and under the tendon of the gracilis, contributing to form the inner ham-string.

CXCIV. Semi-membranosus, attached to,

1. The tuber ischii, between the quadratus and inferior geminus.

2. Behind the inner part of the internal condyle of the tibia, forming the inner ham-string, in conjunction with the last muscle.

CXCV. Biceps flexor cruris, attached to,

1. The lower and outer part of the tuberosity of the ischium, adjoining the semi-tendinosus.

2. By a shorter margin, to the lower half of the linea aspera, uniting with the longer head a little above the condyles of the femur.

3. Upper and exterior part of the head of the tibia, constituting the outer ham-string.

CXCVI. Poplitæus, attached to,

1. The external condyle of the thigh bone, and ligament of the knee joint.

2. Internal edge of the tibia below its head.

CXCVII. Gastrocnemius externus, attached to,

1. Both condyles of the femur, and to the posterior ligament of the knee joint.

2. Upper and back part of the os calcis, by the *tendo Achillis*, in common with the next muscle.

CXCVIII. Gastrocnemius internus, attached to,

1. The upper and back part both of the fibula and the tibia.

2. Into the extremity of the os calcis, by the same tendon as the former muscle.

CXCIX. Plantaris, attached to,

1. The external condyle of the femur, and to the capsular ligament behind; terminating by a very slender, long, and flat tendon, which runs between the heads of the two last-named muscles to be connected with the tendo Achillis.

2. Inside the extremity of the os calcis, in common with the gastrocnemii.

CC. Tibialis posticus, attached to,

1. The posterior and upper part of the tibia, the opposite portion of the fibula, and nearly the whole surface of the interosseous ligament down to the ancle, the tendon then running along a groove behind the malleolus internus.

2. To the first two metatarsal bones, the calcaneum, cuboides, and naviculare.

CCI. Peronæus longus, attached to,

1. The fore and outer part of the head of the fibula, to the upper portion of that bone and the tibia, running behind the malleolus externus in a cartilaginous pulley and annular ligament, which also includes the tendon of the peronæus brevis.

2. Being reflected to the sinuosity of the os calcis, and passing along a groove in the os cuboides, it is inserted into the outside of the root of the metatarsal bone of the great toe and the internal cuneiform bone.

CCII. Peronæus brevis, attached to,

1. The external and anterior part of the fibula, from above its middle, and down to the outer ancle, where it passes through a groove, within the same ligament as the peronæus longus.

2. Root of the outer part of the metatarsal bone of the little toe.

CCIII.

CCIII. Peronæus tertius of ALBINUS, attached to,

1. The lower half of the inside of the fibula, uniting itself with the extensor longus digitorum, of which it is therefore commonly reckoned a portion.

2. The basis of the metatarsal bone of the little toe.

CCIV. Tibialis anticus, attached to,

1. The fore part and outside of the tibia at its junction with the fibula, and to the interosseous ligament, whence it descends obliquely, crosses the ancle, goes under the annular ligament, and through another ring below.

2. The upper and inner part of the os cuneiforme internum, and posterior extremity of the metatarsal bone of the great toe.

CCV. Extensor longus digitorum pedis, attached to,

1. The outer side of the head of the tibia, and inside the head of the fibula, to the interosseous ligament, the aponeurosis of the leg, and anterior spine of the fibula, being divided into four tendons after it has passed under the annular ligament at the tarsus.

2. To the root of the first joint of the four small toes, expanding along their upper sides as far as the last joint; and connecting with the tendons of the interossei, the flexor longus, and the lumbricales.

CCVI. Extensor proprius pollicis pedis, attached to,

1. The inferior part of the head of the fibula, down to within a little of its lower extremity, and to the interosseous ligament.

2. Having passed under the ligamentum annulare, it is affixed to the first and second joint of the great toe.

CCVII. Flexor longus digitorum pedis, attached to,

1. Nearly all the back part of the tibia, ending in a tendon which runs behind that of the tibialis posticus, within the groove of the outer ancle and os calcis; being divided into four tendons at the sole of the foot, which perforate the slits of the flexor brevis, and are implanted into,

2. The last joint of the four lesser toes.

CCVIII. Flexor longus pollicis pedis, attached to,

1. The

1. The lower half and back part of the fibula, passing through a ligament near the side of the os calcis, the astragalus, and the inner ancle.

2. To the last phalanx of the great toe.

CCIX. Flexor digitorum accessorius, attached to,

1. The inferior side and tuberosity of the os calcis, and to the ligament which unites this bone to the astragalus.

2. Inserted into the flexor longus digitorum at its division into four tendons.

CCX. Flexor brevis digitorum pedis, attached to,

1. The lower and back part of the os calcis, having four tendons, which are perforated by the flexor longus digitorum.

2. To the second phalanges of the four small toes.

CCXI. Extensor brevis digitorum pedis, attached to,

1. Upper and fore part of the calcaneum, sending off four tendons, which run over the top of the foot, and are connected with the long extensor.

2. To the first joint of the great toe, and the three adjoining toes.

CCXII. Lumbricales pedis, attached to,

1. The four tendons of the flexor longus digitorum.

2. Inside the first joint of the four lesser toes, and to the tendinous expansion which covers their upper sides.

CCXIII. Flexor brevis pollicis pedis, attached to,

1. The under and fore part of the heel bone, and the os cuneiforme magnum; being united by one head to the abductor, and by another to the adductor pollicis, which are inserted into,

2. The external sesamoid bone, and the root of the first phalanx of the great toe.

CCXIV. Adductor pollicis pedis, attached to,

1. The ligament extending from the os calcis to the cuboides.

2. External sesamoidal bone, and root of the metatarsal bone of the great toe.

CCXV. Abductor pollicis pedis, attached to,

1. Inner and lower part of the os calcis.

2. The

2. The os sesamoideum internum, and root of the first joint of the great toe.

CCXVI. Abductor minimi digiti pedis, attached to,

1. Inferior part of the protuberance of the calcaneum, dividing into two small tendons, which are affixed to,

2. To the metatarsal bone of the little toe, and into its first phalanx.

CCXVII. Flexor brevis minimi digiti, attached to,

1. The metatarsal bone of the little toe.

2. First bone of the same toe.

CCXVIII. } Interossei externi & interni, seven muscles in
CCXIX. } each of the feet, attached to,

1. The metatarsal bones, between which they are situated, by double heads.

2. To the tendons of the long and short extensors on the back of the toes.

CCXX. Transversalis pedis, attached to,

1. The ligament which connects the tarsal bones to each other, and is inserted into,

2. The tendon of the adductor pollicis pedis.

All the muscles and soft parts on the sole of the foot are defended by a thick tendinous aponeurosis, corresponding with that in the palm of the hand: it is divided into three principal portions, adhering together at their edges, and arising chiefly from the tuberosity of the heel bone, whence it is expanded to the roots of all the toes, like a bow-string across its arch; so as not only to cover the subjacent parts, but at the same time to afford support and assistance to the foot during violent motions.

(T) OF THE COMMON INTEGUMENTS AND MEMBRANES.

The membranes which invest *all* parts of the body, are named COMMON INTEGUMENTS. They may be considered under two heads, namely,

§ I. The *skin*, or exterior covering of the body.

§ II. *Reticular* or *cellular membrane*, seated under the skin.

The skin consists of three laminæ, which are denominated epidermis, rete mucosum, and cutis.

I. Properties of the epidermis, cuticle, or scarf skin.

1. Transparent.
2. Insensible.
3. Not vascular.
4. Perforated by hairs and pores.
5. Of unequal density.
6. Investing the outer surface of the body.
7. Lining all the external cavities.
8. Separable by vesication, putrefaction, &c.

II. Properties of the rete mucosum.

1. Forming a delicate net-work, not easily detached.
2. Seated immediately under the scarf skin.
3. Of various colours in different climates.
4. Uncertain in its uses and origin.

III. Properties of the cutis, or true skin.

1. Highly elastic, tough, and pliable.
2. Extremely vascular and porous.
3. Its nerves constituting the organ of touch.
4. Connected above to the rete mucosum, and below to the cellular substance.

The skin has certain appendages; viz.

I. Sub-cutaneous glands and follicles.

II. The hair, for ornament.

III. The nails, for defence.

§ II. *The reticular or cellular Membrane.*

Divided into,

I. An elastic web or net-work, forming a general covering both to the whole surface of the body and to its organs; likewise entering into the composition of many of the viscera.

II. A cellular substance, supplied with fat, capable of retaining various effused or secreted fluids; and existing in most parts of the body, but in different proportions.

The sub-cutaneous muscular covering, or PANNICULUS CARNOSUS, found in quadrupeds, does not exist in the human

man species, except partially on the neck and head.

The other investing membranes of the body are,

I. Those which line particular internal cavities.

II. Those which envelope the different organs, &c.

The three principal cavities of the body, and their contents, are as follow:

1. The cavity of the head, in which are contained,

(a) The brain and its appendages, with their respective membranes, dura mater, tunica arachnoides, and pia mater.

2. The cavity of the chest, including,

(a) The lungs and trachea.

(b) The heart and its large vessels.

(c) The œsophagus and thoracic duct.

The membrane investing these organs, called pleura, divides the thorax into two cavities, and encloses the heart between its reflected lamellæ, so as to form a distinct bag, named pericardium.

3. The cavity of the abdomen, extending from the diaphragm above to the pelvis below, comprehends the following organs:

(a) Those which subserve the purpose of digestion.

(b) The urinary organs.

(c) Part of the organs of generation.

(d) Some important nerves and vessels, &c.

All these viscera are included within (or under) a general covering, named peritonæum, which is reflected over the whole interior surface of the lower belly, and forms various detached processes or doublings. The abdomen is likewise artificially (but not naturally) divided into three REGIONS, each of them having certain imaginary lines of distinction; viz.

I. The *upper region*, which begins opposite to the cartilago ensiformis, at a small depression called *scrobiculus cordis*, or pit of the stomach, and extends to about a hand-breadth from the umbilicus or navel. The middle of this region is termed *epigastrium*, or under part of the belly, and the two lateral parts *hypochondria*, from their lying under the cartilages of the false ribs.

II. The *middle region* occupies an equal distance above and below the umbilicus. The middle part of it is called the *umbilical*, and its lateral parts the *lumbar regions*, or *loins*.

III. The *under region* begins where the middle one terminates, or at a line drawn between the superior anterior spinous processes of the ossa ilii. It forms in its middle the *hypogastrium*, or bottom of the belly; and at its sides, the *iliac regions*.

(U) THE ORGANS AND PHENOMENA OF DIGESTION.

From the period of our birth, until the day of our death, the body is gradually undergoing a considerable waste, both of its fluid and solid parts. To supply this deficiency, as well as to furnish matter for the growth of our body, there exists a perpetual necessity for an accession of alimentary substance, derived from the vegetable and animal kingdoms. Of these nutritious substances, the greater part are originally of such a nature as to require some important changes to be produced in their qualities, before they can be applied to any salutary purpose in the animal economy: and, for the production of the changes here alluded to, it was requisite that the living body should be endowed with the class of organs which are denominated *organs of digestion*. The natural propensities or appetites whereby we are irresistibly impelled to seek for alimentary matter, either in a solid or a fluid form, have been distinguished into two kinds, viz.

I. Hunger, a sensation referred to the stomach.

II. Thirst, a sensation referred to the fauces.

The first process which the food undergoes, previously to that of digestion, is its manducation and dilution in the mouth, by means of,

I. The lips and cheeks.
II. The tongue.
III. The teeth.
IV. Salivary glands.

} Observations on their form, structure, and uses.

The

The next step is that of protruding the masticated substance down into the stomach; which is effected by,

I. The soft palate.
II. The fauces.
III. The pharynx.
IV. The œsophagus.

} Remarks on the phenomena of deglutition, &c.

The stomach is the general receptacle of the aliment; wherein it is detained for the purpose of being subjected to an important change, named *chymifaction*, or its conversion into *chyme*. In this organ we are to consider,

I. Its form in the human body.
II. Its situation and connexions.
III. Its varying amplitude.
IV. Its inlet and outlet, named *cardia* and *pylorus*.
V. Its coats, peritoneal, muscular, and villous.
VI. Its blood-vessels, nerves, and absorbents.
VII. Its muciparous glands, and peculiar secretion.
VIII. Its motions, during health and sickness.
IX. The concurrent action of the diaphragm and abdominal muscles in *vomition*.

