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# ILLUSTRATIONS

OF

PALEY'S NATURAL THEOLOGY.

OXFORD: MDCCCXXVI.

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# ILLUSTRATIONS

OF

# PALEY'S NATURAL THEOLOGY;

WITH

## DESCRIPTIVE LETTER PRESS.

## BY JAMES PAXTON,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS, LONDON.

"Of muscular actions, even of those well understood, some of the most curious are incapable of popular explanation, without the aid of Plates and Figures."

PALEY'S THEOLOGY, Ch. ix.

#### OXFORD:

PUBLISHED BY J. VINCENT.

MDCCCXXVI.

# LLLUSTRATIONS



PALETY'S NATURAL THEOLOGY:

DESCRIPTIVE LETTER PRESS.

BY JAMES PANTON

SHREET OF THE REVAN COLUMN OF SCHOOLS, SQUARE,

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THEORIES OF THE CHRISTIAN C.

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#### HONOURABLE AND RIGHT REVEREND

# SHUTE BARRINGTON, LL. D.

LORD BISHOP OF DURHAM.

My Lord,

To your suggestion the world is indebted for the existence of Dr. Paley's valuable work on Natural Theology. The universal and permanent esteem in which it has been held in this country, and its favourable reception in France, even after the desolating influence of the Revolution, have abundantly approved your Lordship's selection both of the subject and of the person to whom you intrusted it.

In looking round, then, for a patron for these Illustrations, it was natural to have recourse to him who was the original suggestor of the work which it is their object to explain. Nor was I disappointed in my wish; your Lordship

#### DEDICATION.

not only condescending to approve of the design, but to encourage me in its prosecution by your very liberal support. For this distinguished honour you will believe me deeply sensible; and if I may indulge the hope that my humble efforts will increase the utility of so eminent a writer, I shall consider it the highest gratification.

I am,

My Lord,

With great veneration,

Your Lordship's most obliged

And obedient servant,

JAMES PAXTON.

Oxford, January 1, 1826.

# PREFACE.

THE works of Dr. Paley have acquired that popularity which renders it scarcely necessary to observe that his Natural Theology was written to establish the truth of the agency and wisdom of the Deity from the admirable contrivances and mechanism displayed in natural objects, inferring from thence that the knowledge and power requisite for the formation of created nature must be infinite.

The principal physical arguments made use of, relate to organs destined to mechanical functions, as the bones of man—the muscles—the structure of animals, or comparative anatomy—prospective and compensatory contrivances—insects and plants: with most of these objects the anatomist only can be conversant; but all admit of graphic representation, and such has been attempted.

The designs of the following plates are original,

obtained from the most authentic sources, and submitted to the critical examination of the most competent judges. It is hoped that the illustrations will be found the more interesting from their being simple and unincumbered by parts irrelevant to the subject of the author. These are accompanied by notes, which are intended to supply defective or correct erroneous statements, and to explain the plates.

The undertaking originated in the difficulty of understanding the various descriptions introduced by Paley, not however from his want of clearness, for the subjects in general are plainly and correctly described; but it is evident that visible representations strike the mind more forcibly than mere descriptions. It is therefore presumed that the subsequent illustrations will be an acquisition, by bringing vivedly to the imagination, objects of which only an imperfect idea could otherwise be formed; and that they will consequently render the work more intelligible to the general reader.

### CHAPTER L

#### TAR. I .- THE WATCH.

Fig. 1. The spring and barrel or few paper, with in or or or which connects it to-

Fig. 2. The fines and gover wheel. The more is topond as the top to correct the irregular recoil of the apring. The sunth wheel turns—

Fro, 3. The central wheel and pluton, which makes one necessarily indicate in an hour, carries the minute hand, and turns-

Pro. 4. The third wheel and platen, which turns the contrate wheel.

Fro. 5. The contrate wheel, which makes one revolution in a nimite; and turns the balance or recupe wheel.

tio. 0. The lateses whost, which acts upon the pallats of the verge, and escapes or drops from one pallat to another alternately, thereby keeping the balance in constant eibration.

Fig. 7. The bulance cergs and bulance or pendulum spring, whileh regulates the whole machine.

Fro. 8. The common pierces, affixed to the centre which drivener, affixed to the centre which the common hand is placed.

Par. 9. The minute officel.

Fro. 10. The four whoel. These wheels are timed up the came of pinion, and having a greater namber of teeth, move much slower than the camon pinion, and mark the hour by the hand on the dist.

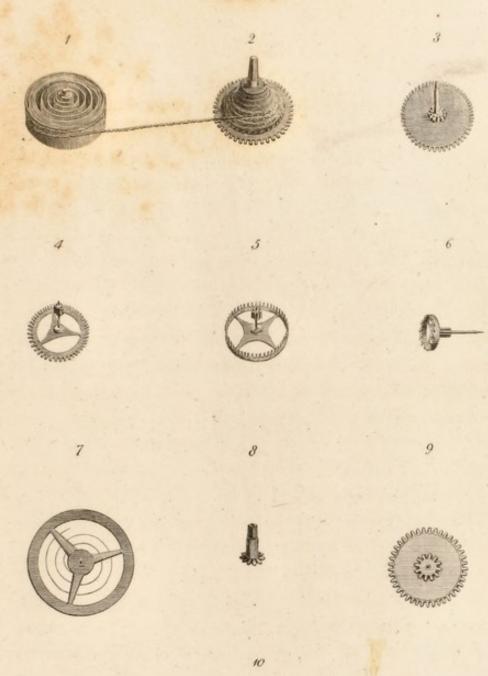
The above is a description of the several wheels alladed to by Paley. Their relative siteation, and combined morement, may be seen by the simple inspections of watch.

#### TAB. I .- THE WATCH.

- Fig. 1. The spring and barrel, or first power, with the chain which connects it to—
- Fig. 2. The fusee and great wheel. The fusee is tapered at the top to correct the irregular recoil of the spring. The great wheel turns—
- Fig. 3. The centre wheel and pinion, which makes one revolution in an hour, carries the minute hand, and turns—
- Fig. 4. The *third* wheel and pinion, which turns the contrate wheel.
- Fig. 5. The *contrate* wheel, which makes one revolution in a minute, and turns the balance or escape wheel.
- Fig. 6. The balance wheel, which acts upon the pallats of the verge, and escapes or drops from one pallat to another alternately, thereby keeping the balance in constant vibration.
- Fig. 7. The balance verge and balance or pendulum spring, which regulates the whole machine.
- Fig. 8. The cannon pinion, affixed to the centre wheel arbour, on which the minute hand is placed.
  - Fig. 9. The minute wheel.
- Fig. 10. The *hour* wheel. These wheels are turned by the cannon pinion, and having a greater number of teeth, move much slower than the cannon pinion, and mark the hour by the hand on the dial.

The above is a description of the several wheels alluded to by Paley. Their relative situation, and combined movement, may be seen by the simple inspection of a watch.

# TAB.I.





Published by J. Vincent Oxford.



### TAR BUT STREET

Fig. 1. The ergendline lens of a fish; it is proportionably larger than in other animals, and perfectly subodied.

Fro. 2, A rection of the human eye. It is formed of various courts, or membraness confidence pollucial immouse of district descript of density.

The external membrane realized solvention is strong and firm, the capper of the open it is deficient in the extinct but that part is supplied by the corner, which is transparent and projects like the segment of a small globe from one of larger size. The intraior of the selectic is lined by the cheroid, covered by a dark mention secretion, terrest physicistics of the selectic is lined by the eigenstant cheroid, in reproducted to almost the globe that the physicistic distribution is reproducted in the plate by the black line. The cheroid and inner membrane, which is marked by the black line. The third and inner membrane, which is marked by the white that, is the extine, the expended optic neares.

Within these coats of the eye, are the humours, of the aqueses humour, a thin field like water; it, the crystalline loss of a dense texture; of the extreme humour, in appearance like jelly. Together they make a compound least, which refracts the rank of light issuing from an object, of and delineates its figure, a, in the focus upon the retina, inverted.

Fig. 3. The feet of the telescope

Fur. 4. The crystalline tank.

Fig. 5, 6. A plop of the circular and radialed three which the wints in appeared to present; the terrace confiners, the latter dilutes the pupil, or apparent found by the ine margin of the life.

Fro, V. s. a. a. a. the four straight muscles, arising from the bottom of the crist, where they surround, a. the optic nerve; and are inserted by broad thin tendence at the fore part of the globe of the eye into the funion selecution.

#### TAB. II.-THE EYE.

Les page 34 Fig. 1. The crystalline lens of a fish; it is proportionably 23 larger than in other animals, and perfectly spherical.

32 Fig. 2. A section of the human eye. It is formed of various coats, or membranes, containing pellucid humours of different degrees of density.

The external membrane, called *sclerotic*, is strong and firm, the support of the spherical figure of the eye: it is deficient in the centre, but that part is supplied by the *cornea*, which is transparent and projects like the segment of a small globe from one of larger size. The interior of the sclerotic is lined by the *choroid*, covered by a dark mucous secretion, termed *pigmentum nigrum*, intended to absorb the superfluous rays of light. The *choroid* is represented in the plate by the black line. The third and inner membrane, which is marked by the white line, is the *retina*, the expanded optic nerve.

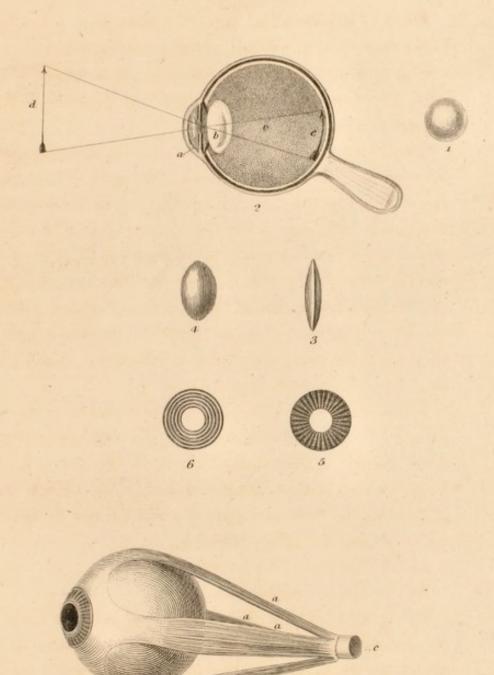
Within these coats of the eye, are the humours. a, the aqueous humour, a thin fluid like water; b, the crystalline lens of a dense texture; c, the vitreous humour, in appearance like jelly. Together they make a compound lens, which refracts the rays of light issuing from an object, d, and delineates its figure, e, in the focus upon the retina, inverted.

Page 23

- Fig. 3. The lens of the telescope.
- Fig. 4. The crystalline lens.
- Fig. 5, 6. A plan of the circular and radiated fibres which the *iris* is supposed to possess; the former contracts, the latter dilates the pupil, or aperture formed by the inner margin of the iris.

Fig. 7. a, a, a, a, the four straight muscles, arising from the bottom of the orbit, where they surround, c, the optic nerve; and are inserted by broad thin tendons at the fore part of the globe of the eye into the tunica sclerotica.

