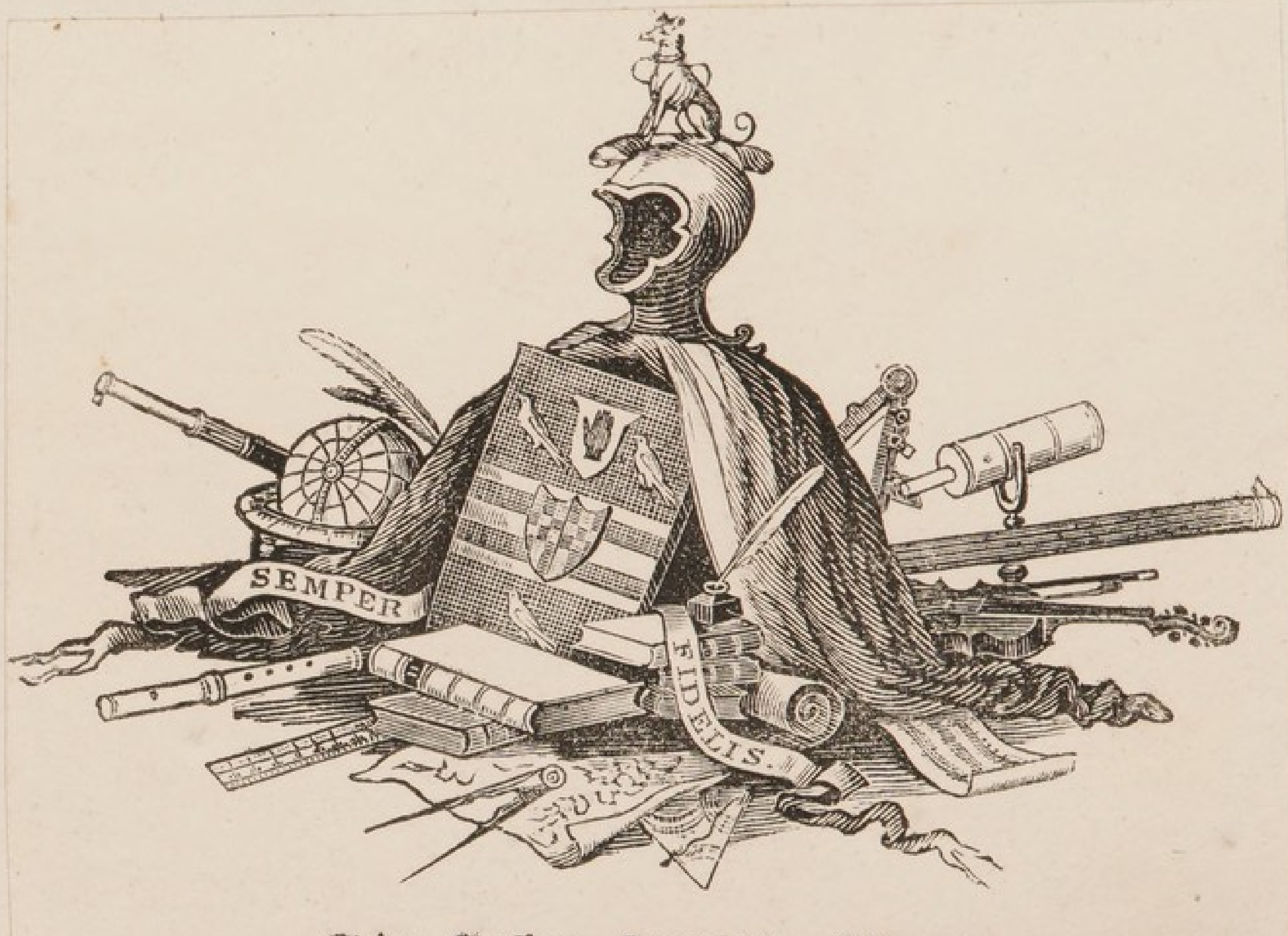

Sir John Smith, Bart.

1st Edition
£75

DOCTRINÂ DELECTANS ANIMAM INCRESCIT.

Pub. Jan. 1 1803, by M. Jones, Paternoster Row.

A POPULAR VIEW OF *THE STRUCTURE AND ECONOMY* OF THE Human Body:

Interspersed with

REFLECTIONS,

MORAL, PRACTICAL, AND MISCELLANEOUS;

INCLUDING MODERN DISCOVERIES,

And designed for

GENERAL INFORMATION AND IMPROVEMENT.

TO WHICH IS ANNEXED,

An Explanation of Difficult Terms.

BY JOHN FELTHAM.

"Science ever tends to improve the Heart, and raise the Mind to contemplate the Power, Wisdom, and Goodness of Him that made us."

Dr. Blizard.

LONDON:

PRINTED FOR J. GINGER, PICCADILLY; R. BENT, COVENTRY-STREET; AND M. JONES, PATERNOSTER-ROW.

1803.

Printed by J. Cundee, Ivy-Lane.