The conversion of food into perfect *chyle* does not wholly take place in the stomach; but the alimentary matter is yet to be mingled with the bile, the pancreatic liquor, and the enteric juices, in the *duodenum*.

The whole intestinal tube, from the stomach downwards, is about six times the length of the body, and has been arbitrarily divided by anatomists into,

I. Small intestines.
1. Duodenum.
2. Jejunum.
3. Ileum.

II. Large intestines.
4. Cæcum.
5. Colon.
6. Rectum.

By the admixture of the saliva, the gastric juice, the bile, the pancreatic liquor, and the secretion from the duodenum, a chemical solation and re-composition of the alimentary matter ensues, so as to render it fit for assimilation. The

nutritious particles are then gradually absorbed by the lacteal vessels, seated within the small intestines; while the insoluble and feculent parts are gradually ejected by the larger intestines.

The principal theories which have been advanced to explain the phenomena of digestion or chylifaction, may be arranged under five heads; viz.

I. Maceration.
II. Coction or heat.
III. Trituration.
IV. Fermentation.
V. Putrefaction.

} All of which are in a great degree erroneous.

The appropriation of the nutriment to the uses of the animal machine, being effected by the absorbent system taking up the chyle and conveying it to the sanguiferous vessels, we are naturally directed to consider, in the next place, the *doctrine of absorption.*

(v) THE ORGANS AND PHENOMENA OF ABSORPTION.

Although the absorbent organs in the animal body have been (at page 16) distinguished into lacteal, lymphatic, and sanguineous, the latter do not properly belong to the system of absorbing vessels, and are not universally allowed to possess the imbibing faculty ascribed to them in the instances alluded to: nor are the lacteals and lymphatics to be considered as different from each other, any further than in office and situation, their structure being exactly the same. Absorbing vessels, wherever they are found in the body, must therefore be regarded as belonging to one general system, whether they be denominated lacteals or lymphatics; and the glandular substances with which the absorbent vessels are frequently connected must likewise be deemed a part of this system, inasmuch as they contribute to the perfection of its uses.

I. Description of the absorbent vessels.

1. Very thin.
2. Pellucid.
3. Valvular.
4. Contractile.
5. Anastomosing.

} To be illustrated and exemplified.

II.

II. Origin and termination of the absorbents.
  1. Arising from all membranous surfaces, both internal and external; but not easily demonstrated in some parts of the body, *e. g.* in the brain and uterus.
  2. Terminating generally in the thoracic duct, which empties itself into the left subclavian vein.

III. Uses of the absorbent system.
  1. To supply the living body with nutriment.
  2. To dilute the blood with lymph, &c.
  3. To remove morbid parts, and superfluous fluids.
  4. To imbibe medicinal and other substances.

IV. Of conglobate or lymphatic glands.
  1. They differ from other glandular bodies, in having no excretory duct, in affording no secretion, and in being of a more simple or solitary nature.
  2. They are composed of a congeries of arteries, veins, nerves, and lymphatic or chyliferous vessels, connected by an intervening cellular tissue.
  3. Their use is supposed to be that of effecting some change in the fluids, which are brought to them by the absorbents. (See the Lecture on SECRETION.)

(W) THE ORGANS AND PHENOMENA OF CIRCULATION.

The circulation of the blood in animals is one of the most interesting and curious subjects of inquiry, whether it be considered in its causes or its consequences. The wisdom and perpetual agency of a DIVINE BEING is in no part of the animal economy so acknowledged and conspicuous as in the vascular system. The structure and uses of the heart and blood-vessels, the laws and coincidences by which their actions are regulated, the mutual connexion between these viscera and all the other organs in the body, are alike deserving of our admiration!

The nutritive matters afforded by digestion and accumulated in the bowels, are transported, as we have already described, by the system of absorbing vessels: but when the absorbents shall have emptied themselves, it was farther necessary

cessary that their contents should be distributed to all parts of the body for its reparation and growth. This distribution of the chyle is provided for by the system of tubes named *arteries*, in conjunction with the ventricles of the *heart*, which may be considered as the source of the circulation: but since it was also requisite that certain fluids should be separated or secreted from the chyle (now converted into blood,) and that the blood should then be brought back to have its vivifying qualities restored; another set of ramifying tubes, viz. the *veins*, are interposed between the heart and arteries for that express purpose. The peculiar mechanism and connexion of the heart, the arteries, and the veins, are now to be explained, before we enter particularly into the doctrine of the circulation.

§ I. *Structure and Situation of the Heart.*

I. Its situation and connexion.

1. Enclosed within a membranous bag, called the *pericardium*, which maintains the heart in its natural position.
2. Situated obliquely across the thorax, with its inferior flat surface lying upon the diaphragm; its apex pointing towards the left breast; its basis directed backwards near the spine; and its upper part covered by the lungs.
3. Connected to the large blood-vessels by its four cavities, viz. by its left ventricle, to the great artery or aorta; by its right ventricle, to the pulmonary artery; by its left auricle, to the four pulmonary veins; and by its right auricle, to the vena cava superior and inferior.

II. Its fabric or composition.

1. Made up chiefly of muscular fibres, distributed into layers, and arranged in a spiral direction.
2. Subdivided by fleshy partitions, constituting the four cavities above mentioned; of which, the left ventricle and auricle are situated more backward than those on the right side: the two ventricles are more strong and thick in their parietes than the auricles, and the left ventricle is much thicker than the right.
3. Having a valvular apparatus adapted to the entrance of the

the large arteries and to the auricles, for purposes to be hereafter explained: the valves of the aorta and pulmonary artery are named semilunar; those at the orifice of the right auricle and ventricle are called mitral valves; and those at the opening of the left auricle and ventricle are named tricuspid. Another valve (that of Eustachius) is situated at the termination of the vena cava inferior, just within the right auricle.

4. The internal surface of the heart is lined with a delicate and smooth membrane, which is highly susceptible of irritations from the blood's impulse. The external superficies of the heart is likewise invested by an appropriate membrane.

5. The fœtal heart differs from the adult, in having an oval foramen leading from the two auricles, and a short canal from the entrance of the pulmonary artery to the aorta.

§ II. *Structure, Connexion, and Use of the Arteries.*

I. Their origin and termination.

1. Arising from the ventricles of the heart.

2. Generally terminating in the extreme branches of veins, or in secreting vessels.

II. Their distribution and number.

1. The large artery or aorta, arising from the left ventricle, is distributed to every part of the body, except the lungs.

2. The pulmonary artery, which takes its origin from the right ventricle, ramifies through the substance of the lungs.

3. These two are the only arteries in the body; but their branches are subdivided into innumerable ramifications, having various names.

III. Their composition and figure.

1. Arteries are pulsating cylindrical tubes, gradually diminishing in diameter as they proceed from the heart.

2. Composed of three membranes; the exterior coat being cellular, the middle one muscular, and the inner coat strong, smooth, and elastic.

IV. The uses of arteries.

1. To convey blood from the heart.

2. To

2. To deposit nutritive matter.
3. To secrete various fluids.
4. To generate and diffuse the animal heat.

§ III. *Structure, Connexion, and Use of the Veins.*

I. Their origin and termination.
   1. Generally arising from the extreme branches of arteries.
   2. Terminating in the auricles of the heart.

II. Their distribution and number.
   1. The ramifications of the vena cava superior and inferior are found in all parts of the body, except the lungs.
   2. The ramifications of the four pulmonary veins are only distributed through the substance of the lungs.
   3. The veins usually accompany their corresponding arteries, but are divided into a much greater number of branches, having different appellations.

III. Their composition and figure.
   1. Veins are non-pulsating cylindrical tubes, gradually enlarging in diameter as they advance towards the heart.
   2. Composed of three membranes, which are more thin and delicate than in the arteries.
   3. They are supplied (except the veins in the viscera) with a great number of double membranous folds of a semilunar shape, acting as valves, and preventing the course of the blood towards the extremities of the body.

IV. The uses of veins.
   1. To return the blood from the arteries back to the heart.
   2. To assist in renewing the animal heat, and in the office of sanguification.

§ IV. *The Phenomena of Circulation.*

I. In the adult subject.

1. The blood is distributed to all parts of the body (except to the lungs) by the ramifications of the aorta, which are endowed with a power of alternately contracting and dilating. Part of the blood is employed or consumed in supplying the different secretions; but, by much the greater portion of the

whole mass is propelled into the capillary extremities of the veins, inosculating with the arteries.

2. The veins then pour out their contents into the right auricle of the heart, by means of the cava superior and inferior; their action being aided by the valvular apparatus already mentioned, and by the compression of surrounding muscles, as well as by the *vis à tergo* or arterial impulse.

3. When the right auricle has thus been distended with blood, it contracts suddenly, and throws its contents into the right ventricle. This completes the *greater circulation*, i. e. the course of the blood through the whole body; for, it has yet to pass through the lungs, which is called the *lesser circulation*.

4. The distension of the right ventricle occasions that cavity to be brought into action, so as to urge the blood forwards through the pulmonary artery: during the moment of its contraction, however, the right auricle is dilated; and, to prevent the regurgitation of the blood, the tricuspid valve becomes rigid.

5. So soon as the pulmonary artery has received the contents of the right ventricle, and begins to contract itself, for the purpose of farther accelerating the blood's progress, the semilunar valves are called into action; and by that means none of the fluids can return into the ventricle during its relaxed state.

6. The blood having now arrived at the extreme branches of the pulmonary artery and its inosculating veins, undergoes some necessary change within the vessels distributed upon the air-cells of the lungs; and is then returned by the numerous ramifications of the pulmonary veins to the other side of the heart, viz. to the left auricle.

7. This cavity next contracts, and forces its contents into the adjoining ventricle.

8. The left ventricle in its turn is called into action, and projects the blood through the aorta; at the same time the

mitral valve prevents the regurgitation which would otherwise take place into the left auricle.

9. The lesser circle being thus completed, the aorta again sends forward its contents into the various arterial canals distributed throughout the body; and, by the reaction of the semilunar valves, placed at the entrance of the aorta, none of the blood can escape back into the heart, but it must run the same circuit as before.

II. In the fœtal state.

1. The general mass of blood does not pass into the lungs of a child, before it has breathed; but, instead of going from the right auricle to the right ventricle, and thence into the pulmonary artery, there is an oval opening through the fleshy division of the auricles, which allows the greater part of the blood to pass immediately into the left side of the heart: another considerable portion of it goes by a short and wide canal (named *canalis arteriosus)* which leads from the root of the pulmonary artery across to the entrance of the aorta; and by this mechanism, the blood in the aorta receives the propelling power of both ventricles at once.

2. The connexion between the mother and the fœtus constitutes another difference in the circulation of an unborn child: for it derives its blood from the mother, by means of a large vein in the umbilical chord or navel-string; whence it is conveyed partly into the liver, by the vena portæ, and partly into the ascending or inferior cava, by a distinct canal, *i. e.* the *ductus venosus.* The fœtus returns its blood back to the mother by means of two umbilical arteries, which arise from the internal iliacs and lead into the placenta. (See the Lecture on GESTATION and PARTURITION.)

§ V. *Remarks on the Action of the Blood-vessels.*

I. The nature of arterial action.

1. Systole, or contractile force. } Depending on the prin-
2. Diastole, or dilating power. } ciple of irritability.
3. Elasticity, or passive motion.

4. Are

4. Are the motions of the heart and arteries synchronous with each other?
5. Do the arteries elongate and become tortuous during their action?

II. The variableness of their action.

1. In health.
2. In disease.

} According to age, sex, climate, &c.

The most simple varieties in the pulse are,

(a) Too frequent or slow.
(b) Too strong or weak.
(c) Too hard or soft.
(d) Too full or small.
(e) Oppressed or irregular.

} These varieties may be compounded.

III. Physical causes of their action.

1. The heart is stimulated to action, by
   (a) The expansive force of the blood.
   (b) The chemical qualities of the blood.
2. The arteries are excited to action by
   (a) The projectile force of the blood.
   (b) The chemical properties of the blood.
3. The veins are called into use (we cannot properly say into action) by
   (a) The *vis à tergo*, or arterial impulse.
   (b) The compressing power of the muscles, aided by the valvular structure of the veins.

IV. Recital of experiments on the heart and blood-vessels,

1. To verify the Harveian doctrine of circulation.
2. To transfuse the blood from one animal to another.
3. To ascertain the qualities and quantity of the blood.
4. To demonstrate the uses of the lesser circulation, *i. e.* through the lungs.
5. To establish an hypothesis of muscular irritability independent of the nerves.
6. To illustrate the phenomena of sanguification, digestion, secretion, &c.
7. To estimate the celerity of the blood's circuition.