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TAR. HIL-THE RYE OF BIRDS AND OF THE BRIL

From 1, 2. The startile view, or loops of the eye of hirds, consisting of bong places, which groups the front of the relavotie; lying close together and occidental action. These bong plates in general form a slightly convex ring, hig. 1, but in the accipitons they form a concern ring, as in Fig. 2, the bony rim of a bank.

Fig. 3, 4, 6. Exhibit the marapian; it arises from the back of the eye, proceeding apparently through a sift in the retina; it passes obliquely into the virrenys humour, and terminates in that part, as in the explectile; it, a section of the eye of the falco chaysaitos. In rome apaches it reaches the lens, and is satisfied to it, Fig. 4, 6. To the plate the marapians is madded with a ...

Fig. 0. The head of an est, tim stirt is represented turned back; and as the transparent forag covering of the eye, w. a. is a cuticular covering, it is septented with it.

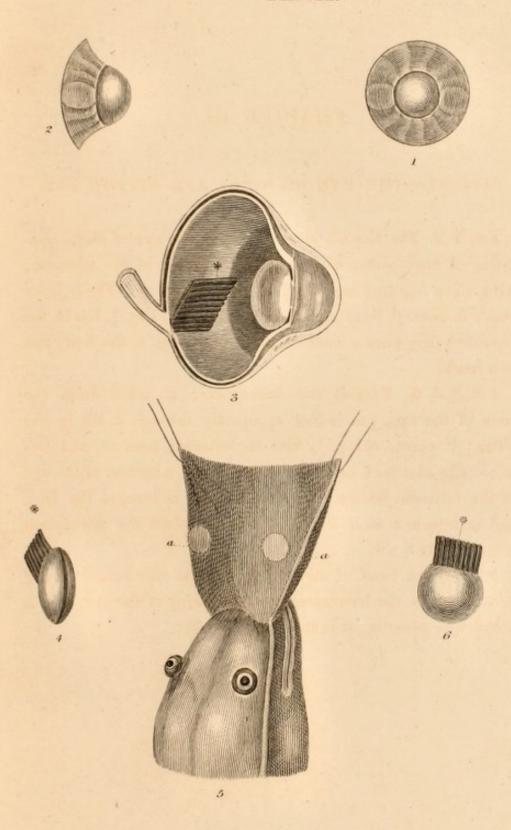
#### TAB. III.-THE EYE OF BIRDS AND OF THE EEL.

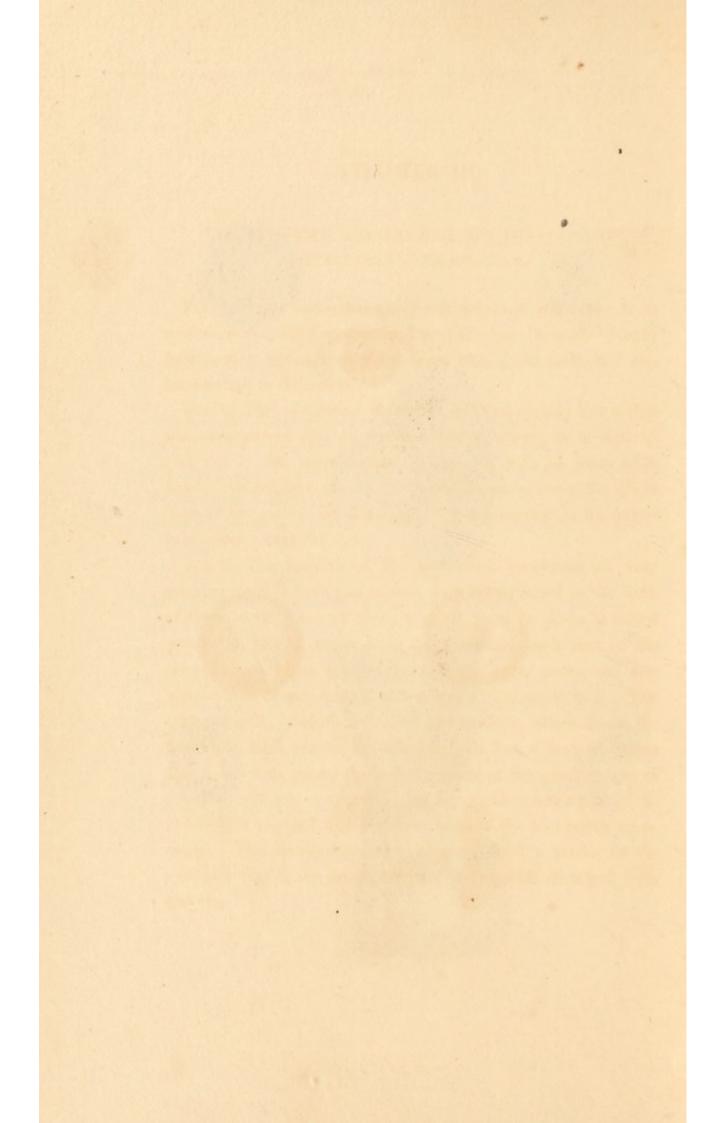
Fig. 1, 2. The *flexible rim*, or hoop, of the eye of birds, consisting of bony plates, which occupy the front of the sclerotic; lying close together and overlapping each other. These bony plates in general form a slightly convex ring, Fig. 1, but in the accipitres they form a concave ring, as in Fig. 2, the bony rim of a hawk.

Fig. 3, 4, 6. Exhibit the marsupium; it arises from the back of the eye, proceeding apparently through a slit in the retina; it passes obliquely into the vitreous humour, and terminates in that part, as in the eagle, Fig. 3, a section of the eye of the falco chrysaëtos. In some species it reaches the lens, and is attached to it, Fig. 4, 6. In the plate the marsupium is marked with a \*.

Fig. 5. The head of an *eel*; the skin is represented turned back; and as the *transparent horny covering* of the eye, a, a, is a cuticular covering, it is separated with it.

## TAB.III.





# TAR. IV. THE LACHRYMAL APPARATUS AND NEWBEANS.

Fro, I. a, the lockrywal place, the source of the tears; & its neveral dears, diffusing the thank over the eye; a, c, the pearts lackrywalia, which course the team into, d, the leckrywal see, terminating in the nextent.

Fro. 2. The micritation membrane, or third epolid; it is a thin send-transparent fold of the conjunctive, which, in a state of rest, lies in the inner coince of the eye, with its loose edge nearly vertical, but can be drawn out so as to cover the whole front of the globe. In this figure it is represented in the act of being drawn over the eye.

Fro. 3. The massless of the nictiteting membrane are very singular lather form and action, they evertached to the back of the solerates, has its origin from the upper and hack part of the selection; its films descend toward, the upper and back part of the nituate in a durad margin with a cylindrical canal in it. The other anades, it, which is called prescribidir, arises from the lower and back part of the selectife. It has a long tendinous chord, o, which passes through the canal of the quadratus a, as chord, o, which passes through the canal of the quadratus a, as chord, o, which passes through the canal of the quadratus a, as being in the first of the description refers also to the nictitating meanage, and Fig. 5, the membrane and its quadrates detached from eye, and Fig. 5, the membrane and its quadrates detached from the eye.

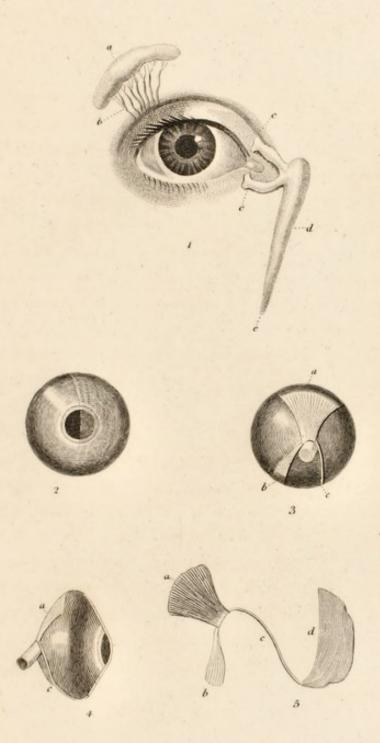
# TAB. IV.—THE LACHRYMAL APPARATUS AND NICTITATING MEMBRANE.

Fig. 1. a, the lachrymal gland, the source of the tears; b, its several ducts, diffusing this fluid over the eye; c, c, the puncta lachrymalia, which convey the tears into, d, the lachrymal sac, terminating in the nostril.

Fig. 2. The nictitating membrane, or third eyelid; it is a thin semi-transparent fold of the conjunctive, which, in a state of rest, lies in the inner corner of the eye, with its loose edge nearly vertical, but can be drawn out so as to cover the whole front of the globe. In this figure it is represented in the act of being drawn over the eye.

Fig. 3. The muscles of the nictitating membrane are very singular in their form and action, they are attached to the back of the sclerotic; one of them, a, which from its shape is called quadratus, has its origin from the upper and back part of the sclerotic; its fibres descend towards the optic nerve, and terminate in a curved margin with a cylindrical canal in it. The other muscle, b, which is called pyramidalis, arises from the lower and back part of the sclerotic. It has a long tendinous chord, c, which passes through the canal of the quadratus, a, as a pulley, and having arrived at the lower and exterior part of the eye-ball, is inserted into the loose edge of the nictitating membrane. This description refers also to Fig 4, a profile of the eye, and Fig. 5, the membrane and its muscles detached from the eye.

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## CHAPTER IIL

# TAB. V .- THE HUMAN EAR, AND TEMPACOM OF THE BLEPHANT.

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Fig. 2. The bones of the ear magnified. at the malless, connected by a process to the tympanous: the round head is lodged in the body of, b, the incus, and the incus is united to, c,

Fig. 3. The labyrinth, so named from the intricacy of its cavities; it is situated in the petrons part of the temporal bone, and consists of the evalibeing or emtral eneity, time associated consists of the evalibeing or emtral eneity, time associated from the consists of the evaluation of the plate. Fig. 1,

The vibrations of sough, striking against the apendrana tyringani, are proposited by the intervention of these four little bones, to the resist contained within the certains of the labyriath; and by means of this sufer the impression is conveyed to the extremities of the auditory active.

Fish require no tympaning nor external opening to the cor; the finid in which they live in the median or constraint counts through the bones of the band, re-

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# TAB. V.—THE HUMAN EAR, AND TYMPANUM OF THE ELEPHANT.