PREFACE.

THE importance of a work on the present plan, unfettered (as much as possible) by terms of art, has been acknowledged by those who can best appreciate the extensive influence of physical science on human happiness.

The path to most departments of science has been surrounded with so many difficulties, that he who removes the obstructions, and, by inviting an examination of the subject, induces a participation in its advantages, at least performs a useful duty to society.

Were these assertions not very apparent, decisive proofs of public opinion might be adduced—two respectable authors will now suffice—"An opinion is beginning rapidly to prevail, that society would be benefited by the possession of a certain degree of knowledge *in every individual*, of the laws of his structure and œconomy."*

Dr. Beddoes (Essays, Vol. I. 1802.) regrets his "inability to point out any English work, calculated to instruct persons in general in the highly useful and important science of the animal structure and œconomy." He laments that the knowledge of the human frame, has been neglected, without any adequate reason, in the course of general education, and that the advantages of this science have been consequently lost†.

---

* Rev. Richard Warner.

† Sensible of the importance of this subject, in this view Mr. Jauffret of Paris has recently published a small volume intitled, "Les merveilles du corps humain, ou notions familières d'anatomie a l'usage des enfans et des adolescens. 18mo. Paris, VII.

To

To excite an interest in favor of this study, is therefore the avowed intention of this volume, which, those acquainted with the subject will be aware could not be produced without some attention—nor, the Author fears, without some defects. While the work is meant to be adapted to the general enquirer, a few remarks are incorporated with a view to benefit the Student.

It is hoped, that no objection will be made to the manner in which each chapter is conducted, it being essential to afford the general edification the author has in view; and with respect to its tenor, so many appropriate passages occur in the course of the work, that he forbears from any farther comment in its favor.—He relies on that candid criticism which he has hitherto experienced, and commits it with due deference to PUBLIC OPINION.

J. F.

No. 27, Coventry-Street, Haymarket,
Jan. 1, 1803.

To excite an interest in favor of this study is therefore the avowed intention of this volume; which, those acquainted with the subject will be aware, could not be produced without some [illegible]fication—nor, the Author fears, without some defects. While the work is meant to be adapted to the general enquirer, a few remarks are incorporated with a view to benefit the Student.

It is hoped, that no objection will be made to the manner in which each chapter is conducted, it being essential to afford the general edification the author has in view; and with respect to its tenets, so many appropriate passages occur in the course of the work, that he abstains from any further comment in its favor.—He relies on that candid criticism which he has hitherto experienced; and commits it with due deference to [illegible] notice.

CONTENTS.

CHAP. I.

CHAP. II.

CHAP.

CHAP. III.

OF THE BONES.—Page 88.

CHAP. IV.

OF THE MUSCLES.—Page 127.

CHAP. V.

OF THE NERVES.—Page 154.

CHAP. VI.

CHAP. VII.

CHAP. VIII.

CHAP. IX.

OF THE STRUCTURE OF THE HUMAN FORM, MALE AND FEMALE.—Page 315.

CHAP. X.

TRAITS OF THE VARIOUS ORGANIZATION OBSERVED IN NATURE, COMPARED WITH MAN ---MISCELLANEOUS REMARKS ON THE SUPERIORITY OF MAN TO ANIMALS.---Page 339.

CHAP.

CHAP. XI.*

* By an error printed Chap. XII.

AUTHORITIES.

Beside a variety of other authors quoted, the works of the following writers have been consulted in the composition of the present volume.

Anatomy Syst. of
Addison
Adams
Bancroft
Boyle
Brown, Sir T.
Beattie
Bell, J. and C.
Cicero
Cheselden
Camper
Chaptal
Cuvier
Chattelleux
Cavallo
Derham
Darwin
Doddridge
Erasmus
Evans
Edgeworth
Edwards
Ency, Britt.
Fothergill, A.
Fellows
Ferguson, Dr. A.
Gregory
Gisborne
Garnett
Helvetius
Harvey
Hume
Hervey, Rev. Mr.
Hamilton, M.
Hunter, Henry
Hawes, Dr. W.
Jenyns
Jardine
Knox, Rev. V.
Lavater
Lettsom Dr.
Lond. Med. Review
Mem. ManchesterS.
Medical Extracts
Monro
Med.&Phy.Journal
Mitchell
Marat
Malkin
MSS. Vario.
Northcote
Nesbit
Pierre, St.
Priestly
Perceval
Quinsey
Ray
Rush
Ryland
Sheldon
Simmonds
Smith, Dr. A.
Sanders
Smyth, Dr. C.
Thompson, Dr.
Thornton
Tillotson
Townsend, Rev. Mr.
Wollaston
Watts
Westley
Wallis, Dr.
Wollstonecraft, Mrs.
Willich
Wilkins
Willan
White
Watson, Dr.
Underwood.

CHAP. I.

COMPRISING A GENERAL VIEW OF THE SCIENCES CONNECTED WITH THE STUDY OF THE HUMAN FRAME.