8. To discover the terminations, connexions, and ramifications of the vessels.

Having thus proceeded from the consideration of the structure of the heart and sanguiferous vessels to their respective functions, we are led to inquire next into the properties and uses of the blood.

(x) ON THE PROPERTIES AND USES OF THE BLOOD.

The fluid which circulates in the blood-vessels, when superficially inspected, appears to be of a homogeneous quality; but, in fact, it is composed of several parts, which merit a distinct consideration. Independently of the *halitus* or subtile vapour, that exhales from the blood immediately on its escape from the living body, we may distinguish,

I. The serum, or watery portion of the blood.

II. Coagulable lymph. } Forming the cruor.
III. The red globules. }

§ I. *Properties of the Serum.*

I. Separates spontaneously in fresh-drawn blood.

II. Is semi-transparent, slightly tinged with a yellowish green hue.

III. Containing a large proportion of water, with some gelatine or albuminous gluten.

IV. Is readily coagulated by heat.

V. Heavier than pure water, but lighter than the other component parts of the blood.

VI. Holds various saline matters in solution, and affords the basis of several secretions.

§ II. *Properties of the coagulable Lymph.*

I. Coagulates and separates from the serum spontaneously, in fresh-drawn healthy blood.

II. Is heavier than the serum, but allows the red globules to sink through its upper part while in a fluid state.

III. Consists chiefly of fibrous animal matter, and composes most of the solids in the body.

IV. Coagulates most firmly when it has been quickly drawn from

from the body in inflammatory disorders, but may be prevented from concreting by artificial means.

V. Is more or less abundant and tenacious in certain diseases.

§ III. *Properties of the red Globules.*

I. They give the red or purple colour to the mass of blood.

II. Do not exceed the 3000th part of an inch in diameter, but are naturally inadmissible into the smallest capillary branches of the blood-vessels.

III. Of uncertain figure, but generally believed to be spheroidal

IV. Suspended in the coagulable lymph, and contributing to form the crassamentum or cruor.

V. May be separated from the coagulable lymph by frequent ablution and evaporation.

VI. Are rendered beautifully florid or of a vermilion colour, by exposure to oxygen or vital air; and become of a very dark livid hue, by exposure to the azotic principle or phlogisticated air. (See the Lecture on RESPIRATION.)

VII. Does the colour of the red particles depend on the presence of oxydated iron?

§ IV. *General Remarks on the Blood.*

With regard to,

I. Its smell.
II. Taste.
III. Consistence.
IV. Colour.
V. Heat.
VI. Quantity.

} In different animals, climates, and periods of life.

VII. Its uses in the animal economy.

1. To transmit and retain the animal heat.
2. To distend and stimulate the vessels.
3. To act as a vehicle of the nutritive matter.
4. To afford various secretions and depositions.
5. Are the temperaments affected by the state of the circulating fluids?
6. Is the blood alive, in the same sense as the solid parts of the body?

VIII.

VIII. Morbid changes, and phenomena depending on the blood-vessels or the state of their contents.

(Y) OF THE GLANDS, SECRETIONS, AND EXCRETIONS.

§ I. *Preliminary Observations on the Nature of a Gland.*

I. Glands are organized parts of the body, destined for the secretion, elaboration, or alteration of a fluid; and are enclosed within a peculiar membranous capsule.

II. But some parts, so named, do not perform the functions of glands, and have therefore no excretory duct; as the thymus, renal, thyroid, pituitary, and pineal gland, &c.

§ II. *Glands have been classed,*

I. According to the nature of their secretions. (Vide pages 13, 14, for an enumeration of the secreted fluids.)

II. According to their supposed fabric.

1. Simple follicles, lacunæ, and cryptæ.
2. Conglomerate, or compounded of many simple glands; with the union of several excretory ducts, having a connecting cellular tissue or parenchymatous substance.
3. Conglobate or lymphatic, not having an excretory duct, (See p. 109, IV.)
4. To some glands there is a reservoir attached, for the reception and accumulation of the fluids secreted.

§ III. *The material and physical Causes of Secretion.*

I. Do any of the secreted fluids exist formally in the blood?

II. Do the phenomena of secretion depend on mechanical or chemical causes? Has Galvanism any material effect on the secretions?

III. Which of the secretions are altered by local and mental irritations?

IV. Is there not in health a certain relative proportion or equilibrium preserved among the different secretions?

V. Are not solid parts of the body deposited or secreted in a similar manner to the fluids?

VI. Wherein do the excretions differ from the secretions? (Vide page 14, III. The excrementitious fluids.)

(z) THE ORGANS AND USES OF RESPIRATION.

Respiration or breathing consists in the alternate inhalation and exhalation of respirable air: we must therefore first describe,

I. The organs which are subservient to inspiration.

II. Those which contribute to the process of expiration.

Of these organs, some are active, viz. the diaphragm, intercostal and abdominal muscles, &c.

Others are wholly passive, their motions depending on the action of the muscular parts, viz. the ribs, lungs, trachea, &c.

As intimately connected with respiration, we are to explain the phenomena of,

I. Coughing.
II. Expectorating.
III. Sneezing.
IV. Hiccoughing.
V. Laughing.
VI. Crying.
VII. Yawning.
VIII. Sucking.
IX. Drinking.
X. Smelling.
XI. Suffocation, strangulation, submersion.

Remarks on the qualities of respirable air, and the changes it undergoes during animal and vegetable life.

I. Mechanical
II. Chemical
} Properties.

The primary uses of respiration are to generate and diffuse the animal heat, by effecting a peculiar change in the blood as it passes through the lungs. How is this proved?

Does the placenta perform the office of lungs to the fœtus in utero? (See the Lecture on PARTURITION, page 120, IV. 5.)

How is the internal heat produced in vegetables, and in creatures which have no lungs? What are the principal theories relative to the production of animal heat?

(AA) THE ORGANS AND THEORY OF SPEECH.

I. General remarks on the properties and uses of speech.
II. Description of the organs for articulation. } See page 17,
III. Those for modulating the voice. } § X.
IV. The progressive states and varieties of the human voice, in both sexes.
V. Suggestions on the method of teaching dumb persons to speak.
VI. Of ventriloquism and inarticulate sounds.

(BB) OF PROCREATION, GESTATION, AND PARTURITION.

I. Description of the organs of generation.
1. In the male. } See pages 17, 18, § XI.
2. In the female. }
3. On what does the fecundating quality of the semen depend? Does it contain animalcules?

II. The pre-requisite conditions of generation.
1. In the male } human subject.
2. In the female }
3. In hermaphrodite animals and vegetables.

III. Phenomena of conception and utero-gestation.
1. During the early months.
2. During the latter months.

IV. The period and signs of parturition, &c.
1. Changes in the general state of health.
2. Changes in the uterus and breasts, &c.
3. Circumstances of natural labour, at the ordinary period.
4. Of protracted, laborious, and preternatural child-birth.
5. Connexion between the fœtus and parent. (See Lectures on RESPIRATION and CIRCULATION.)

V. Forensic and pathological considerations,
1. Respecting virgins.
2. Respecting mothers.
3. Respecting infants.
4. Respecting juries and trials, &c.

(cc) OF ANIMAL GROWTH AND DECREASE, &c.

I. During the present state of human existence, our senses and perceptions are gradually evolved, matured, and perfected. At first our propensities and wants are few; the appetites we discover are chiefly confined to nourishment and sleep; our corporeal faculties are imperceptibly opened; our ideas enlarge and multiply; our feelings, which in early life were generally painful, become less unpleasant, and by degrees we assimilate with the objects around us.

II. About the seventh month dentition usually advances; first the incisors, then the lateral teeth; and lastly some of the grinders, which appear twelve or eighteen months later than the others: but the entire set is not formed until twenty or more years have elapsed; and, during that interval, commonly about the seventh year, the primary or milk teeth will have shed themselves, and have given place to another row, with longer as well as wider fangs.

III. The bony system in general is completed very slowly: the ossific matter is gradually deposited in a nidus of cartilage or membrane; the central parts of the long and flat bones become harder and harder, while their extremities continue soft or more flexible. The spaces between the bones of the head, called *fontanels*, by little and little are obliterated; and, about the second year after birth, the infant is able to sustain its own weight agreeably and progressively.

IV. The head still is disproportionably large; the limbs and cheeks are rotund; there is a superabundance of fluids and of fat; but, in a few years, the several members of the body approach nearer to the standard of maturity and symmetry. About the twelfth or fourteenth year (though differing in various climates) the phenomena of pubescence begin to appear; menstruation, with a rising of the breasts, take place in the female; and in both sexes there are novel propensities.

V. During the period of adolescence or puberty, the two sexes not only discover signs of personal attachment for each other, but in the male there is a change of voice, occasioned by an

enlargement of the larynx; and in both sexes there are other marks of increasing organical action, with a developement of the genital parts. But it must ever remain a problem, too difficult of solution, what are the immediate physical causes of all these phenomena.

VI. When the period of virility and of complete growth has arrived, the body is in its utmost strength and activity: this happens between the 20th and 35th year; but, after a lapse of ten or fifteen years longer, the fulness of the countenance and of the female breasts begins to subside, the skin exhibits wrinkles, and loses its glowing complexion; at the same time the menses cease to flow, or they become irregular; and if no material injury has been hitherto sustained by the constitution, a woman then acquires a state of health which bids fair to exceed that of man in duration.

VII. The varying relations and energies which subsist among certain individuals, constitute what have been named the temperaments; and of these there are modifications or idiosyncrasies resulting from the different states of peculiar organs. The knowledge of the temperaments is highly useful to medical practitioners, and interesting to the observant physiognomist. Perhaps the best-defined temperaments are, *first*, the sanguineous; *secondly*, the phlegmatic; *thirdly*, the melancholic; *fourthly*, the irritable or choleric: to which some have thought we may add, *fifthly*, the nervous temperament, *i. e.* the acutely sensible.

VIII. The grand national characteristics observable among the human species, will be noticed in our concluding lecture on PHYSIOGNOMY and CRANIOGNOMY.

IX. In the decline of life, our bodily strength fails; the spine yields under its accustomed burden; the whole bulk of the animal system gradually diminishes; the skin loses its former tension, especially in the face and female bosom; the hair is more scanty, harsh, and grey; the external secretions mostly decrease; the fluids tend towards a state of pravation; the blood flows with a languid pace, and the arteries become obliterated at their extreme branches; sensibility is likewise blunted;

blunted; the organs of vision and of hearing are impaired; the digestion and absorption of nutriment are impeded; the rigid limbs hardly advance with the superincumbent frame; the decayed teeth fall out, from a removal of their bony sockets; the rapid strides of death now soon become inevitable, and the veil of eternity is at length drawn aside by complete dissolution.

X. This event happens at every age; but calculations have been made of the probability of human life continuing till a given period. The celebrated Dr. HUFELAND computes that, of a hundred persons, there are

50 who die before they attain the age of 10 years,
20 - - between - - - 10 and 20
10 - - between - - - 20 and 30
6 - - between - - - 30 and 40
5 - - between - - - 40 and 50
3 - - between - - - 50 and 60
6 - - above the age of - - - 60

M. BUFFON has calculated that a fourth part of the children who are born alive, die before eleven months; a third of them perish before the twenty-third month; and nearly half, before they attain their eighth year: that two thirds of mankind die before their thirty-ninth year; three fourths before they reach the fifty-first; and, of about twelve thousand human beings, only one survives a whole century.

Another estimation has been made as follows:

Of 1000 persons, 260 die within the first year; 80 in the second; 40 in the third; and 24 in the fourth; and within the first eight years of life, 446, or almost one half of the number, are cut off by premature death.

Mr. EASTON, in 1799, had found authentic accounts of one thousand seven hundred and twelve persons, after A. D. 66, who lived above an entire century, in the following ratio:

1310 persons died between the age of 100 and 110 years.
277 - - - between - - 110 - 120
84 - - - between - - 120 - 130
26 - - - between - - 130 - 140
7 - - - between - - 140 - 150

3 persons died between the age of 150 and 160
2 - - - - between - - 160 - 170
3 - - - - between - - 170 - 185

XI. What is the principal cause *in nature* which has shortened the duration of human life so much, compared with that of the antediluvian world?

(DD) OF THE BRAIN, NERVES, AND SENSATION.