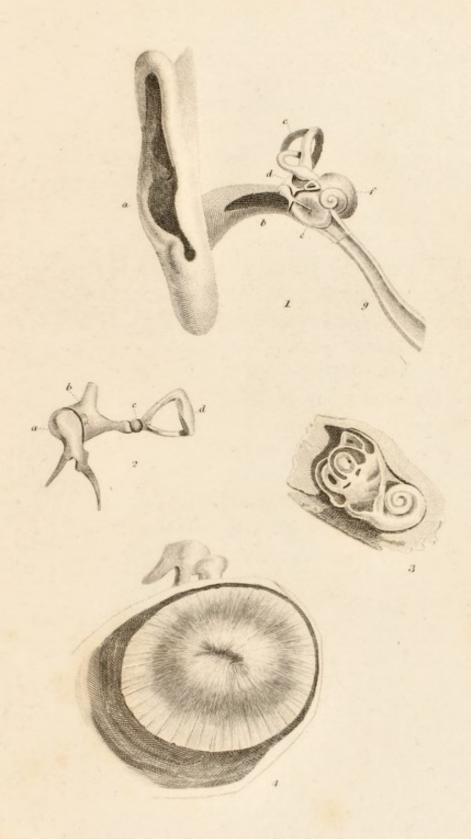
- Fig. 1. a, the external ear; b, the meatus auditorius externus; c, the membrana tympani; d, the ossicula auditus; e, the semicircular canals; f, the cochlea; g, a section of the eustachian tube, which extends from the cavity of the tympanum, to the interior of the fauces.
- Fig. 2. The bones of the ear magnified. a, the malleus, connected by a process to the tympanum: the round head is lodged in the body of, b, the incus, and the incus is united to, c, the os orbiculare, and this to, d, the stapes.
- Fig. 3. The *labyrinth*, so named from the intricacy of its cavities; it is situated in the petrous part of the temporal bone, and consists of the *vestibule*, or *central cavity*, three *semicircular canals*, and *cochlea*, and is best explained by the plate, Fig. 1, and 3.

The vibrations of sounds, striking against the membrana tympani, are propagated by the intervention of these four little bones, to the *water* contained within the cavities of the labyrinth; and by means of this water the impression is conveyed to the extremities of the *auditory nerve*.

Fish require no tympanum, nor external opening to the ear; the fluid in which they live is the medium for conducting sounds through the bones of the head.

Fig. 4. The tympanum of the elephant, of its natural size.

#### TABN





### CHAPTER VIL.

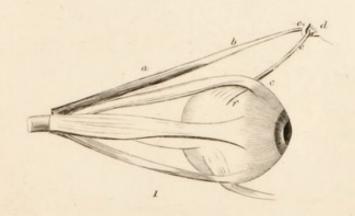
# TAR. VI. -FROCELEAR MUSCLES OF THE EYE,

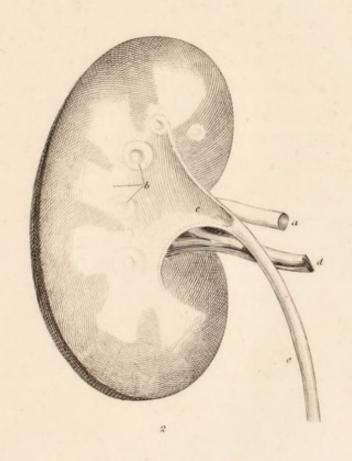
Fig. b. The trachier or superior oblique muscle, asiate with the straight muscles from the bottom of the crisit. Its muscular portion, a, is extended over the upper part of the eye-ball, and gradually assumes the form of a smooth round tendon, b, which posses through the pulley, a, and is fixed to the inner edge of the orbit, d, then turning backwards and downwards, e, is inserted into, f, the selection membrane.

Fig. 2. A section of the human kidney; a, the enalgent artery which conveys the blood to, b, the papillar, where the peculiar fluid is secreted; from whence it passes by tubes into c, the pelvix; d, the enalgent rain which returns the blood; c, the worder, or take, which conducts the secretion to its receptacle.

# TAB. VI.—TROCHLEAR MUSCLE OF THE EYE, AND KIDNEY.

- Fig. 1. The trochlear or superior oblique muscle, arises with the straight muscles from the bottom of the orbit. Its muscular portion, a, is extended over the upper part of the eye-ball, and gradually assumes the form of a smooth round tendon, b, which passes through the pulley, c, and is fixed to the inner edge of the orbit, d, then turning backwards and downwards, e, is inserted into, f, the sclerotic membrane.
- Fig. 2. A section of the human kidney; a, the emulgent artery which conveys the blood to, b, the papillæ, where the peculiar fluid is secreted; from whence it passes by tubes into c, the pelvis; d, the emulgent vein which returns the blood; e, the ureter, or tube, which conducts the secretion to its receptacle.







TAR VIL-VERTERRE OF TRESHUMAN NECK.

Fro. 1. A representation of the head and the chek; the latter

Fig. 2, exhibits the first and second veridite, with their mode of connexion. The appearant veridity is termed the affect from its supporting the globe of the head, has an oval concare surface on either side, a, a, for the reception of two corresponding convex surfaces placed on the layer part of the head, in such a manner as only to admit of the action of bending and raising the head.

Fig. 3. The affect

Fig. 4. The second vertebra, called dealard, has two plane sartaces, a, a, adapted to the planesta, a, l'ig. 3. of the atlast and this manner of articulation provides for the turning of the bead laterally in almost every direction. Fig. 2. and 4. b, b, abow the feeth like process which; affords a firm pivot for the production of the lateral motion data described. This process is meetived into a corresponding endealation of the alms, Fig. 3. b, and a strong ligament passes behind it, serving as an effectual security against dislocation, and consequent compression of the spinal marrow. Fig. 4. d, marks, the situation for the spinal marrow, which passes through the cing of each vertebra. The letter, c, indicates a perforation in the lateral process; and as there is a corresponding perforation in the lateral process; and as there is a corresponding perforation in coch lateral, or as it is the formed transmers process of the seven corrigal variebras in one transmit or as the stransmit of the seven corrigal variebras in one constant for the consequent constant in the lateral process; and as the blood-vessels destined to adopt the protection of two important blood-vessels destined to adopt the brain.

#### TAB. VII .- VERTEBRÆ OF THE HUMAN NECK.

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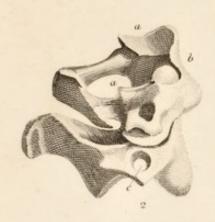
Fig. 1. A representation of the head and the neck; the latter is composed of seven bones called *vertebræ*.

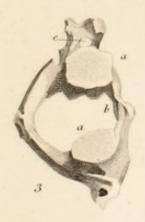
Fig. 2. exhibits the first and second vertebræ, with their mode of connexion. The uppermost vertebra, termed the atlas, from its supporting the globe of the head, has an oval concave surface on either side, a, a, for the reception of two corresponding convex surfaces placed on the lower part of the head, in such a manner as only to admit of the action of bending and raising the head.

Fig. 3. The atlas.

Fig. 4. The second vertebra, called dentata, has two plane surfaces, a, a, adapted to the planes, a, a, Fig. 3. of the atlas: and this manner of articulation provides for the turning of the head laterally in almost every direction. Fig. 2. and 4. b, b, shew the tooth-like process which affords a firm pivot for the production of the lateral motion just described. This process is received into a corresponding indentation of the atlas, Fig. 3. b, and a strong ligament passes behind it, serving as an effectual security against dislocation, and consequent compression of the spinal marrow. Fig. 4. d, marks the situation for the spinal marrow, which passes through the ring of each vertebra. The letter, c, indicates a perforation in the lateral process; and as there is a corresponding perforation in each lateral, or as it is termed transverse process of the seven cervical vertebræ, a continuous passage is thus formed for the protection of two important blood-vessels destined to supply the brain.











## TAR. VIII .- BONES OF THE AUM.

Fig. 1; or the Asserve; the bead, it is a parties of a sphere, and exhibits an example of the best and reserve, or universal joint; or the American in the others of the radius; or the almost Thereships belongs more peculialise of the wrist, being the bone attach supports the hand, and some time with it in all its revolving motions. The almost prime point point belongs to the choos joint, for by it we perform all the actions of bending or extending the arm.

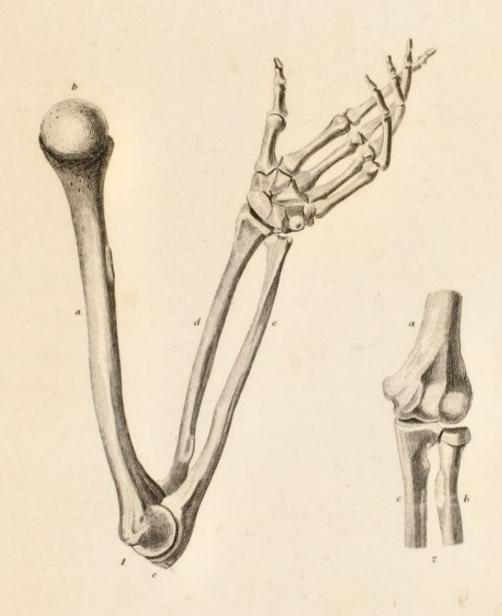
Fra. 2. a, the humeright b, shows the connexion of the radius, with, c, the alma, at the choos, The modes of articulation at the wrist is seen, Fig. 1.

Page 104 & 105

#### TAB. VIII .- BONES OF THE ARM.

Fig. 1. a, the humerus; the head, b, is a portion of a sphere, and exhibits an example of the ball and socket, or universal joint; c, the hinge joint, instanced in the elbow; d, the radius; e, the ulna. The radius belongs more peculiarly to the wrist, being the bone which supports the hand, and which turns with it in all its revolving motions. The ulna principally belongs to the elbow joint, for by it we perform all the actions of bending or extending the arm.

Fig. 2. a, the humerus: b, shows the connexion of the radius, with, c, the ulna, at the elbow. The mode of articulation at the wrist is seen, Fig. 1.





#### TAB. IX.-THE SPINE.

Fig. 1. The deman spine, so maned from the deal of tharp processes projecting from the posterior past of the retebra. The spine of wint of the next, distinguished by the perfectings in their transverse processes; of trades belonging to the back, and marked by depressional of the rites; and, hardy, of fire helonging to the back, and marked by depressional or the heads and hardy, of fire helonging to describe, and, hardy, of fire helonging to describe, which are larger than the other vertebras.

Fro. 2. A separated stored contains: o. the large of the very telesa; b, the ring through which the spinal nations posses; c. c. tha articulating carriers to which the spinal nations of days.