The organs and phenomena of sensation are so intimately connected with all the other functions of the human body, that the study of their laws constitutes one of the chief branches of physiology. Previous to the consideration of any of the senses in particular, (of which there are usually reckoned five,) it will be proper to give an account of the nervous or brainular system in general.

§ I. *Structure of the Brain and Nerves.*

The principal circumstances to be here noticed are,

I. The situation of the brain,
II. Its figure and magnitude, } in different animals.

III. Its membranes. (See p. 105, 1. (*a*.)

IV. Its texture, colour, medullary and cortical substance.

V. Its hemispheres, lobes, and convolutions.

VI. Its natural and artificial distinctions, ventricles, &c.

VII. Its arteries, sinusses, and veins. Lymphatic vessels?

VIII. Its medullary processes, elongations, and numerous branches of nerves.

IX. The ten pair of nerves, which arise immediately from the brain, have been thus described by a French poet:

"The first in rank directs our fragrant smell;
The second gives us power of seeing well;
The third commands the motions of our sight
To contemplate with ease the sacred light;
The fourth to secret lovers gives the law;
The fifth keeps time in moving either jaw;
The sixth, by turns, pourtrays our pride or sight;
The seventh asserts to melody a right,

To

To wake the soul with feelings fit for kings;
The eighth strong nerve employs a hundred springs;
The ninth excites the call for daily bread;
The tenth sustains with grace the neck and head."

§ II. *Peculiar Uses of the Brain and Nerves.*

I. The brain receives impressions or physical motions from the impulse of tangible bodies, producing a variety of sensations and perceptions: but under certain conditions, these impressions may be interrupted, so as not to be conveyed to the brain; and then no feeling or mental change will be produced. What are the *conditions* here alluded to?

II. The nerves transmit volitions or imperative determinations from the brain to the voluntary muscles: but, under given circumstances, the nerves fail to transmit, and the muscles to obey, such voluntary intimations. What are these peculiar *circumstances?*

III. Can physiologists explain the phenomena of muscular action, when it is unaccompanied with any perception, sensation, or volition; and even after the entire excision of a muscle from the living body?

IV. Is there a secreted nervous fluid, or a peculiar oscillation, or any other known physical change propagated through the brain and nerves, during the phenomena of sensation and muscular motion? (See p. 57, *Query.*)

V. Does sensation, perception, consciousness, or mental action of any kind whatever, result from a peculiar texture and organization of the brain and nerves?

VI. Is it not incompatible with the well-known properties of matter, or extended substance, to possess the attributes of thinking and feeling?

VII. Do not these attributes, under all their various modifications, necessarily belong to, and inhere in, a subject which is neither divisible nor corruptible, *i. e.* incorporeal?

VIII. A conclusive argument to prove the unity or indivisible nature of the percipient principle in MAN, may be derived from the fact of his ability to experience and compare

together

together *different sensations* (such as smells, tastes, sounds, colours, and other kinds of feeling) by successive acts of consciousness in the same individual; which fact demonstrates that, however distinct and diverse from each other these perceptions are, they must be experienced by a being essentially ONE, *i. e.* UNCOMPOUNDED, and therefore immaterial.

IX. Are physiologists fully acquainted with the proximate causes of torpor, sleep, and mental inactivity? Can there be such a state during the continuance of animal life, as that of complete inactivity? Does not such a state imply total insensibility and absolute death?

(EE) ON THE ORGANS AND THEORY OF HEARING.

The ear consists of external and internal parts, *viz.*

I. *Externally:* an elastic cartilaginous expansion; having a central concavity with surrounding eminences and depressions, a pendent lobule, and an auditory tube or *meatus*, bounded by a delicate but tense membrane, resembling the head of a drum. This outer part of the organ is supplied with muscles, (sometimes possessing voluntary motion,) and is lubricated within by a viscid ceruminous secretion.

II. *Internally:* seated in the petrous portion of the temporal bone, we find a cavity named tympanum, and four separate ossifications, (from their figure called *malleus*, *incus*, *orbiculare*, and *stapes*,) having peculiar muscles; with several openings from the drum, (viz. *fenestra ovalis*, *fenestra rotunda*, the Eustachian tube, and the entrance of the mastoid cells,) lined by a very thin membrane; beyond which is a very intricate and curious labyrinth, composed of solid bone, and distinguished into the following parts:

1. The vestibulum, in which are five openings.
2. Three semicircular canals (both membranous and bony) leading into the vestibule.
3. The cochlea, consisting of two and a half spiral windings.
4. Soft filaments of the auditory nerve (from the 7th pair) lining all the recesses of the labyrinth.
5. A semi-gelatinous fluid, peculiarly adapted to receive undulations

dulations excited by the vibrating air, as it passes into the *meatus externus* and the Eustachian tube.

From the foregoing account of the structure of the ear, we may apply the laws of acoustics to this organ in explanation of its PHYSIOLOGY.

An opportunity will likewise here offer, of adverting to some of the ordinary causes and remedies of deafness.

For a description of the experiment (which has been lately revived) of perforating the *membrana tympani*, see Dr. *Holder*'s Elements of Speech, published in 1669; *Willis*, De Anima Brutorum, c. 14; *Valsalva*, Tract. de Aur. Hum. c. 5. § 5; *Morgagni*, Epist. Anat. 13, § 11; and several authors referred to in *Medical Review*, vol. ix. p. 586.

(FF) THE ORGAN AND THEORY OF SMELLING.

I. As the sense of vision is produced by the impulse of luminous particles upon the expanded optic nerve, and the sense of hearing by the vibration of elastic bodies upon the fluid which moistens the fibrils of the auditory nerve; so is the sense of smelling occasioned by the volatile particles of odorous substances impinging on the olfactory nerves, and the sense of taste by the appulse of sapid bodies on the nervous papillæ of the tongue. Thus, then, it appears that the excitement of all the other senses depends on the same principle as that of feeling or touch; namely, the mechanical impression of substances, either mediately or immediately in contact with the percipient organ. Those substances only which emit subtile effluvia from their surfaces, are capable of affecting us with the perception called smell or odour; and the ordinary vehicle of odorous particles is the air we respire, which dissolves and conveys them into the nostrils at every inspiration. The invisible pungent vapours, being thus wafted by the air, strike more or less forcibly upon the interior surface of the nasal cavities: these cavities, therefore, are to be regarded as the proper seat or organ of smelling.

II. The acuteness of this sense (greatly differing in different animals) will depend on several circumstances, *e. g.*

1. On

1. On the extent of the nasal *fossæ*, which are every where lined with a delicate pituitary membrane.
2. On the quantity or quality of the secreted mucus, which naturally lubricates this membrane, and sometimes desiccates upon its surface.
3. On the sensibility and healthy state of the olfactory nerves, spread over the various sinuosities of the nose.
4. On the degree of percussion and retention of the air during the act of smelling.
5. The condition of the odorous substance; *viz.* its state of solubility and tenuity, &c.

Odorous qualities are almost indefinite in their number, and indescribable in their nature. The attempts which have been made to class them, by Boerhaave, Linnæus, Haller, &c. have therefore been very unsuccessful, and inconsistent with each other.

(GG) THE ORGAN AND THEORY OF TASTING.

I. It is not less difficult to class and define the qualities of sapid bodies, than those of odorous effluvia. We all know what is meant by sweet, bitter, sour, saline, spirituous, and astringent flavours; and no person can mistake the *fragrance* of a rose for the *nauseousness* of aloes; but to attempt a definition of these various terms, would betray an ignorance of the complex nature of language, and the indescribable simplicity of our sensations.

II. These at of taste is chiefly in the nerves which are distributed upon the superior surface of the tongue; but all the inner parts of the mouth seem to possess the sense of tasting in a lower degree, or at least they assist in rendering our perception of flavours more exquisite than when sapid bodies are applied to the tongue alone.

III. Taste resembles the sense of feeling or touch much more than any of the other senses: it requires, however, that a substance should be in a state of solution, as well as of close contact with the tongue, before a savour can be excited by it. A perfectly dry body (suppose a lump of sugar or salt) will not

not occasion any flavour until it is dissolved by the saliva; but it will produce only the usual sense of feeling in the tongue, in the same manner as if it had been applied to another part of the body. To preserve a correct and natural flavour, we should, therefore, keep the nervous papillæ of the tongue clean from slimy or bilious impurities; and should not frequently indulge a vitiated taste for condiments or luxurious viands, &c. which (by excess of action) blunt the sensibility of this organ.

IV. Many quadrupeds possess the sense of taste in a higher degree of perfection than man; perhaps, from their tongue having larger nerves, a softer and moister skin, a more extensive surface, more flexible and varied motions, a taste not at any time depraved by unnatural savours, and possessing an acuteness which is more indispensably requisite for their well-being than in the human species. This exquisite faculty belongs to the herbivorous tribe of animals.

V. By habitual use we may become perfectly reconciled to flavours, which once were most disgusting; *e. g.* those of olives, coffee, oysters, tobacco, austere wines, &c. But that effect of habit does not exclusively belong to the sense of tasting.

VI. By a figurative mode of speech, we apply the term *taste* to the senses of hearing and seeing; when, for example, we say, "such a person has a taste for music or for painting." The appetites of hunger and thirst are to be carefully distinguished from the sense of tasting.

VII. This voluble member, the tongue, though apparently a single organ, is composed of two parts bearing an exact symmetry with each other, but in reality as distinct as the two sides of the heart itself. Both anatomical and pathological observations confirm this remark, of the almost total independence of the two sides of the tongue.

(HH) ON THE MECHANISM AND USES OF THE EYE.

A competent knowledge of the mechanism and uses of the eye has taught us the mode of constructing various optical instruments; but no mathematician has ever been able to

form an apparatus half so beautiful as the eye, and so exquisitely adapted for its purpose. This little organ possesses all the known excellencies of the most perfect optical instruments, without being chargeable with any of their defects; and therefore, among a thousand other examples, it serves to demonstrate that the mechanism even of the best human contrivances falls infinitely short of that degree of perfection which is hourly produced by the DIVINE ARTIFICER!

The chief peculiarities and uses of the human eye may be described under the following heads:

§ I. *Situation of the Eyes.*

I. The eyes are seated in two deep bony sockets, near the upper and lateral parts of the nose. The advantages of their situation consist,

1. In being very near the brain or common sensorium, for the ready conveyance of impressions excited by visible objects.
2. For the purpose of affording an elevated and ample view of the different creatures surrounding us, either celestial or terrestrial.
3. That the eyes should be out of the reach of danger from external casualties; which would not have been so much the case, if they had been situated more prominently and within softer parts of the body.

II. The bony socket itself, in which the organ of vision is placed, is of a somewhat conical figure, with its apex backwards, having several irregular openings for the transmission of nerves and blood-vessels. Each of these orbits is composed of different processes of the following bones, viz.

1. Os frontis.
2. Os sphenoides.
3. Os ethmoides.
4. Os maxillare superius.
5. Os unguis.
6. Os malæ.
7. Os palati.

§ II. *The Number of the Eyes.*

I. In the human subject, and most other animals, there are two eyes, which afford several advantages:

1. We receive a clearer, more perfect, and more vivid perception of luminous objects from two eyes than from only one.
2. When one of them is hurt or impaired, the other serves as a provision for the misfortune, and officiates alone.
3. We are better able to form a correct notion of distances and the relation of objects to each other, with both eyes than with one; as any person may perceive in attempting to snuff a candle or thread a needle, one eye being shut at the same time.

II. But some creatures have more than two eyes; and this is particularly the case, where the CREATOR hath denied the power of motion either to the eyes or to the head.

1. Spiders have no neck, and therefore could not, with two eyes only, have been enabled to see in various directions with facility: they are therefore provided with four, six, or eight eyes.
2. Common flies, wasps, and some other insects, have many perforations, equivalent to as many eyes, in the anterior part of the visual organ; by which means they are enabled to see their prey or their adversaries, without directing their head toward the object. In the dragon-fly this curious structure is very observable, so that its head appears to be almost composed of visual organs.

§ III. *The Form and Connexion of the Eyes.*

I. The organ of sight in man and quadrupeds is of a spherical form; but in birds and fishes it is of a spheroidal, or flattened globular figure, *i. e.* depressed before and behind. This shape of the organ is peculiarly convenient:

1. For the purpose of easy and unimpeded motion within the bony socket, which is lined with a slippery pinguedinous substance.