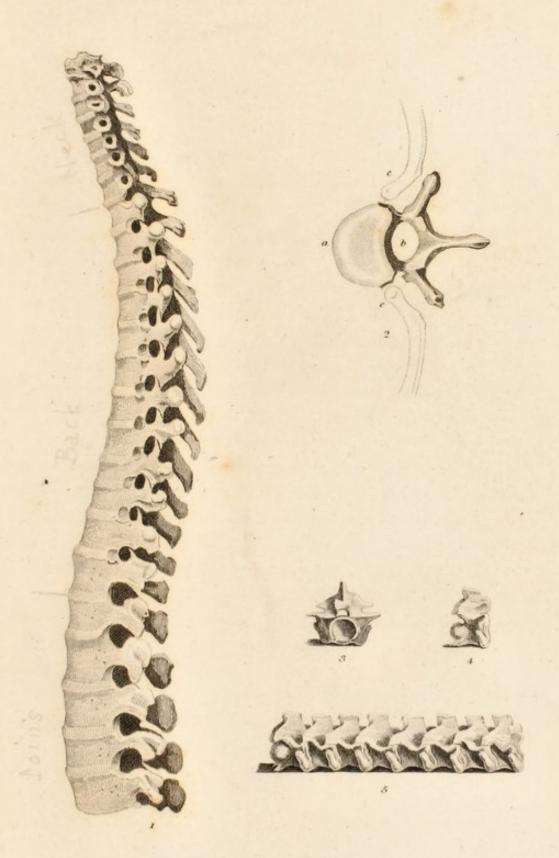
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Fig. 4. the ball or rounded joint, evidently at a stori for ex-

Fig. 5. A part of the spine of the same repulse. I seemed in the strings each bound-heins united to the sales of them and seemed activated activat

#### TAB. IX.—THE SPINE.

- Fig. 1. The human spine, so named from the series of sharp processes projecting from the posterior part of the vertebræ. The spine consists of seven vertebræ of the neck, distinguished by the perforations in their transverse processes; of twelve belonging to the back, and marked by depressions for the heads of the ribs; and, lastly, of five belonging to the loins, which are larger than the other vertebræ.
- Fig. 2. A separated *dorsal vertebra*: a, the body of the vertebra; b, the ring through which the spinal marrow passes: c, c, the articulating surfaces to which the ribs are united.
- Fig. 3. The vertebra of a very large serpent, drawn from a specimen belonging to the Anatomy school of Christ Church, Oxford. This figure shews the socket of the vertebra.
- Fig. 4. the ball or rounded joint, evidently calculated for extensive motion.
- Fig. 5. A part of the spine of the same reptile; it is exceedingly strong, each bone being united to the other by fifteen surfaces of articulation.





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TAB. X.—THE CHEST, PATELLA, AND SHOULDER BLADE.

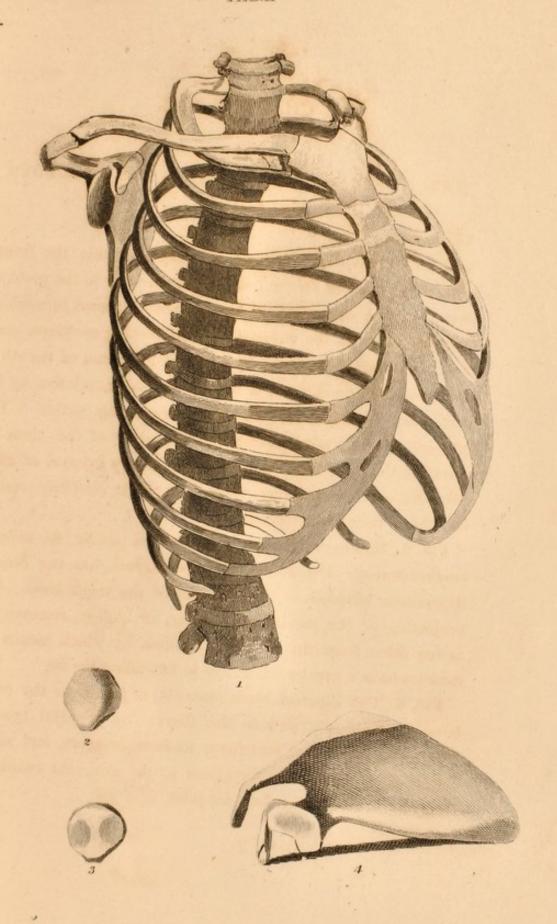
Fig. 1. The spine, ribs, and sternum, constitute the framework of the chest or thorax. Referring however to the plate, or to nature, we observe that the ribs are not continued throughout from the spine to the sternum, but intervening cartilages complete the form of the chest, by connecting the end of the rib to the breast bone. This is a further provision, relative to the mechanical function of the lungs, deserving notice. The muscles of respiration enlarge the capacity of the chest by elevating the ribs; and during the momentary interval of muscular action the cartilages, from their great elasticity, restore the ribs to their former position.

Fig. 2. Represents the true shape of the patella, the anterior surface convex. Fig. 3. the posterior surface, has two concave depressions adapted to the condyles of the thigh bone. The projection of the patella, as a lever, or pulley, removes the acting force from the centre of motion, by which means the muscles have a greater advantage in extending the leg.

Fig. 4. The shoulder-blade (scapula) is joined to the collar bone by ligaments, and to the thorax by powerful muscles which are capable of sustaining immense weights, and whose action gives the various directions to the arm, and enables it freely to revolve at the shoulder joint.

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TABL XL-THE HIP, KEEP, AND MEETE POINTS.

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TAB. XI.-THE HIP, KNEE, AND ANKLE JOINTS.

Fig. 1. The capsular ligament is here opened in order to shew the ligament of the hip, named the round ligament. It allows considerable latitude of motion, at the same time that it is the great safe-guard against dislocation.

Fig. 2. and 4. The crucial or internal ligaments of the knee-joint arise from each side of the depression between the condyles of the thigh bone; the anterior is fixed into the centre, the posterior into the back of the articulation of the tibia. This structure properly limits the motions of the joint, and gives the firmness requisite for violent exertions. Viewing the form of the bones, we should consider it one of the weakest and most superficial, but the strength of its ligaments renders it the most secure, and the least liable to dislocation of any joint in the whole body.

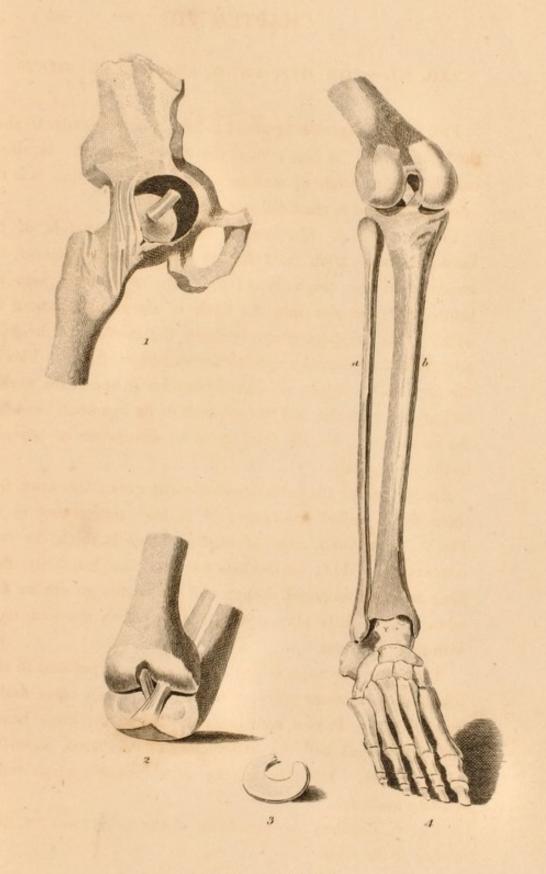
Fig. 3. one of the interarticular cartilages of the knee, from their shape called semilunar; it is also represented in situ Fig. 2. The outer edge of each cartilage is thick, the inner concave edge thin; the sockets for the condyles of the thigh bone are thus rendered deeper, and the cartilages are so fixed as to allow a little play on the tibia, by which the joint moves with great freedom.

A moving cartilage is not common, but is peculiar to those joints whose motions are very frequent, or which move under a great weight. It is a contrivance found at the inner head of the collar bone and the articulation of the wrist, as well as at the knee. The obvious use is to lessen friction and facilitate motion.

Fig. 4. Exhibits the formation of the ankle joint; a, the fi-bula; b, the tibia.

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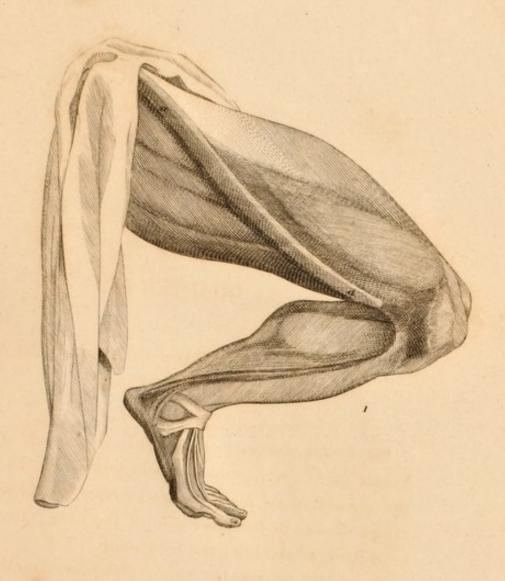
TAB. XII.—THE SARTORIUS AND OBLIQUE MUSCLES
OF THE HEAD.

Fig. 1. a, a, the sartorius, is the longest muscle of the whole human fabric: it is extended obliquely across the thigh from the fore part of the hip (the anterior superior spinous process of the os illium,) to the inner side of the tibia. Its office is to bend the knee and bring the leg inwards.

Fig. 2. There are two pairs of oblique muscles; a, a, the obliquus capitis superior, arising from the transverse process of the atlas, and inserted into the occipital bone; b, b, the obliquus capitis inferior, arising from the spinous process of the dentata, and inserted into the transverse process of the atlas.

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Fig. 1. of the biospic bility is flower cubin) arised by two portions from the serpe of they form a thick mass of thesh in the middle of the arth, which is finally inserted into the upper end of the radiant boths bruchess interset, wises from the middle of the radiant boths bruchess interset, and its inserted into the ulus. Both these muscles lead the bruches as one muscle, thickes arthur arthur as; the section better named as one muscle, thickes attended on the or hame is by three distinct heads, which unite and to the or hame is by three distinct heads, which unite and invest the whole hack spart of the bone, becoming a strong tenden where a toplanted into the above, it is a powerful enden where a toplanted into the above, it is a powerful outself, situated at the content of the forestrue, of the answers, a shall triangular muscle, situated at the colors; it may be had muscle, situated at the colors; it may be had muscle.

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Pro. 2. f. the della described angels, the annels at the shoulder by which the arm is raised.

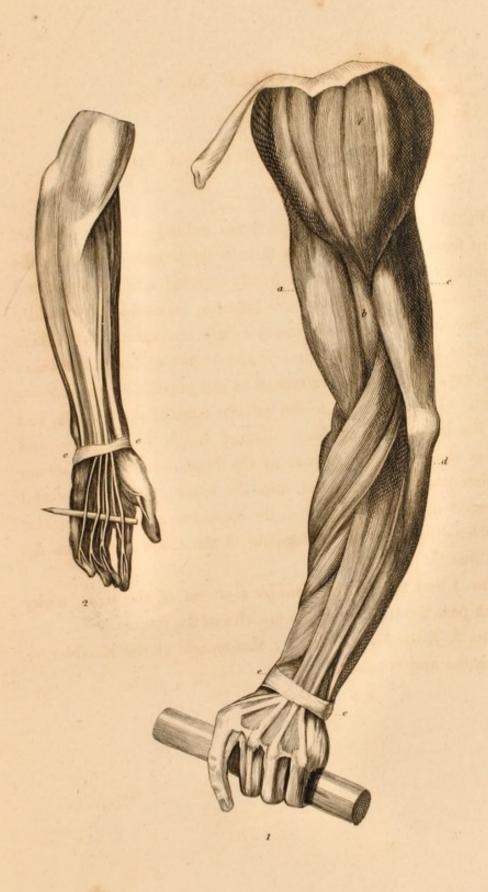
#### TAB. XIII .- THE MUSCLES OF THE ARM.