2. The roundness of the anterior part of the eye is adapted for the convergence or approximation of the rays of light, and serves to direct them into the pupil towards the bottom of the eye.
3. This figure also is the very best that could have been contrived for containing the various humours, which are to receive and refract the rays of light coming from luminous bodies.
4. By the spherical form of this organ, the humours (as Dr. Porterfield observes) are not only commodiously laid together for performing their office of refraction; but all the parts of the *retina* are placed at a due focal distance behind the *crystalline* lens.

II. The globe of the eye is attached to its appendages and to the surrounding parts by various means:

1. It is embedded in a soft fatty substance, which may partly serve for its defence or security, in the event of any blow or external compression being received, and partly to facilitate the different motions of the eye.
2. It is further connected to the bony orbit by the large nerve which passes obliquely into its interior, and is spread over the greater part of its humours.
3. But the eyeballs are principally connected to the sockets and to the eyelids by means of a delicate tunic, called membrana conjunctiva or adnata; which extends itself over a great part of the anterior surface of the sclerotic coat, (to the edge of the *cornea*,) and is reflected back to cover the inside of the eyelids.
4. Besides these connecting membranes, &c. some anatomists describe a fine cuticular covering to the fore part of the eye, and a white tendinous expansion; which, by others, are considered not as distinct coats, but as layers of the *sclerotica*.

§ IV. *Appendages to the Eye.*

These are, all those parts which lie externally, or without the globe itself; comprehending,

I. The eyebrows or supercilia, which are peculiar to the human species.

1. Their form is that of an arch.
2. Situated upon the ridges of the frontal bone.
3. Composed of short hairs, arranged obliquely, with their roots toward the nose.
4. Their use is uncertain. They have been supposed serviceable to defend the eyes from dust and sweat, or to shade them from too strong a light; but perhaps they are more for expression and beauty than for use.
5. They are moved and wrinkled by the frontal, the corrugator, and the orbicular muscles.

II. The eyelids or palpebræ, upper and lower.

1. We observe, that they are made up of a folding of the skin, enclosing part of the orbicularis palpebrarum muscle. In nocturnal birds, &c. there is a membrana nictitans, which answers the purpose of a third eyelid on particular occasions.
2. They are stretched out by slender cartilaginous arches, in the edge of each eyelid, named tarsi.
3. At their margins are situated the rows of hair called eyelashes or cilia; which may assist in performing the offices that have been ascribed to the eyebrows.
4. Between the tarsus and lining of the eyelid is found a row of minute sebaceous glands or follicles; which secrete an unctuous substance through the puncta ciliaria, placed at the edges of the lids, to prevent their accretion during sleep, &c.
5. The angles formed by the junction of the palpebræ are named canthi, of which the inner is the largest; and where may be seen a red conoid glandular body, named
6. Caruncula lachrymalis; which separates the puncta lachrymalia, and directs the tears into them while the eyelids are closed.
7. The uses of the palpebræ are, to exclude the light during sleep or at any other time we desire; also to produce the effect named winking, whereby the tears are equally diffused

diffused over the eye, and extraneous substances are washed off; they are likewise a safeguard to this organ, against little accidents of various kinds which might happen to them, and injure the sight.

III. The lachrymal gland and its ducts.

1. The gland itself is of the conglomerate kind, situated upon the upper and outer part of the eye, in a hollow behind the exterior end of the superciliary ridge.

2. There are some lesser glandular bodies likewise found lying between the principal gland and the upper eyelid, connecting them to each other; whence arise several excretory ducts.

3. About ten or twelve ducts are found opening under the edge of the upper palpebra, which continually pour out the lachrymal fluid to moisten the eye, &c.

4. The tears are directed into two very minute orifices or puncta, which originate from an eminence on the inner edges of the eyelids, approaching each other gradually, and then terminating by an angle in the lachrymal sac.

5. This receptacle is so named from its office of receiving all the tears from the *puncta lachrymalia*; and is seated near the upper part of the nose, communicating with the *ductus ad nasum*, which descends towards the nostrils, on each side, behind the conchiform bone. We may hence explain why persons are compelled to blow their nose, when the tears are flowing very freely; and why those who have a *fistula lachrymalis* cannot prevent that briny fluid from running down the face.

IV. The numerous muscles of this dioptric machine belong either,

1. To the eyelids, or
2. To the eyeballs.

} For the description of these muscles, see the MYOLOGY.

The muscles of the palpebra are, an elevator, a depressor, and a compressor: those of the globe of the eye are, an elevator, a depressor, an abductor, an adductor, and two oblique muscles. By means of these the visual organ is not only turned towards objects in every direction, with extreme celerity,

celerity, but we are also enabled to express a variety of mental emotions: again, by the simple contrivance of a muscular lid or curtain to the eye, we perceive how nimbly this delicate and useful instrument is wiped, defended, and closed! Well might a philosopher maintain, that the examination of the eye was a cure for atheism. (This argument is applied with admirable force and elegance by Dr. PALEY, in his "*Natural Theology*," chap. iii.—a volume which I beg leave to recommend, as highly deserving the perusal of every considerate physiologist.)

§ V. *The Coats or Tunics of the Eyeball.*

I. The external vestment of the eyeball is named *sclerotica*, which is very dense, tough, thick, and of a white substance: it encloses the whole of the humours, and is distinguished into several parts.

Its anterior portion is more convex than the rest of the globe, is perfectly diaphanous, and from its horny texture has been denominated *cornea transparens*.

The principal opake portion lies behind, and is named *cornea opaca*; the fore part of which being of a pure glistening white, and penetrated as it were by the tendons of all the straight muscles, is thence called *tunica albuginea*.

Its posterior and inner part is pierced through by the optic nerve, near its exit from the brain, at the *foramen opticum*.

II. The middle tunic, which next follows, is the *choroides*, an extremely vascular, nervous, cellular, and thin membrane; connected closely at its anterior edge to the sclerotic coat, by the *ciliary circle* or ligament, and to the outer margin of the beautiful septum named *iris*. The inside of the choroid coat is covered with a dark paint-like mucus, *nigrum pigmentum*, probably secreted by minute arteries on its surface: this pigment (which varies its colour in different animals) forms little elevated processes or *radii* opposite the ciliary circle; and by its blackness it stifles the light, producing by that means a true *camera obscura*.

From

From the anterior edge of the *choroides* is suspended a circular veil, the *iris*, perforated in its centre by the *pupil:* this membrane has the power of alternately contracting and dilating, so as to admit more or less light, as occasion may require; and is of a variegated tint, *viz.* hazel, grey, blue, green, black, yellowish, brown, &c. in different persons. The internal or back part of this curious septum has been termed *uvea* by the older anatomists: it is composed both of transverse and orbicular fibres, wonderfully important, and truly muscular in their office! In the early months of fœtal existence the pupil is completely closed by a vascular tissue, denominated *membrana pupillaris*, which before birth is removed by a marvellous decree of nature!

Let the dullest reasoner say, whether or not this little piece of mechanism demonstrates the previous intention, contrivance, and design of a creating hand, divinely skilful?

III. The inner coat or lining of the globe, called *retina*, is the proper seat of vision; and consists of a whitish pulpy expansion of the optic nerve, extending forwards over the whole *vitreous humour* to the edge of the *crystalline lens*. The retina, then, lies between the choroid membrane and that which immediately envelopes the vitreous humour; but adheres to neither of them till it reaches the ciliary circle, before described. It has been computed that the fibrils of this nerve do not equal the thirty-two thousandth part of an hair's breadth in diameter: and that, near their origin, the two portions of optic nerve decussate and interlace each other, so as to form only one medullary centre for botl. eyes. A small artery is always seen penetrating the middle of the optic nerve, and ramifying within the retina itself.

§ VI. *The Humours or refracting Media.*

I. The aqueous humour is least in quantity, and by much the thinnest fluid of all: it is lodged within the space betwixt the transparent cornea and the crystalline lens; which, being intersected by the iris, forms two distinct cavities, *viz.* the anterior and posterior chambers, communicating through the pupil.

pupil. This aqueous fluid is readily supplied again, when it has been evacuated by artificial means or by accidental wounds of the cornea: and although its quantity exceeds no more than five or six grains in weight, there is enough to preserve the iris in a pendulous or floating position, that it may not contract adhesions with contiguous parts of the eye.

II. Immediately behind the aqueous humour is placed the *crystalline lens*, a brilliant double convex body, enclosed in a capsule, and embedded in the fore part of the vitreous humour: it is of a viscid semi-fibrous nature in its composition; made up of concentric laminæ, which are most dense in their centre, and are apt to become still more so (as well as amber-coloured) in the decline of life. The degree of convexity is greater at its posterior surface, and is almost spherical in the fœtus; but varies considerably in different animals. This lens may be extracted or depressed in certain cases of blindness, caused by an opacity of the lens or its capsule; though it will never be regenerated like the aqueous humour, and must therefore be compensated by the use of a double convex glass.

III. The third humour, called vitreous, from its resemblance to melted glass, is much larger in bulk than the other two; and occupies all the remaining space in the eyeball, which is about nine tenths of the whole cavity. This semi-gelatinous fluid is also enclosed in a peculiar reticulated capsule, named *hyaloid*; as that of the crystalline is termed the *aranea*, from its web-like structure: but the general mass of the vitreous humour is diffused through a cellular tissue of extremely delicate fibres, intersecting each other, and which may be rendered visible by congelation, &c. The central artery of the optic nerve passes over the surface of this humour, and is continued on to the capsule of the crystalline lens.

§ VII. *Remarks on the Phenomena of Vision.*

To give an ample account of the theory of vision, (which is impossible in this summary course of lectures,) it would be requisite that the properties of light and colours should first be explained: *viz.* more especially,

I. The difference between light as a peculiar sensation, and as it consists in luminous rays of various colours.

II. The incalculable divisibility and tenuity of luminous particles, which can penetrate the hardest substance (a diamond for example) without any apparent obstruction.

III. The inconceivable velocity of the sun's rays, moving upwards of two hundred thousand English miles in a moment of time.

IV. The property of different media through which pencils of rays may pass, in varying the course of the light as it penetrates those of a different density.

V. The nature and optical effects of reflecting and refracting substances.

VI. The manner in which any object is depicted by the lenses of a telescope, or in a *camera obscura*, which bears an humble resemblance to the dioptrical apparatus of the eye.

The infinite superiority of the natural organ of vision to the most ingenious piece of human mechanism, contrived for similar purposes, will appear from the following considerations:

1. In its admitting, moderating, or excluding the light, as occasion may require.
2. In spontaneously accommodating itself to objects at various distances.
3. In the power of giving distinctness of sight with two visual organs.
4. In having the faculty of self-motion, or inherent voluntary action.
5. In rectifying many of the inconveniences, disorders, and accidental defects, to which this apparatus is liable by constant use in a variety of circumstances.

(11) ON THE COMMON SENSE OF TOUCH OR FEELING.

§ I. *General Observations.*

1. This sense, which exists in almost every part of the animal body, may be called the UNIVERSAL SENSE; and, like the other four senses, implies a perception or consciousness

ness of some extrinsic cause affecting the sentient organ.

A late writer (in his Treatise upon the Economy of Plants) has put the following question: "Plants are supposed to have no sensation, because in the vegetable system no nerves are detected; but is not sensation perceived in all intestinal worms, in which nothing like nerves can be found?" To this question we may answer, by asking him another: Does the author mean to insinuate that vegetables have a *perception* or *consciousness* of the agency of external bodies, in the same manner as he himself is affected by cold, heat, light, or any other quality of visible and tangible substances? If the mutations produced in plants, by the impulse of external bodies, be not precisely similar to what we ourselves experience under similar circumstances; what good end can be expected, either in philosophy or religion, from throwing out an indefinite hint concerning the "*sensibility*" of vegetables? Equally unmeaning is the declaration of this ingenious author—"that the motions of the leaves and parts of fructification, which" (he thinks) "are very similar to those of animal muscles, constitute in vegetables the *animal functions*." If the life of a plant be thus supposed to resemble that of an animal, we shall not be surprised to find it also affirmed by the same author, "that the *death* of a plant is of a *similar* nature to that of an animal."

II. In order to produce distinct vision, it is absolutely requisite that a picture should be formed in the retina of the eye: and to produce an audible sound, it is necessary that a vibrating impulse should be communicated to the labyrinth of the ear: also, in order to produce the sense of smell, it is required that the effluvia of an odorous substance shall impinge on the pituitary membrance of the nose: in like manner it is necessary, before we can produce a savour, that the sapid body be applied to the tongue in a state of solution: and, lastly, it is not less requisite, in order to produce the sense of touch, that a tangible body shall come in contact with the nerves of feeling: but, we are totally unable to find out why this necessity exists in nature, and how any one

perception is excited by the physical means above mentioned. That there do, however, subsist such natural relations, and that our corporeal feelings are excited by no other mode than through the intervention of material agents, is as evident (perhaps we may say) as our very existence. Thus far then we can go, and no farther, towards an explanation of the *causes* of bodily sensation; that is, of consciousness produced by terrene or visible beings. Ingenious hypotheses respecting this subject, might indeed be formed out of the BERKLEYAN system, and from that of LEIBNITZ's pre-established harmony.

III. It does not much facilitate our conception of this intricate affair to say, with Mr. LOCKE, that the qualities of corporeal bodies are communicated to our minds by the motion of particles applied to our nerves of sense, and thence to the brain or common sensorium: for, as Dr. SAMUEL CLARKE has wisely observed, in his answer to DODWELL, "No real quality can result from the composition of different qualities, so as to be a NEW quality in the same subject, of a different kind or species from all and every one of the component qualities;" since this would be "a creation of something out of nothing." Consequently, the motion, figure, magnitude, or any other known physical property of a substance, which may excite in us the sensation of its hardness, colour, smell, flavour, &c. could not (by any combination, composition, or change of its natural state) produce a MENTAL PERCEPTION, differing specifically from all and every one of the aforesaid qualities of matter. "The operation of insensible particles on our senses," mentioned by Mr. LOCKE, can therefore be regarded in no other light than a simple fact, which every body knows, *viz.* that *motion* is necessary to the production of any sensation; but why this imperceptible operation is requisite, or how the impulse of one particle of matter against another should be the apparent cause of an effect totally different from *motion*, is beyond all human conjecture: and surely no person will deny that our feelings, perceptions, ideas, and all other mental affections, do essentially differ from mere mechanical motion in two or more particles of matter.

IV. The sense of touch is occasioned by the juxta-position and collision of tangible bodies applied to the nerves of touch. By means of this impression we may acquire the ideas of solidity, moisture, cold, heat, figure, distance, continuity, and indeed every sensation not manifestly belonging to the other four; among which we also are accustomed to reckon various painful and unpleasant sensations, that have not yet been reduced to particular classes, genera, or orders.

V. The nerves of the skin, or the surfaces of our external organs, are mostly accounted the seat of touch; although the nervous system in general is undoubtedly sentient, in different degrees, but in a somewhat similar manner with the skin.

The four kinds of sensation already described, may be regarded as forming only one genus or class of sensations; *viz.* hearing, smelling, tasting, and seeing: 1st, as they have something common to each other; 2dly, as they arise from impressions made on no more than one part of the body; and, 3dly, as they arise from the agency of one kind of substance only. But no such characters concur with respect to the latter sense, that of TOUCH; to which physiologists have therefore referred every sensation or feeling, not evidently included in the other four.

VI. Dr. CULLEN has endeavoured to establish a distinct class of sensations, which perhaps should rather be referred to the head of purely intellectual or mental operations: namely, 1. Those of apperception, by which we are in general conscious of thinking, of perceiving, judging, and willing, and thereby of our existence and identity. 2. The sensations arising from the particular state of thinking, as our perception, memory, and judgment, are more or less clear, ready, or exact. 3. The sensations arising from the particular state of volition, and its various modes. 4. The sensations arising from the general state of action, as vigorous or weak, easy or difficult. 5. The sensations arising from particular actions, or a consciousness of the actions excited, and of the motion of the different parts of the body. 6. The sensations arising from the diminution or absence of impressions.

§ II.

§ II. *Suggestions by Sir Isaac Newton.*

The most profound mathematical philosopher whom this kingdom (or the world itself) ever produced, having condescended to throw out several modest hints, in the form of QUERIES, designed to elucidate the physical cause and phenomena of sensation, I shall close the present abstruse and difficult inquiry by quoting a few observations from that author's celebrated Treatise on Optics.

"*Qu.* 12. Do not the rays of light in falling upon the bottom of the eye excite vibrations in the *tunica retina?* which vibrations being propagated along the solid fibres of the optic nerve into the brain, cause the sense of seeing?"

"*Qu.* 13. Do not several sorts of rays make vibrations of several bignesses, which, according to their bignesses, excite sensations of several colours; much after the manner that the vibrations of the air, according to their several bignesses, excite sensations of several sounds?"

"*Qu.* 14. May not the harmony and discord of colours arise from the proportions of the vibrations propagated through the fibres of the optic nerves into the brain, as the harmony and discord of sounds arise from the proportions of the vibrations of the air?"

"*Qu.* 15. Are not the species of objects seen with both eyes united where the optic nerves meet before they come into the brain; the fibres on the right side of both nerves uniting there, and, after union, going thence into the brain in the nerve which is on the right side of the head; and the fibres on the left side of both nerves uniting in the same place, and after union going into the brain in the nerve which is on the left side of the head; and these two nerves meeting in the brain in such a manner that their fibres make but one entire species or picture; half of which on the right side of the sensorium comes from the right side of both eyes through the right side of both optic nerves to the place where the nerves meet, and from thence on the right side of the head into the brain, and the other half on the left side of the sensorium comes in like manner from the left side of both eyes?"

"*Qu.*

"*Qu.* 16. When a man in the dark presses either corner of his eye with his finger, and turns his eye away from his finger, he will see a circle of colours like those in the feather of a peacock's tail. If the eye and the finger remain quiet, these colours vanish in a second minute of time, but if the finger be moved with a quavering motion they appear again. Do not these colours arise from such motions excited in the bottom of the eye by the pressure and motion of the finger, as at other times are excited there by light for causing vision? And do not the motions once excited continue about a second of time before they cease? And when a man by a stroke upon his eye sees a flash of light, are not the like motions excited in the *retina* by the stroke? And when a coal of fire moved nimbly in the circumference of a circle, makes the whole circumference appear like a circle of fire, is it not because the motions excited in the bottom of the eye by the rays of light are of a lasting nature, and continue till the coal of fire in going round returns to its former place? And considering the lastingness of the motions excited in the bottom of the eye by light, are they not of a vibrating nature?"

"*Qu.* 18. If in two large tall cylindrical vessels of glass inverted, two little thermometers be suspended so as not to touch the vessels, and the air be drawn out of one of these vessels, and these vessels thus prepared be carried out of a cold place into a warm one; the thermometer *in vacuo* will grow warm as much, and almost as soon, as the thermometer which is not *in vacuo*. And when the vessels are carried back into the cold place, the thermometer *in vacuo* will grow cold almost as soon as the other thermometer. Is not the heat of the warm room conveyed through the *vacuum* by the vibrations of a much subtiler medium than air, which after the air was drawn out remained in the *vacuum*? And is not this medium the same with that medium by which light is refracted and reflected, and by whose vibrations light communicates heat to bodies, and is put into fits of easy reflection and easy transmission?"

"*Qu.* 19. Doth not the refraction of light proceed from the

the different density of this ethereal medium in different places, the light receding always from the denser parts of the medium?"

"*Qu.* 21. Is not this medium much rarer within the dense bodies of the sun, stars, planets, and comets, than in the empty celestial spaces between them?—And that the elastic force of this medium is exceeding great, may be gathered from the swiftness of its vibrations. Sounds move about 1140 English feet in a second minute of time, and in seven or eight minutes of time they move about one hundred English miles. Light moves from the sun to us in about seven or eight minutes of time, which distance is about 70,000,000 English miles, supposing the horizontal parallax of the sun to be about 12″. And the vibrations or pulses of this medium, that they may cause the alternate fits of easy transmission and easy reflection, must be swifter than light, and by consequence above 700,000 times swifter than sounds. And therefore the elastic force of this medium, in proportion to its density, must be above 700,000 × 700,000 (that is, above 490,000,000,000) times greater than the elastic force of the air is, in proportion to its density. For the velocities of the pulses of elastic mediums are in a subduplicate ratio of the elasticities and the rarities of the mediums taken together."

"*Qu.* 23. Is not vision performed chiefly by the vibrations of this medium, excited in the bottom of the eye by the rays of light, and propagated through the solid, pellucid, and uniform capillamenta of the optic nerves into the place of sensation? And is not hearing performed by the vibrations either of this or some other medium, excited in the auditory nerves by the tremors of the air, and propagated through the solid, pellucid, and uniform capillamenta of those nerves into the place of sensation? And so of the other senses."

"*Qu.* 24. Is not animal motion performed by the vibrations of this medium, excited in the brain by the power of the will, and propagated from thence through the solid, pellucid, and uniform capillamenta of the nerves into the muscles, for

for contracting and dilating them? I suppose that the capillamenta of the nerves are each of them solid and uniform, that the vibrating motion of the ethereal medium may be propagated along them from one end to the other uniformly, and without interruption: for obstructions in the nerves create palsies. And that they may be sufficiently uniform, I suppose them to be pellucid when viewed singly, though the reflections in their cylindrical surfaces may make the whole nerve (composed of many capillamenta) appear opake and white. For opacity arises from reflecting surfaces, such as may disturb and interrupt the motions of this medium."

"*Qu.* 28. The main business of natural philosophy is to argue from phenomena without feigning hypotheses, and to deduce causes from effects, till we come to the very FIRST CAUSE, which certainly is not mechanical; and not only to unfold the mechanism of the world, but chiefly to resolve these and such-like questions:—How came the bodies of animals to be contrived with so much art, and for what ends were their several parts? Was the eye contrived without skill in optics, the ear without knowledge of sounds? How do the motions of the body follow from the will, and whence is the instinct in animals? Is not the sensory of animals that place to which the sensitive substance is present, and into which the sensible species of things are carried through the nerves and brain, that there they may be perceived by their immediate presence to that substance? And, these things being rightly dispatched; does it not appear from phenomena that there is a BEING INCORPOREAL, LIVING, INTELLIGENT, OMNIPRESENT, who in infinite space, as it were in his sensory, sees the things themselves intimately, and thoroughly perceives them, and comprehends them wholly by their immediate presence to himself: of which things the images only carried through the organs of sense into our little sensoriums, are there seen and beheld by that which in us perceives and thinks. And though every true step made in this philosophy brings us not immediately to the knowledge of the FIRST

CAUSE, yet it brings us nearer to it, and on that account is to be highly valued."

"Our organs of sense," this great man remarks, *Qu.* 31, "are not for enabling the soul to perceive the species (or images) of things in its sensorium, but only for conveying them thither; and GOD has no need of such organs, he being every where present to the things themselves." *Optics*, by Sir ISAAC NEWTON, Knt. 3d edit. *Lond.* 1721, 8vo.

The limited state of our faculties will probably for ever prevent us from acquiring any considerable degree of knowledge respecting the immediate secondary causes of sensation and perception. The powers of human nature I think will necessarily remain inadequate to the discovery of an ethereal "*medium*" so inconceivably subtile as that which Sir ISAAC NEWTON has alluded to; and, of course, I can attach no other importance to his observations than as they come from a man, who would make no conjecture without profound deliberation. Whether or not the late discoveries in the science of *Galvanism* tend to confirm this hypothesis of Sir ISAAC NEWTON, I am uncertain. (See our *Query*, page 57.) But the difficulties which attend the present matter of inquiry, are not peculiarly applicable to this subject; for similar difficulties occur, from similar causes, on a variety of other physiological subjects.

Mr. NICHOLSON has very properly observed that the motions by which the operations of nature are performed, are not, for the most part, within the reach of our faculties; either by reason of the minuteness of the system of moving and mutually acting bodies, or the celerities of their motions. Our senses are bounded on either hand, by an immensity, of which an exceedingly small part comes under their perception. We reason concerning motion and attraction, but can form no conception of either: we judge from effects only; their causes are, and probably will for ever be, mysterious.