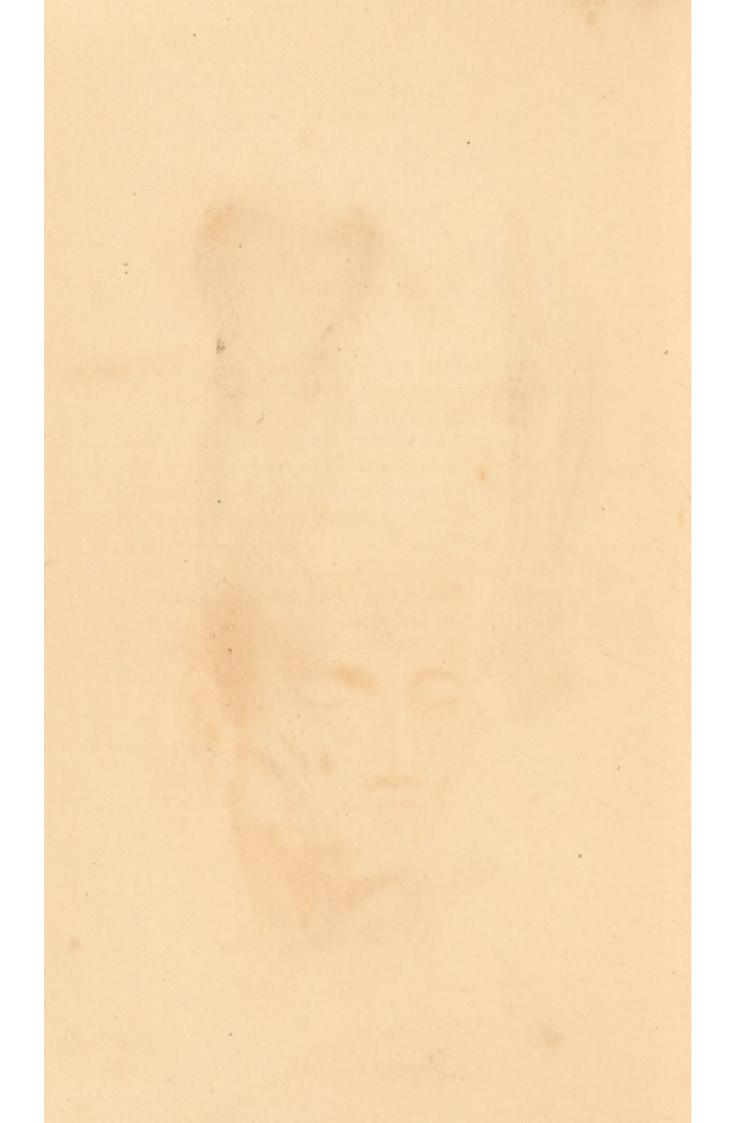
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Fig. 1. a, the biceps (biceps flexor cubiti) arise by two portions from the scapula; they form a thick mass of flesh in the middle of the arm, which is finally inserted into the upper end of the radius; b, the brachiæus internus, arises from the middle of the os humeri, and is inserted into the ulna. Both these muscles bend the fore-arm. c, the longus et brevis brachiæus externus; these are better named as one muscle, triceps extensor cubiti. It is attached to the inferior edge of the scapula, and to the os humeri, by three distinct heads, which unite and invest the whole back part of the bone, becoming a strong tendon which is implanted into the elbow. It is a powerful extensor of the fore-arm. d, the anconæus, a small triangular muscle, situated at the outer side of the elbow: it assists the last muscle.

Fig. 1 and 2. e, e, the annular ligament of the wrist, under which pass the tendons of the muscles of the fingers.

Fig. 2, f, the deltoid muscle; the muscle at the shoulder by which the arm is raised.





AND RESINOUS OR CLAUSER BURGERS.

Fig. 1. A front view of this muscle named fresher pulpobra superiorie: Fig. 2. a profile of the same in its natural position. This muscle-arises within the orbit, and is intered by a broad

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## TAB. XIV.—THE MUSCLES THAT RAISE THE EYE-LIDS, AND SPHINCTER OR CIRCULAR MUSCLES.

- Fig. 1. A front view of this muscle named *levator palpebræ* superioris: Fig. 2. a profile of the same in its natural position. This muscle arises within the orbit, and is inserted by a broad tendon into the upper eye-lid.
- Fig. 3. exhibits examples of sphincter muscles: a, a, the orbicularis palpebrarum, encircling the eyelid; it closes the eye, and compresses it with spasmodic violence when injured by particles of dust, &c. b, the orbicularis oris, surrounding the mouth; its chief use is to contract the lips.

## TAB.XIV





# CHAPTER UL

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### TAB. XV .- THE DIGASTRIC MUSCLE.

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Fig. 1 and 2. The digastric muscle has is origin, a, at the lower part of the temporal bone; it runs downwards and forwards, and forms a strong round tendon, b, which passes through the stylo-hyoïdeus, f; it is then fixed by a strong ligament, c, to the os hyoïdes, d; it again becomes fleshy, runs upwards, and is inserted into the chin. This description differs from Dr. Paley's, and it will be found by reference to dissections or the plate, that the os hyoïdes furnishes a stay or brace instead of a pulley, and that the loop or ring is in the stylo-hyoïdeus muscle.





CHAPTER IN

TAR NYL-THE TEXBONS OF THE TOES

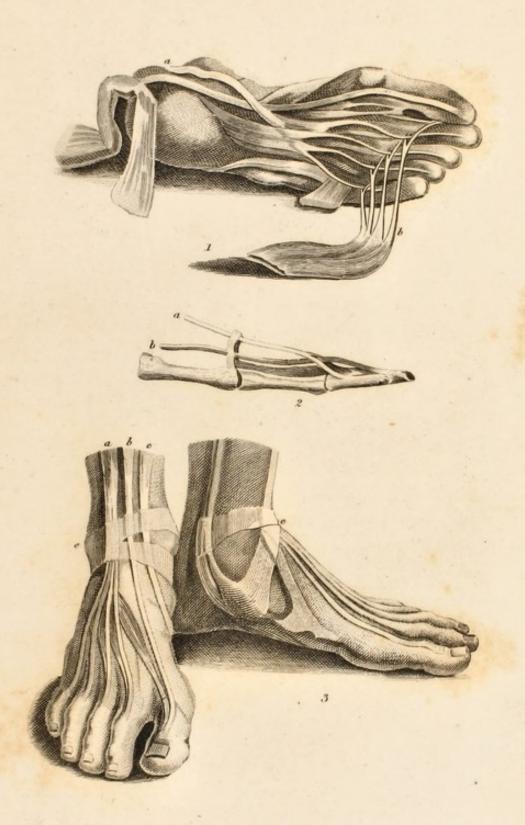
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Fig. 2, a, 5, tendons of the extension organization torus; c. a. bendon of a florest of the 1800-2 flores have been down and extensions in air lay, c. the annexes of the consistent of the consistency of the

#### TAB. XVI.-THE TENDONS OF THE TOES.

Fig. 1. a, the tendon of the long flexor of the toes, which divides about the middle of the foot into four portions, passing through the slits in, b, the short flexor tendons. Fig. 2. explains a similar contrivance belonging to each finger: a, a tendon of the flexor sublimis; b, a tendon of the flexor profundus, passing through it.

Fig. 3. a, b, tendons of the extensor muscles of the toes; c, a tendon of a flexor of the foot. These are bound down and retained in situ by, e, the annular ligament of the instep.





CHAPTER M.

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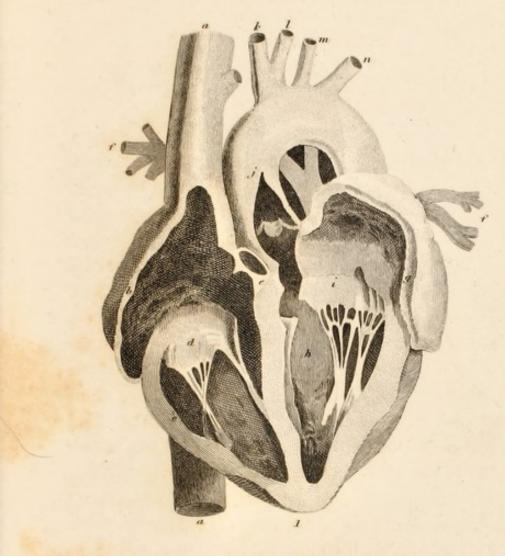
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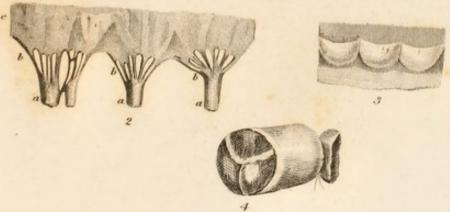
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#### TAB. XVII .- THE HEART.

from page 166 to page 180

- Fig. 1. A section of the human heart; a, a, the superior and inferior vena cava, the veins which convey the blood to the, b, right auricle; and thence into, c, the corresponding ventricle; from this ventricle the blood is impelled through, e, the pulmonary artery into the lungs; and returning by, ff, the pulmonary veins, it is received into, g, the left auricle: it flows next into, h, the left ventricle; which by its contraction distributes the blood through the general arterial system:—j, the aorta, the great artery which transmits blood to the different parts of the body, from whence it is returned by veins to the cava: k, the right subclavian; l, the right carotid arteries, originating from one common trunk; m, the left carotid; n, the left subclavian: d, the valves of the right; i, the valves of the left ventricle.
- Fig. 2. the valves of the right side (tricuspid valves) separated from the heart; a, a, a, the carneæ columnæ, or muscular fibres of the valve; b, b, b, the chordæ tendineæ, or tendinous filaments which are attached to, c, the valves.
- Fig. 3. Exhibits the artery cut open with the form of the semilunar valves.
- Fig. 4. a portion of the artery filled, shewing how effectually the valves prevent the retrograde motion of the blood.







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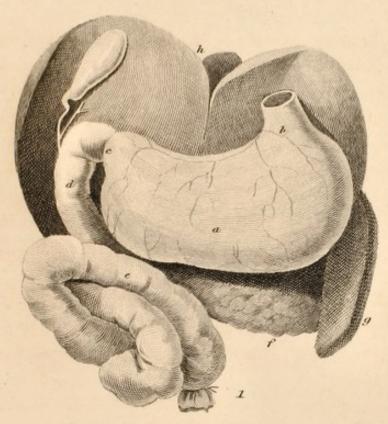
TAB. XVIII .- THE STOMACH, GALL BLADDER, &c.

Fig. 1. a, the stomach; b, the cardia; c, the pylorus. The gastric juice is a secretion derived from the inner membrane of the stomach, and digestion is principally performed by it. In the various orders of animated beings it differs, being adapted to the food on which they are accustomed to subsist. The food, when properly masticated, is dissolved by the gastric fluid, and converted into chyme; so that most kinds of the ingesta lose their specific qualities; and the chemical changes to which they would otherwise be liable, as putridity and rancidity, &c. are thus prevented.

In this plate, h, the *liver* is turned up, in order to shew the gall-bladder which is attached to its concave surface; d, the duodenum; e, part of the small intestines; f, the pancreas; and g, the spleen.

Fig. 2. explains the several ducts and their communication with the duodenum; a, the gall-bladder; b, the ductus cysticus; which uniting with, c, the ductus hepaticus, forms, d, the ductus communis; which, after passing between the muscular and inner coats of the intestine, opens into it at e. f, the pancreatic duct. The bile is said to become more viscid, acrid, and bitter, from the thinner parts being absorbed during its retention in the gall-bladder.

# TAB.XVIII





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CHARTER X

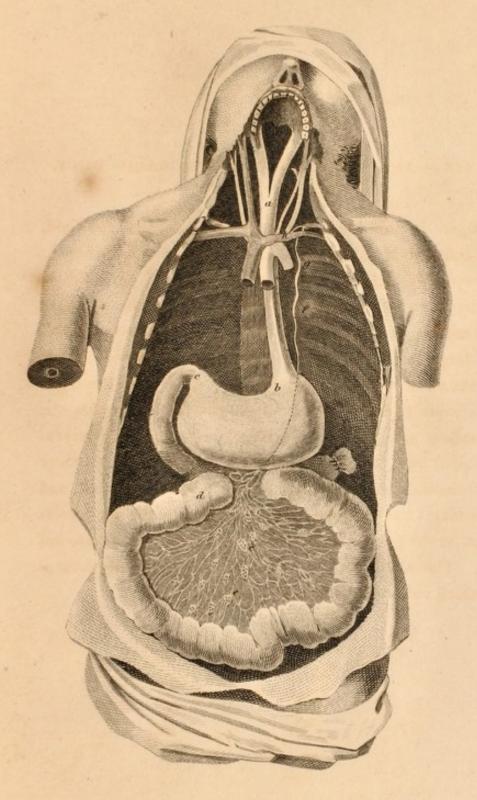
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TAB. XIX .- THE LACTEALS, AND THORACIC DUCT.

The figure in this plate represents the course of the food, from its entrance at the mouth to its assimilation with the blood; a, the asophagus, extending from the pharyna to, b, the stomach; where the alimentary matter having undergone the digestive process, escapes at, c, the pylorus, into, d, the intestines. In this plate a large portion of the latter is spread out to shew a part of the absorbent system called lacteals: these collect and imbibe the chyle from the ingesta, and transmit it through, e, e, the mesenteric glands, into one general receptacle, f, (receptaculum chyli,) from which, g, the thoracic duct ascends in a more or less tortuous direction to the lower vertebræ of the neck, and after forming an arch, it descends and enters, h, the left subclavian vein, at the point where that vein is united with the internal jugular. The absorbents of the right side frequently form a trunk, which enters the right subclavian vein.

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### TAB. XX.-THE PAROTID GLAND.

Fig. 1. A dissection to exhibit the parotid gland.

Page 193

Fig. 2. Explains the former; a, a, the integuments turned back; b, the parotid gland; c, its pipe or duct passing over the masseter, then perforating, d, the buccinator muscle, and opening into the mouth opposite the second molar tooth.





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#### TAB. XXI.-THE LARYNX.

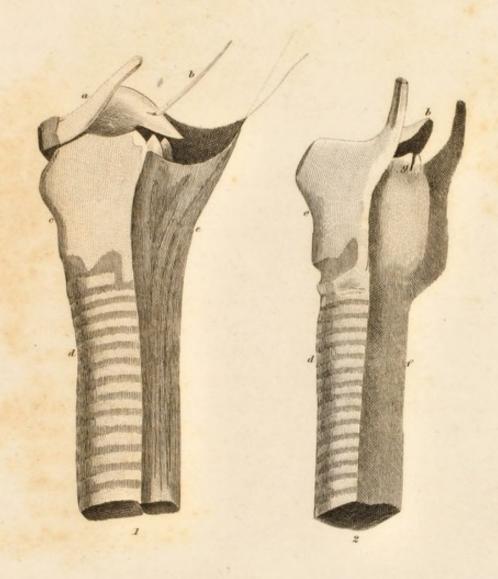
From have 194 to page 199

Fig. 1. The larynx, pharynx, &c. a, the os hyoïdes, b, the epiglottis pressed down, thus covering the glottis, or opening of the larynx; as it does in the act of deglutition.

Fig. 2. Exhibits the larynx, and trachea; which is a continuation of the former; b, the epiglottis; g, the arytenoid cartilages; e, the thyroid cartilage, exceedingly strong, for the protection of the upper part of the air tube; d, the cartilaginous ringlets of the trachea or wind-pipe, each forming nearly two-thirds of a circle, and completed by a soft membrane, which, from its apposition to, e, Fig. 1. the asophagus, accommodates itself to the substances passing into the stomach.

Fig. 3. The larynx or upper part of the wind-pipe of a bird.

## TAB.XXI







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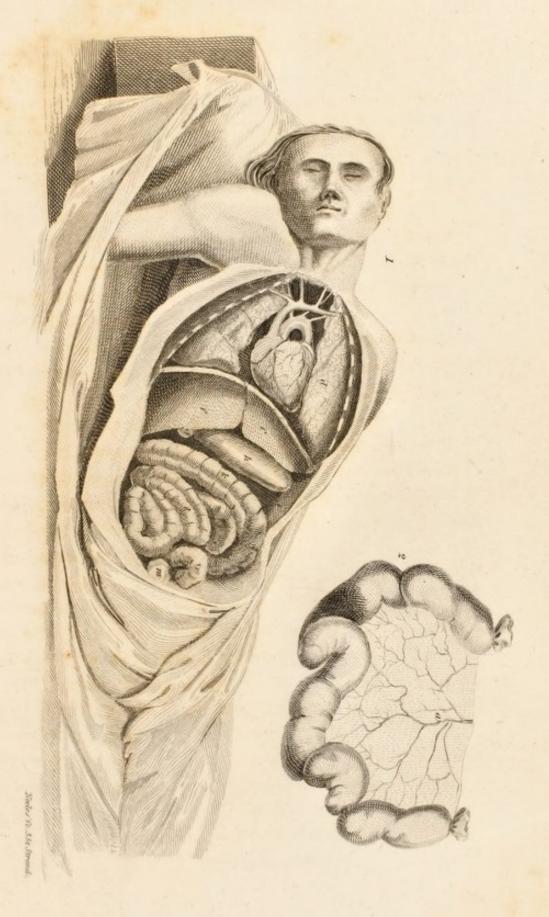
TAB. XXII.—PACKAGE OF THE VISCERA, AND MESENTERY.

Fig. 1. In this plate the parietes of the chest and abdomen, with the omentum, are removed to shew the viscera in situ; a, the heart; b, the aorta; c, the descending vena cava: d, the lungs divided by the mediastinum into two portions; three lobes belong to the right, and two to the left portion of the lungs; e, the diaphragm; f, the liver; g, the gall-bladder; h, the stomach; i, the spleen; k, the large intestines; l, the small intestines; m, the bladder.

The viscera of the thorax and abdomen, i. e. the viscera of organic life, are irregularly disposed. The agents of volition are double, but the instruments of involuntary motion, namely the interior life, are single, and at least are irregular in their form.

The several viscera are correctly described in the Theology, and sufficient is said for the purposes for which they are introduced. To the supposed use of the *spleen* only an objection must be taken: various hypotheses have been entertained as to its office, but none are conclusive; the most probable is, that it is a source of supply of blood for furnishing the gastric secretion, or that the blood undergoes some important change in it.

Fig. 2. The mesentery. This membrane is formed by a reflection of the peritonæum from each side of the vertebræ; it connects the intestines loosely to the spine, to allow them a certain degree of motion, yet retains them in their places; and furnishes their exterior covering. Between the laminæ of, a, the mesentery, are received the glands, vessels, and nerves; and its extent admits of a proper distribution of each.



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# CHAPTER XIL

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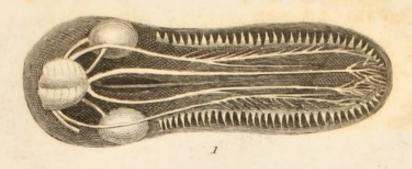
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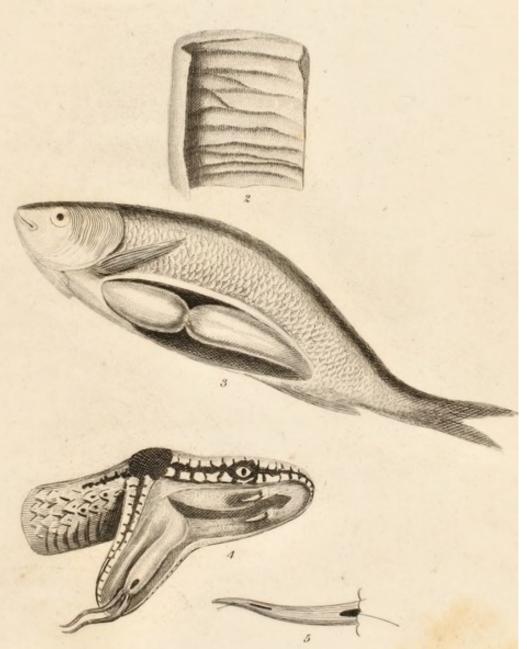
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which governor the poison is ejected.

- TAB. XXIII.—NERVES OF THE BILL OF A DUCK, VALVULÆ CONNIVENTES. CHAP. XIII. AIR-BLADDER OF A FISH, AND FANG OF THE VIPER.
- Fig. 1. The upper mandible of the duck, on which are distributed the first and second branches of the fifth pair of nerves; the former passing through the orbit to the extremity of the bill, and, together with the latter, supplying the whole palatine surface.
- Fig. 2. A small portion of the human intestine cut open in order to shew the valvulæ conniventes. It may be questioned, whether these extremely soft rugæ or folds of the villous coat of the intestine can in the least retard the passage of the food through its canal; nor does, as Paley supposes, the erect attitude of man require them; for, since there are as many of the convolutions of the intestines ascending as there are descending, the weight of the food can have no influence in the action of the intestine: it is certain, however, that this arrangement of the internal coat, affords a more extensive surface for the lacteals and secreting vessels; and this appears to be the real use of the valvulæ conniventes.
- Fig. 3. The air-bladder in the roach. This vessel differs in size and shape, in different species of fish; generally communicating, by one or more ducts, either with the æsophagus or stomach; by which means the fish receives or expels the air, thus sinking or rising without effort: but as some are destitute of this organ, it is considered as an accessary instrument of motion.
  - Fig. 4. The head of a viper of the natural size.
- Fig. 5. The fang magnified, at the root of which is the gland which secretes the venom: a hair is represented in the tube, through which the poison is ejected.