In things or acts of the same nature, reason, by the method of analogy, is able to carry us far beyond the immediate sphere of our senses: but when the object is of a different

nature

nature from any foregone perception, it may be such as entirely to elude them, and of course, never to come under the notice of the reasoning faculty. It is impossible for a blind man to form any idea of the manner in which we who see are affected by colours; for though an instance is recent of a teacher of optics, (the learned SANDERSON,) who never was endued with sight, yet his knowledge was merely that of the mathematical part, which may be obtained from the abstracted consideration of lines and angles. It is therefore not only possible, but very probable, that there may be many agents in nature which escape our observation merely for want of additional senses. If the sensation of the olfactory nerves were as obtuse as that of those nerves which, being distributed over the surface of the body, are supposed to be the organs of feeling, it is evident that we should not so much as suspect that such potent and plentiful emanations were constantly flowing from odoriferous bodies; for they are too minute to affect the touch, and too transparent to affect the sight. Serpents are said to be stupified with the smell of musk. Granting the fact, how many ingenious hypotheses of sympathy or antipathy would have been invented for the solution of the appearance by the philosophers of the Cartesian school, if they had not been endued with the sense of smelling. Thus, again, the current of the air which we call wind, is perceptible enough to the touch; but those extremely quick undulations which give us the sensation of sound would have for ever remained undiscovered, if the Creator had omitted to provide us with the curious apparatus which is adapted for that purpose in the ear. Without that most perfect optical instrument the eye, we should have remained totally ignorant of a very principal agent, *light*, except so far as it produces heat; and should have found so much difficulty, then, in conceiving how the knowledge of the existence of distant bodies could be obtained without contact, as we now do in conceiving how distant bodies can mutually act on each other by attraction or otherwise. Another sense would probably clear up many of our difficulties, by exposing

the intermediate agents; but as the case now is, it becomes us to be wary, and direct our search to those objects, in the contemplation of which there is some prospect of success.

It arises from a narrow and contracted way of thinking, that we are so ready to suppose the human faculties equal to every attempt; and much time and labour would be saved, if a due consideration were constantly had of what is and what is not in our reach. Yet, however certain we may be of the imbecility of our powers, and however probable it may be, that the greater part of nature is hid behind an impenetrable veil, it is highly necessary to advance as far as the lights of which we are in possession will allow. Such a proceeding, besides the numberless advantages which arise in common life from the sciences, is so natural to the constitution and texture of the mind, that it may justly be doubted whether we are capable of standing still with respect to increase of knowledge. If the attention be not directed to affairs of consequence, it will of itself fix upon trifles.

Of the many intelligences we receive from our senses, there still remains a great number which have not been accurately or rightly considered. Before the time of Sir Isaac Newton, it was never suspected that the rays of light consisted of a mixture of particles possessed of the property of exciting ideas of an almost infinite number of colours: and till this last century, the electric matter, which is perhaps one of the principal agents in nature, was entirely unnoticed; the means of subjecting it to the observation of our senses being till then unknown. Original discoveries in nature have usually arisen from accidental circumstances; for where there is no ground for previous argumentation, it is clear that a settled intention can seldom be followed. Nothing seems more surprising and extra-natural than the electric shock, (which may be produced either by an electrical machine or by the *Galvanic* apparatus.) The laws by which that fluid, if it may be so called, acts, are yet very imperfectly known, and it is not impossible but that future operators may meet with phenomena

phenomena as unexpected and as strange as that uncommon sensation was to the philosopher who first experienced it.

"Lo, these are parts of GOD's ways; but, how little a portion is known of them!!!"

(JJ) ON THE CORPOREAL EFFECTS OF THE PASSIONS.

§ I. *Preliminary Suggestions.*

I. To the moralist, the politician, and to the medical man, the study of the human passions must be regarded as highly interesting: but my present design being only to treat of what strictly relates to the animal economy, this subject will be considered in a very limited point of view; and chiefly, as the bodily frame is affected by our different mental emotions.

II. The term PASSION is used to denote those tumultuous and transient affections, which are either not at all, or but imperfectly under the control of the human will. It is therefore to be considered as an expression of some vehement natural disposition or propensity, rather than as signifying a distinct and independent principle of action.

III. Various opinions have been entertained respecting the number and distribution of the passions: but to enter much into this kind of inquiry, would be wandering from the professed object of our lecture. They have most frequently been arranged under the two heads, of *exciting* and *depressing* passions; which seems to be a convenient distribution of them for medical purposes.

IV. If we advert to the strong impression made upon the corporeal system by every violent emotion of the mind, it will not appear surprising that they should effect permanently important changes under particular circumstances. We are unable to state exactly in what manner these effects are produced on the human frame; but they are commonly supposed to arise from an immediate influence on the nervous power.

V. In consequence of this influence, deviations are produced either on the whole body or some particular organ; and thus there happens a deviation or derangement of one or more

more of the functions. These deviations are caused by some or other of the following changes:

1. By moderating inordinate motions.
2. By restoring the body from a state of languor and inactivity, to a salutary degree of vigour.
3. By exciting some organ to excessive action.
4. By inducing a temporary torpor.
5. By permanently debilitating the animal frame.

§ II. *Of Hope.*

Hope, in its temperate exercise, communicates a mild and agreeable sensation to the breast. It elevates and invigorates the whole body and mind. It produces a flow of animal spirits, diffusing an increase of vivacity and energy to the system. It unites moderation with vigour, checks the violence of tumultuous emotions; and removes, or tends to remove, every species of morbid debility. Hence it is the practice of medical men to inspire their patients with hope in alarming diseases, especially when they proceed from fear, sorrow, or anxiety. Hope therefore demands a place among the class of remedies which are grateful in their operation and exhilarating in their effects.

§ III. *Of Joy.*

Joy is very similar in its influence to hope; but in its effects it is more powerful and more tumultuous. It stimulates to bodily action, and diffuses a considerable vivacity over the whole system. It quickens the circulation of the blood; excites temporary palpitations of the heart; accelerates the contractions of the arteries; enlivens the sparkling eyeballs; animates the countenance; gives a glowing warmth to the blushing cheek; and stimulates the lachrymal glands, so as to occasion a flow of tears.

Both mind and body seem to sympathize, and are involuntarily compelled to shew their feelings, by loud acclamations or extravagant gestures. Hence then, in dull phlegmatic habits, where coldness and hebetude prevail, the cordial

of

of joy is found to act like a charm, by its exhilarating and vivifying powers.

Immoderate transports of joy have, indeed, produced epilepsies, palsies, and other bad effects, from an over-quantity or degree of excitability, beyond what a delicate system could endure: we should therefore at all times communicate very joyful and unexpected tidings to susceptible persons, with a prudent deliberation and a foresight of possible consequences; lest the suddenness and violence of the concussion produce an effect diametrically opposite to what was intended. Even death itself has ensued from the too sudden reception of unexpected good news!

§ IV. *Of Love.*

Love is both an affection and a passion. It does not produce any of the rude effects of the other exciting passions; but inspires the mind with delight and complacency, unknown to the other emotions. The blandishments of pure love tame the most ferocious nature, and calm the most perturbed spirits.

Rising to *desire*, this passion acts as a powerful stimulant, diffusing a genial warmth, and augmenting the sensibility of the system.

Love, as it prompts to sexual attachment, may become the source of many other emotions; such as fear, hope, joy, sorrow, anger, envy, jealousy, revenge, and even suicide; but the effects are here to be distinguished from the cause, both in their nature and influence upon the animal economy.

Love acts on cold temperaments as a moderate stimulus; it fortifies the body against danger, hardship, and incredible difficulties. Disappointed love may impel to raging fevers, hysterics, epilepsy, and melancholy madness! It therefore behoves every man to consider what he loves, and how his affections should be regulated.

§ V. *Of Anger.*

Anger causes violent perturbations, redness of countenance, fire-flashing eyes, vehement agitations of body, muscular exertion,

exertion, nervous energy, and uncontrollable raging. Hence may arise inflammatory fevers, apoplexy, madness, sudden dissolution: and these consequences are most likely to happen in persons who abound in blood, and are highly irritable. It becomes us then to "be angry and sin not," to temper our wrath, and govern the turbulence of our mind by the exercise of reason.

§ VI. *Of Fortitude.*

Fortitude comes next to be considered. It gives energy and perseverance to bodily exertion: it inspires us with cheering hope, and counteracts the effect of inordinate fear. It supports pain and hardships, prevents us from yielding under trials and fatigue; it kindles an emulous spirit, impels to great achievements; and props up our drooping nature, under loads of painful vicissitudes.

This passion should not be confounded with *courage*, which partakes of a more active and enterprising quality. Courage prompts to noble deeds, fortitude sustains us under disappointment; courage despises pain, fortitude helps us to endure it; courage rushes on in the face of danger, but fortitude is passively familiar with it.

§ VII. *Of Fear, &c.*

Fear, *shame*, and *sorrow*, are depressing affections of the mind. They chill the energies of life; they distort and contract the pallid countenance, deprive us of bodily vigour, infuse a painful anxiety, depress the action of the heart, and bring on the diseases of torpor and palsy.

But time and the occasion do not allow me to pursue this inquiry, either with satisfaction to my own feelings, or with justice to the subject. One word may, however, be added respecting the medical influence of imagination.

§ VIII. *Imagination.*

Many of those disorders which are usually denominated "*imaginary*" are only so at their commencement: for such

is

is the influence of the mind over the body, that the latter is eventually affected, and an imaginary is converted into a real disease. This ought to be a powerful incentive to hypochondriacal persons, to resist or divert those workings of the imagination, which embitter life, and must infallibly produce those very evils, which as yet exist only in imagination.

Such unhappy persons are frequently the dupes of knaves, who often convert ideal into real diseases; whereas a physician of skill and candour will readily distinguish the cause, and if he discover it to be real, he will use his utmost endeavours to procure speedy and effectual relief; if imaginary, his knowledge of the human heart, and of the influence of the mind on the body, will enable him to alleviate those perturbations of mind, which are the sources of much anxiety and distress.

The effects of the passions have been hitherto considered with reference to the whole bodily frame: but there are certain consequences of the mental affections, which confine their appearance to the face chiefly, and which may sometimes become so permanent as to afford matter of important observation to the physiognomist. These local effects are remarked in the emotions of joy, rage, malice, envy, sadness, &c.

§ IX. *Sympathy.*

In this place, it may not be amiss to offer a few thoughts on what has been denominated SYMPATHY: I do not mean that fellow-feeling or conformity of sentiment, which, as it were, assimilates two beings to each other: but I here treat of certain relative and simultaneous changes with which many parts of the body are reciprocally affected. These connected and harmonious actions in the animal machine are known to medical men by the appellation of *sympathies:* but we are not yet familiar with the causes of these phenomena, nor with all the laws by which they are regulated. The instruments of such sympathetic associations are usually supposed to be the nerves; though parts will often sympathize together, even where no immediate nervous connexion has been

traced. The different kinds and phenomena of sympathy have been thus distinguished by a modern physiologist:

1st, Two organs that perform the same function, the kidnies, for example, are reciprocally influenced; the impregnated uterus causes both breasts to participate in its own state, and to receive a supply of humours necessary for the secretion that is about to take place, &c.

2d, The continuity of membranes is a powerful medium of sympathy. The presence of worms in the intestinal canal occasions a troublesome *pruritus* about the nostrils. In calculous affections of the bladder, patients experience a greater or less degree of itching at the extremity of the glans penis.

3d, The irritation of a part causes the secretion of a fluid: on this principle the presence of food in the mouth in contact with the extremity of the Stenonian or excretory duct of the parotid gland, produces an irritation that is propagated as far as the glands, and augments their secretion.

4th, If we irritate the pituitary membrane, the diaphragm (which has no immediate organic connexion with it, either nervous, vascular, or membranous) then contracts, and we sneeze. Should not this sympathy be classed among those which Haller makes dependant on the reaction of the *sensorium commune?* If the sensation produced by snuff on the olfactory nerves be too acute, it is transmitted to the brain, which determines to the diaphragm a sufficient degree of the principle of motion to induce a sudden contraction of the diameters of the chest, and expel a volume of air sufficient to detach from the surface of the nostrils those bodies which had been the cause of the disagreeable affection.

5th, Does not the principle of life seem to direct sympathetic phenomena? The rectum, when irritated by the presence of excrements, contracts. What induces the auxiliary and simultaneous action of the diaphragm and abdominal muscles? is it in consequence of organic connexions? why, also, is not the sympathy reciprocal? for what reason does not the rectum contract when the diaphragm is irritated? is

it

it possible for the reiterated habit of the same motions to explain the harmony observed in the action of symmetrical organs? when we direct our sight to an object situated laterally, why does the rectus externus muscle of one eye act at the same instant as the rectus internus of the other? the indispensable utility of this phenomenon is evidently perceived for the parallelism of visual axes; but can any cause be assigned for it? for what reason is it so difficult to perform rotatory motions in a contrary direction with two members situated in the same lateral division of the body? If we conclude with Rega, that there are sympathies of action or *irritability, (consensus actionum,)* sympathies of *sensibility, (consensus passionum,)* &c. does it convey to us any just idea of the innumerable varieties of this phenomenon, and of its frequent anomalies?