# TAB.XXIII





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CHAPTER XIII.

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## CHAPTER XIII.

#### TAB. XXIV .- THE OPOSSUM.

- Fig. 1. The American opossum; (didelphis marsupialis.)
- Fig. 2. One of the young of the opossum.
- Fig. 3. The pelvis of the opossum; a, a, the two bones (ossa marsupialia) placed on the anterior part called the ossa pubis. Drawn from a specimen in the Museum of the Royal College of Surgeons, London.

The kangaroo and several other animals of New Holland have a similar structure.

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# CHAPTER XUL

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Fig. 1. The haddle chart of the herin.

Fro. 2. The head of the felend seems (principal beauties).

## CHAPTER XIII.

TAB. XXV.—CLAW OF THE HERON, AND BILL OF THE SOLAND GOOSE.

- Fig. 1. The middle claw of the heron.
- Fig. 2. The head of the Soland goose, (pelicanus bassanus) drawn from a specimen in the Ashmolean Museum, Oxford.

## TAB.XXV







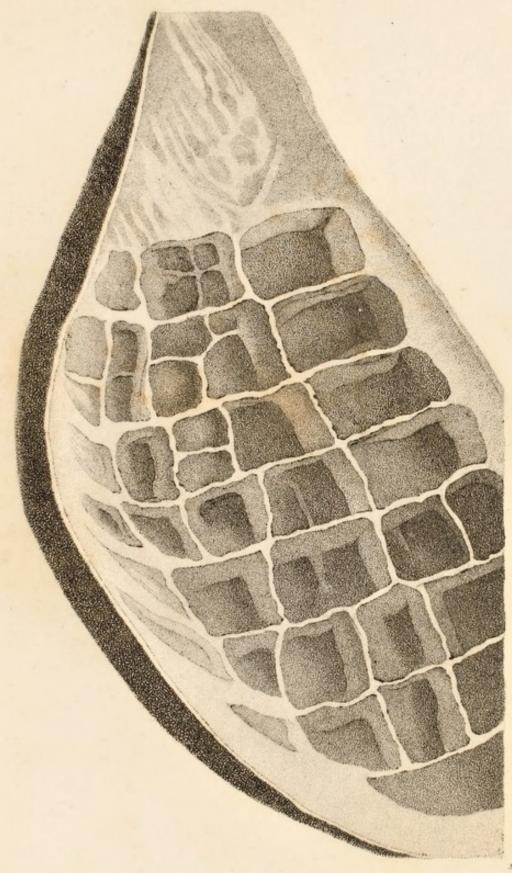


### CHAPTER XIII.

#### TAB. XXVI.-STOMACH OF THE CAMEL.

The figure in this plate exhibits the cells in the stomach of the camel, from a preparation in the museum of the Royal College of Surgeons, London. In the camel, dromedary, and lama, there are four stomachs, as in horned ruminants; but the structure, in some respects, differs from those of the latter. The camel tribe have in the first and second stomach numerous cells, several inches deep, formed by bands of muscular fibres crossing each other at right angles; these are constructed so as to retain the water, and completely exclude the food. In a camel dissected by Sir E. Home, the cells of the stomach were found to contain two gallons of water; but in consequence of the muscular contraction, which had taken place immediately after death, he was led to conclude this was a quantity much less than these cavities were capable of receiving in the living animal. See Lectures on Comparative Anatomy, by Sir E. Home, vol. i. p. 168.

## TAB.XXVI



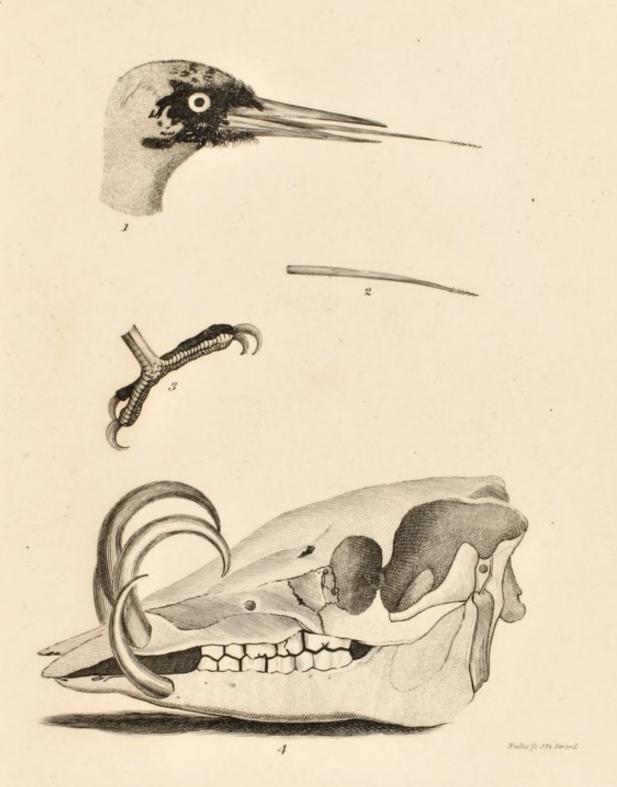
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## CHAPTER XIII.

# TAB. XXVII.—TONGUE OF THE WOODPECKER, AND SKULL OF THE BABYROUESSA.

- Fig. 1. The head of the woodpecker, (picus viridis.)
- Fig. 2. The tongue, the natural size.
- Fig. 3. The claw of the same bird, referred to in Chap. V.
- Fig. 4. The skull of the babyrouessa, from a specimen in the Anatomy School, Christ Church, Oxford.



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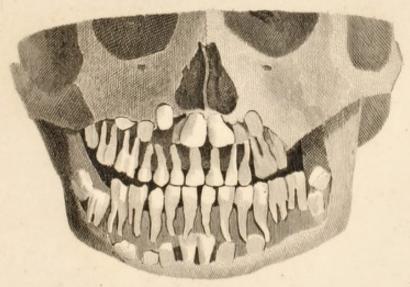


#### CHAPTER XIV.

#### TAB. XXVIII. - TEMPORARY AND PERMANENT TEETH.

- Fig. 1. The gums and outer plate of the bone are removed, shewing the teeth of the infant, as they exist at the time of its birth; they are without roots, and contained in a capsule within the jaws.
- Fig. 2. In this figure also, the outer alvelolar plate of the jaws has been removed to shew the succession of teeth. This is the state at six years of age. The temporary teeth are all shed between the ages of seven and fourteen, and are supplied by the permanent teeth, already nearly perfectly formed, and situated at the roots of the former.





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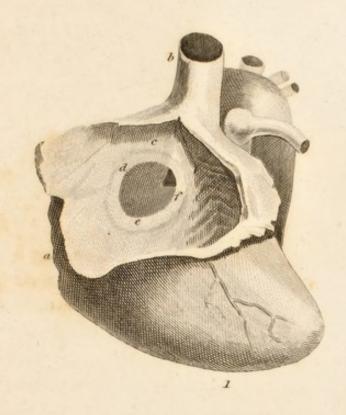
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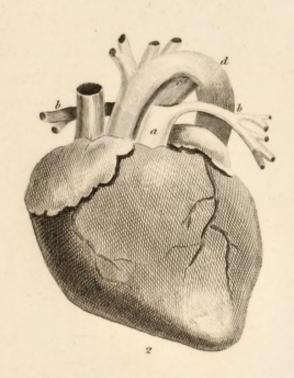
### CHAPTER XIV.

## TAB. XXIX.—FORAMEN OVALE, AND DUCTUS ARTERIOSUS.

- Fig. 1. A view of the feetal heart; a, the ascending, b, the descending vena cava; c, the right auricle; d, e, f, mark the elevated ring of the foramen ovale, or the opening between the two auricles.
- Fig. 2. The fætal heart; a, the pulmonary artery; b b, its branches; c, the ductus arteriosus, or canal for transmitting the blood into d the aorta. As the lungs are useless in the fætus, unless as a "prospective contrivance," the heart has to carry on a single circulation only: the free communication between the two auricles identifies them as one cavity; and the ventricles also force the blood into one vessel, the aorta.

## TAB.XXIX





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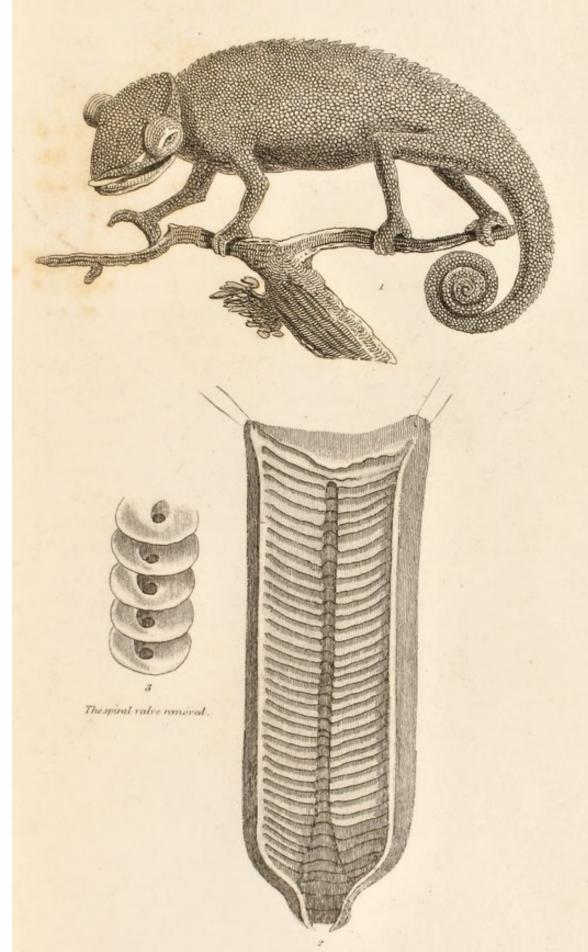
### CHAPTER XVI.

TAB. XXX.—THE CHAMELEON, AND GUT OF THE SEA FOX.

Fig. 1. The chameleon, drawn from one of the species preserved in the Anatomy School, Christ Church, Oxford. The eyes of this creature are very peculiar: they are remarkably large, and project more than half their diameter. They are covered with a single eye-lid, with a small opening in it opposite the pupil. The eye-lid is granulated like every part of the surface of the body, with this difference, over the eye the granulations are disposed in concentric circles which form folds in that part to which the eye is turned: and as the lid is attached to the front of the eye, so it follows all its movements. The neck is not "inflexible," but its shortness, and the structure of the cervical vertebræ exceedingly limit the motion; this however is admirably compensated by the not less singular local position than motion of the eye, as the animal can see behind, before, or on either side, without turning the head.

Fig. 2. The spiral intestine of the sea-fox cut open; taken from a preparation in the museum of the Royal College of Surgeons London. The sea-fox is not, as Paley supposes, a "quadruped;" but a species of shark (squalus vulpes.) The convoluted intestinal tube is found in some genera of fish, only. In this specimen the internal membrane is converted into a spiral valve, having thirty-six coils, so that the alimentary substances, instead of passing speedily away, by proceeding round the turns of the valve, traverse a very considerable circuit: an extensive surface for the absorbents is thus provided.

Fig. 3. The valve removed from the intestine in a dried preparation shewing its real form.



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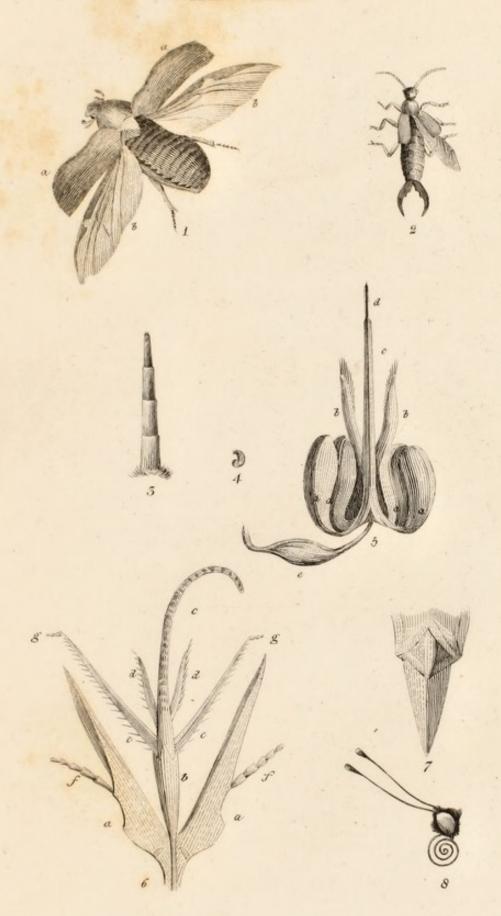
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### CHAPTER XIX.

# TAB. XXXI.—THE WINGS OF THE BEETLE, AWL, STING OF THE BEE, PROBOSCIS, &c.

- Fig. 1. Is an instance of the horny and gauze wings in one of the most beautiful of the beetle class of this country, the scarabæus auratus, or rose chafer; shewing the expanded elytra, a, a: the true wings, b, b.
- Fig. 2. A specimen of the elytra covering half the body in the ear-wig, forficula auricularia:) one of the elytra is extended, and the membranous wing unfolded.
- Fig. 3. The awl of the astrum bovis, or gad-fly, highly magnified.
  - Fig. 4. One of the hooks.
- Fig. 5. The sting of a bee, drawn from nature as it appears by means of a magnifier of very high powers; a, a, a, a, the apparatus for projecting the sting; b, the exterior, c, the interior sheath of d, the true sting, which is divided into two parts barbed at the sides; e, the bag which contains the poison.
- Fig. 6. The *proboscis* of a bee extended; a, a, the case or sheath; b, the tube; c, the exterior; d, the interior fringes; e, the tongue; f, f, the exterior, g, g, the interior palpi.
- Fig. 7. The appearance of the proboscis when contracted, and folded up.
  - Fig. 8. The head of a butterfly, shewing the coiled proboscis.





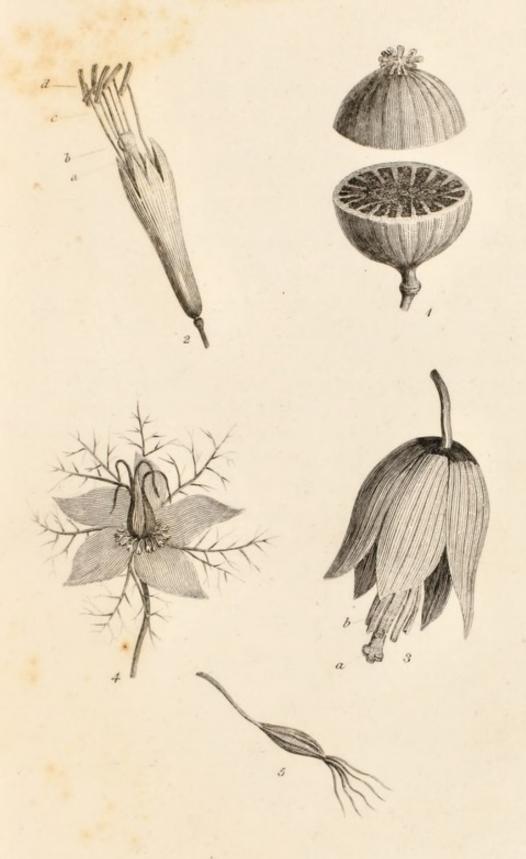
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## CHAPTER XX.

# TAB. XXXII.—THE CAPSULE, PISTIL, STAMINA, NIGELLA, PLUMULE, AND RADICLE.

- Fig. 1. The *capsule* or seed vessel of the poppy: (papaver somniferum:) it is divided to exhibit its internal structure.
- Fig. 2. Is an instance of an erect flower, the agave Americana; in which the pistil is shorter than the stamina.
- Fig. 3. A flower of the *crown-imperial*. The relative length of the parts is now inverted.
  - Fig. 4. A blossom of the nigella.
- Fig. 5. A grain of barley, shewing the plumule and radicle growing from it.

## TAB. XXXIII.





CHAPTER XX.

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Fig. 1. Pattimeria spiretia. The femali plant, the flowers of whick are puspie. This is drawn from a specimen in the possession of Dr. Ogla.

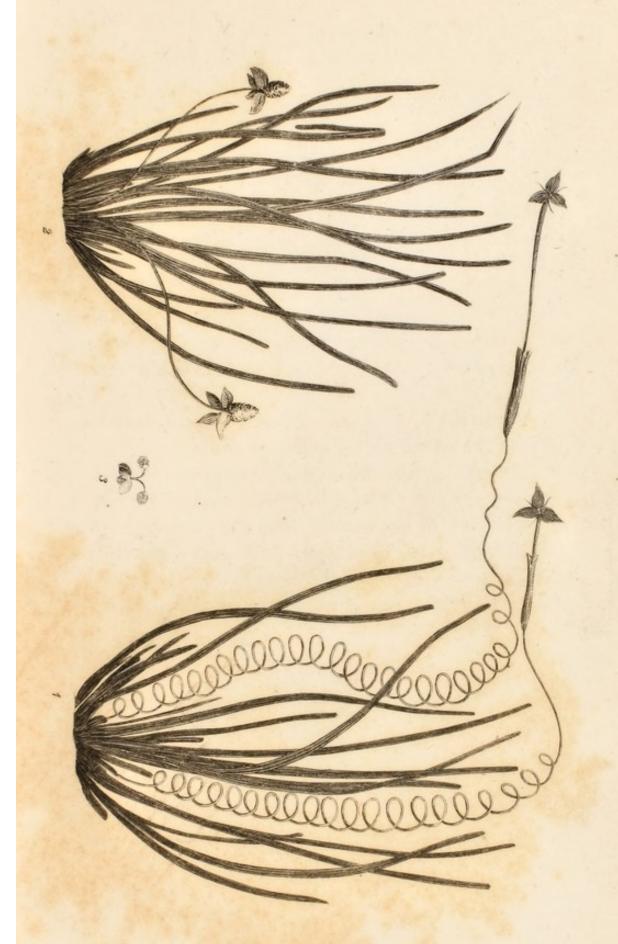
Fig. 2. It he made plant, producing white flowers; these when materic rise like air bubbles, and suddenly expanding when they could like surface of the water, float about in such abundance as toscover it entirely. "Thus their pollen is scattered over the rigmas of the first mentioned blossoms, whose stalks soon afterwards resume their spiral figure, and the fruit comes to materials at the bottom of the materials.

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### CHAPTER XX.

#### TAB. XXXIII. - VALLISNERIA.

- Fig. 1. Vallisneria spiralis. The female plant, the flowers of which are purple. This is drawn from a specimen in the possession of Dr. Ogle.
- Fig. 2. The male plant, producing white flowers; these when mature rise like air bubbles, and suddenly expanding when they reach the surface of the water, float about in such abundance as to cover it entirely. "Thus their pollen is scattered over the stigmas of the first mentioned blossoms, whose stalks soon afterwards resume their spiral figure, and the fruit comes to maturity at the bottom of the water."
  - Fig. 3. One of the separated male flowers magnified.





## CHAPTER XX

## TAB. XXXIV.-CUSCUTA EUROPAIA

This plant is a native of our own country, and is found in hedges, on clover, or on beans, where it purves exceedingly injurious to, the crop. It flowers from June to Angust. The drawing was taken from a specimen which grew in the Physic Gardens, Oxford. It is represented tripping about some nettless on which it annually affected itself.

"Of all this parasitival plants, the dodder (cuscuts) tribe are the most singular, trueling for their nonrishment entirely to those vegetables doubt which they trained and into whose tender bark, they insert most villages tabereles serving as roots, the original root of the dodder withouring away entirely, as soon as the young such has fixed itself to any other plant; so that its connexton with the earth is out off." Truelish Homer, p. 65.

### TAB. XXXIV .- CUSCUTA EUROPÆA.

This plant is a native of our own country, and is found in hedges, on clover, or on beans, where it proves exceedingly injurious to the crop. It flowers from June to August. The drawing was taken from a specimen which grew in the Physic Gardens, Oxford. It is represented twining about some nettles on which it annually attaches itself.

"Of all the parasitical plants, the dodder (cuscuta) tribe are the most singular, trusting for their nourishment entirely to those vegetables about which they twine, and into whose tender bark they insert small villous tubercles serving as roots, the original root of the dodder withering away entirely, as soon as the young stem has fixed itself to any other plant; so that its connexion with the earth is cut off." English Botany, p. 55.





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#### TAB. XXXV .- THE AUTUMNAL CROCUS.

The colchicum autumnale. This plant before us exhibits a mode of fructification scarcely paralleled among British vegetables. The flowers appearing very late in autumn, the impregnated germen remains latent under ground close to the bulb till the following spring, when the capsule rises above the surface accompanied by several long upright leaves, and the seeds are ripened about June, after which the leaves decay. See British Botany, vol. i. p. 133. The plant is represented as it appears in spring; the root is divided to shew the seed vessel near the bulb. The flower is remarkable for the length of its tube.





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#### TAB. XXXVI.-THE DIONÆA MUSCIPULA.

Venus's fly-trap. Some parts of this plant are so remarkable as to deserve a particular description. It is a native of North Carolina; the root perennial; leaves all radical, supported on long fleshy and strongly veined footstalks, leaving a small portion of this next the leaf naked: the leaf itself consists of two semi-oval lobes jointed at the back, so as to allow them to fold close together; they are fleshy, and when viewed through a lense glandular, sometimes of a reddish colour on the upper surface; the sides of both lobes are furnished with a row of cartilaginous ciliæ which stand nearly at right angles with the surface of the leaf, and lock into each other when they close. Near the middle of each lobe are three small spines, which are supposed to assist in destroying the entrapped insect. In warm weather the lobes are fully expanded and highly irritable, and if a fly or other insect at this time light upon them they suddenly close, and the poor animal is imprisoned till it dies. See Curtis's Botanical Magazine, No. 785.





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