All these difficulties induce us to excuse Dr. WHYTT for having considered the soul as the only cause of sympathies, which was a modest avowal of the impossibility of explaining them. We cannot regard sympathies as anomalous acts, as aberrations from vital properties. Is the natural order of sensibility and irritability destroyed by the sympathetic erection of the clitoris and nipple, or by the swelling of the breast, occasioned in consequence of distention of the uterus?

It is by means of sympathies that all the organs concur to one and the same end, and mutually assist each other; it is by them that we can explain how a local affection, at first topical and circumscribed, is propagated throughout every system; for it is in this manner that a morbid state is established: it is always from the isolated affection of one organ, or one system of organs, that those diseases called general take their origin by *association.*

How far do the effects produced by *habit* and *association* tend to illustrate the nature of sympathy?

Some very striking examples and illustrations of nervous sympathy are given by WHYTT, in his valuable book on hypochondriacal diseases, p. 9, &c.

(KK) ON PHYSIOGNOMY AND CRANIOGNOMY.

I. That branch of knowledge which professes to make us acquainted with the natural correspondence subsisting between the external and internal man, between the visible superficies and the invisible contents, forms the science of HUMAN PHYSIOGNOMY. This science has been classed by some persons among the fanciful arts of magic, astrology, and alchemy; but the respectable footing on which it has been placed by the acuteness of LAVATER, seems to prove that physiognomy is capable of much elucidation in the hands of real observers of nature. It may be questioned whether the study of the cranium and its contents, which has recently been so much cultivated by a German professor, ought to be regarded as a distinct science, or only as a subordinate branch of physiognomy: however, that the pretended discoveries of Professor GALL may be kept apart from those of LAVATER, I shall here discourse on them separately.

II. The leading idea among physiognomists, from the days of Aristotle to the present time, seems to be, *That a peculiar temperament or conformation of the body is uniformly attended with a specific cast or disposition of the mind.* Thus, it may be supposed, that strong hair, a deep voice, robust limbs, and a firm step, are indications of courage or vigour; while slender limbs, a delicate step, an effeminate voice, light and feeble hair, with a soft skin, denote a timid or pusillanimous mind. From different associations which men have formed, as it were spontaneously and without suspecting it, they are accustomed to estimate all things by their physiognomy, *i. e.* by their exterior properties.

III. It has, therefore, been received as a universal truth, that there must be some kind of analogy or correspondence between the external varieties of the form and countenance of man, and the internal varieties of his mind: but, how to distinguish the accidental, transient feature, from the real, permanent outline, is a task replete with the greatest difficulty, as Lavater himself has acknowledged. Nothing, says he, can be more certain than that the smallest shades, which are scarcely

scarcely visible to an inexperienced eye, frequently denote a total opposition of character. How wonderfully may the expression of countenance and character be altered by a small inflexion or diminution, lengthening or sharpening, even though but an hair's breadth!

IV. How difficult, then, how impossible must this variety of the same countenance, even in the most accurate of the arts of imitation, render precision! How often does it happen, that the seat of character is so hidden, so enveloped, so marked, that it can only be caught in certain, or perhaps uncommon positions of the countenance; which will again be changed, and the signs all disappear, before they have made any durable impression. Or, supposing the impression made, these distinguishing traits may be so very difficult to seize, that it shall be impossible to paint or describe them by language! In short, how many thousand accidents, alterations, passions, and discordant circumstances, may exhibit the countenance so disadvantageously, as to betray the physiognomist into a false judgment respecting the true forms and character! How easily may these occasion him to overlook essential traits, and to ground his judgment of character on what is wholly accidental!

V. These are some of the difficulties, which even Lavater himself confesses must be encountered by the student in physiognomy; and he does not dissemble, that his own knowledge of this science was so limited, that he daily erred in his decisions, and was as distant from the true physiognomist as heaven was from earth. If the love of truth constrained such an observer of human nature to make such a confession, what must men in general, what must so humble a disciple of Lavater as myself, be compelled to acknowledge? Nearly all I can pretend to is, respectfully to trace the footsteps of so great a master at a distance; and to present you with an imperfect outline of what was considered by him as the groundwork of this intricate science.

VI. To know, to desire, and to act; or, accurately to observe and meditate; to perceive and wish, to possess the

power

power of motion and resistance; these combined powers (Lavater thinks) constitute an animal being, an intellectual being, and a moral being. Though the physiological, the intellectual, and the moral life of man, with all their subordinate powers, and their constituent parts, so eminently unite in one being; though these three kinds of life do not, like three distinct families, reside in separate parts or regions of the body, but co-exist in one point, and by their combination form one whole; yet it is plain, that each of these powers of life has its peculiar station, where it more especially unfolds itself and acts. Thus, it cannot be doubted, that the physiological or animal life especially displays itself in the shoulder, the arm, and the fingers; that the intellectual life, or powers of the mind, are most apparent in the circumference and form of the skull, and particularly of the forehead; likewise, that the moral life or faculties principally reveal themselves in the lines, the features, and transitions of the human countenance. When any passion is called into exercise, such passion is depicted in the face, by the motion of the muscles, and these emotions are accompanied by a strong palpitation of the heart; but if the countenance be tranquil, it always denotes tranquillity in the breast.

VII. This threefold life of man is capable of being studied and detected in its different appropriate parts. If we take the face to be the representative or epitome of all the regions in the body, then will the forehead be the mirror or image of the understanding; the nose and cheeks will be the picture of the moral or sensitive life; the mouth and chin will represent the animal life; and the eyes will be as a summary or centre to the whole. These are the general *data* or fundamental principles on which the science of physiognomy is founded. We now proceed to state a few of the facts resulting from the above principles; which may be considered as so many physiognomical axioms, or received truths, established by long observation; but to detail these at length, would be anticipating what belongs to the Lecture itself.

VIII. The present inquiry will lead us to discourse on the following topics:

1. The forehead, and its several indications.
2. The eye and eyebrows.
3. Of the nose.
4. Of the mouth.
5. Of the teeth and chin.
6. Of the cranium or skull.
7. Physiognomical relation of the sexes.
8. Concluding remarks by PARSONS, CAMPER, WHITE, HUNTER, SMITH, BUFFON, BELL, BLUMENBACH, and others; illustrated by comparative sketches of national features, and observations on the supposed causes of this variety.

IX. CRANIOGNOMY, CRANIOSCOPY, or ENCEPHALO-CRANIOSCOPY, is that novel science (if it deserve the name) which pretends to elucidate the character, the passions, the morals, and the interior faculties of man, from certain appearances exhibited by the brain and cranium. Professor GALL, of Vienna, is said to have principally founded his system on the following *data:*

1st, He supposes the brain to be the material organ of the internal faculties; since it is only where this organ exists, that the internal faculties are found in perfect exercise.

2dly, He imagines the brain to contain within itself a variety of organs for the different faculties, either independent of each other, or not necessarily co-existing in the same subject; so that one of these organs and its corresponding faculty may be found, while another shall be defective, or entirely wanting.

3dly, The Professor supposes the expansion of the organs contained within the skull to be in the direct ratio of the force of their corresponding faculties; and, consequently, the vigorous exercise of any particular internal faculty will be a just criterion of the proportional maturity of the corresponding organ. We cannot, therefore, judge of the strength of the faculties but by the evolution or developement of the separate organs.

4thly,

4thly, Dr. Gall concludes, that we may always judge of these different organs and their relative faculties by the exterior appearances of the cranium. He supposes that the depressions, lines, and protuberances, which are always seen in the skull, depend on the peculiar internal configuration or texture of the brain itself.

X. Being guided by these fundamental *data*, as principles which cannot be doubted, the ingenious author examines the skulls of different men, and other animals; in which he finds, or thinks he has found, a sufficient number of coincidences and analogies to establish the science of *Cranioscopy* upon a sure basis. He thinks it incontestable, that the faculties of inferior animals resemble those of man; and that what we call instinct in them is also found in human beings, such as attachment, cunning, circumspection, courage, &c.

XI. Hence it follows, that the quantity of the cerebral organs fixes the difference between the genera of animals, and their reciprocal proportion determines that of the individuals. He imagines that the disposition originally given to each faculty may be called forth to exercise by favourable circumstances, or may remain dormant, but can never be created or produced where it did not naturally pre-exist; and that an accumulation of the organs takes place in a constant manner, from the hind part of the head to the fore part, from the bottom to the top, in such a way, that animals approaching man in their faculties have a proportional expansion of the superior and anterior parts of their brain.

XII. Lastly, Dr. Gall maintains, that in the most perfect animal, *man*, there are found organs in the fore and upper parts of the frontal and parietal bones destined exclusively to the exercise of human faculties. It is under this latter point of view chiefly, that the discoveries and reasoning of Professor Gall have been thought to agree with the theory of the facial angle, which therefore seems (in the opinion of some persons) to confirm the truth of his hypotheses.

XIII. Without pretending fully to illustrate or exhibit the details of this system, I shall here subjoin a list of the different

ferent cerebral and cranial organs, which the author is said to have discovered in the human species.

1. Organ of the tenacity of life.
2. Organ of the instinct of self-preservation.
3. Organ of the choice of nourishment.
4. Cerebral organs of the external senses.
5. The organs of instinct and copulation.
6. Organ of the reciprocal love of parents and children.
7. Organ of attachment and friendship.
8. Organ of courage.
9. Organ of the instinct to assassinate.
10. Unknown organs.
11. The organ of cunning.
12. Organ of circumspection.
13. Organ of the instinct to elevation.
14. Organ of the love of glory.
15. Organ of the love of truth.
16. Organ of the sense of locality.
17. Organ of the sense of facts.
18. Organ of painting—the sense of colours.
19. Organ of the sense of numbers.
20. Organ of the sense of music.
21. Organ of the sense for mechanics.
22. The organ of verbal memory.
23. Organ for the acquisition of languages.
24. The organ of memory for persons.
25. The organ of liberality.
26. The organ of comparative judgment.
27. The organ of metaphysical taste.
28. Organ for a spirit of observation.
29. Organ for a satirical spirit.
30. The organ of goodness.
31. Organ for a theatrical talent.
32. The organ of theosophy.
33. The organ of perseverance.

XIV. These are the different organs which this eccentric teacher pretends to have discovered. No person, I think, of

common talents, can read this enumeration, without at first entertaining a suspicion that the whole system is fanciful and groundless. For my own part, the series of facts and observations which seem requisite for affording a solid basis to these suggestions, are so numerous and difficult to be collected, that I must beg leave to withhold my assent to the author's assertions until I shall have received the most unquestionable evidence in support of them. If there be any foundation for the scheme at all, I should scarcely doubt that the multitude of our organs may nearly equal the number of our passions and speculations: and how numerous these are, let every man judge for himself! But, to speak freely, the whole has such an air of mystery, and is couched in such incomprehensible jargon, that I cannot conceive a man of solid and unbiassed understanding would propose the system for general belief; although I can easily imagine a person shall start a theory (however unintelligible or improbable it may be) for the sake of attracting universal notice, and of acquiring a name for singularity.

XV. It has been feared by many people, that Dr. Gall's notions are calculated to make converts to materialism; and on this account he has been authoritatively prohibited from lecturing on Craniognomy to the citizens of Vienna. But the apprehension, perhaps, was not very well founded; for there is too little of sound philosophy in this system for thinking men, and too little of common sense for the vulgar: so that I conceive there is not much danger of a general contamination. Most likely, the reveries of this ingenious professor will soon share the same fate as the dreams of Mesmer, De Mainaduc, and Perkins.

XVI. There is this difference, however, between animal-magnetism and Cranioscopy; that the former is supported by the exercise and obvious effects of a lively imagination, but the latter has nothing to adduce in evidence beside the author's gratuitous suggestions. To draw circles and describe organs in the dead human cranium is no difficult undertaking; but to prove the existence and relative attributes of

these supposed organs in the living body, is a task of a very different nature. We may admit the reality of certain lines, depressions, and eminences in the skull, when they have been demonstrated after death; but to shew the connexion which any philosopher pleases to imagine between these appearances and the intellectual, the moral, or the sensual faculties in man, must be in its own nature impossible; for no person is of himself aware of such a connexion while living, and after death this relation must be inevitably dissolved, if it ever existed.

THE END.

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