Is then the being who such rule attains,
Nought but a bunch of fibres, bones, and veins?
Is all that acts, contrives, obeys, commands,
Nought but the fingers of two feeble hands;
Hands that a few uncertain summers o'er,
Moulder in kindred dust and move no more.
No---powers sublimer far that frame inspire,
And warm with energy of nobler fire,
And teach mankind to pant for loftier joys
Where death invades not, nor disease annoys,
But transports pure, immortal, unconfin'd,
Fill all the vast capacity of mind.-------

I. H. BEATTIE.

AT the present moment, when the sciences in general are cultivated with ardour, and when a love of knowledge has taken deep root in every order of society, it has been suggested, that a plain and familiar account of the economy and various parts of the human body, will not be unacceptable or unuseful. The inclinations, or rather

 the

the pursuits, of many persons, debar them from this ample field of study, and such a popular display of the science of anatomy will now be attempted, as may inspire a relish for those pleasures which the investigation of the grandest operations of nature must ever afford to the inquisitive mind.

In elucidating the most striking parts of the science, the being and perfections of the Deity, will be either directly demonstrated or indirectly inferred. If enough be said, to satisfy for the present, and stimulate curiosity for a more extensive and deep investigation of the study in future, the author's design is accomplished. The practical advantages attending such research, both in public and private life, cannot be doubted; and the mind, by the pursuit may become enlightened and replenished with those enlarged and liberal ideas, that exalt and dignify the human character.

Some rays of omnipotence, some corruscations of the "divinity that stirs within us," shine through our frame, which, to understand perfectly, is worth an age of study—a century of toil. That God is supremely good, is proved by the constitution, and general tendency of na-

ture;

ture; and from the dispensations of his providence in the moral government of the world. What beauty, what simple magnificence adorns the face of nature! The earth is filled with inhabitants, of species almost infinitely diversified, all susceptible of enjoying, in a greater or less degree, what Providence is most ready to impart, namely, happiness. Its surface is embellished with a rich variety of objects, that please without cloying. Above it is spread a wide and beautiful canopy, in which the sun moves with resplendent majesty, from whom the moon and planets borrow their milder rays, and where ten thousand times ten thousand far distant lights contribute to enliven and illustrate the variegated scene.

Man is evidently placed at the head of the inhabitants of this beauteous residence, and is constituted with appetites and passions qualified to receive the most delightful impressions from the objects that surround him—impressions which should lead him to adore the goodness of the great First-cause and Parent of all, and enable him to indulge the hope of more substantial bliss in the maturer ages of his being.

Every moral duty may be conscientiously performed without neglecting to pay due attention, at the same time, to the ordinary affairs of life, and occasionally to its innocent amusements; the charms of intellectual gratification, the splendor of the fine arts, and the innocent pleasures of polished society. An attention to some art or science, or being habitually devoted to some employment, useful or ornamental, has a wonderful effect in strengthening the mind, and preserving the very soul in a state of health.

So many pleasures result, indeed, from the acquisition of useful or elegant knowledge, that the disposition of those who neglect the cultivation of their mental faculties is exceedingly to be lamented, and they must ever remain strangers to the "calm peace," the "comforts," that wisdom has to bestow, who will not be found "watching at the doors of her posts!"

Not a few of the sciences are connected together, by a concatenation of similar effects—in particular, anatomy, botany, chemistry, and the *materia medica*, to which may be added, different branches of natural history—sciences, all of which are, besides, fraught with such objects of instruction or amusement, as should in-

duce

duce every thinking man, if possible, to make them objects of his enquiry.

To descend to particulars—the study of anatomy may be very properly recommended as highly important to women, not only to enable them to take proper care of their own health, but to make them rational superintendants of their infants, parents, and husbands. Till of late years, women were kept in a state of Turkish ignorance, as to the objects and means of intellectual improvement; every source and channel of acquiring knowledge was obstructed, if not discountenanced, by fashion. Books of science were replete with a jargon of unintelligible terms, by which ignorance was often mysteriously and pompously veiled, and shielded from public contempt; but now, by a happy revolu ion in the public taste and judgment, writers offer their discoveries to the public in distinct terms, which every body may understand; technical language is no longer allowed to supply the place of real knowledge; and the art of communicating instruction, has been carried to the greatest perfection. This gradual change is all in favour of women. Many things which were formerly thought to be above their comprehension, or totally unsuited to their sex, have now been found to be perfectly within the compass of their abilities, and admirably adapted to their peculiar offices and situations.*

Among these congenial studies, the natural history of our own species ought, unquestionably, to take the lead; it is a more interesting subject, and presents a more ample field for the speculative and practical observations of genius, than the natural history of other animals, and much more insects, spiders, butterflies, and cockle-shells.

Our happy, or at least comfortable, situation in this world, is very much dependent on the civilization of our mental faculties; as this is attended to, the understanding becomes enlarged and improved, and on this, every man depends for numerous advantages in the intercourse of life; and hence his apprehension and other powers become competent to all the duties of society, furnishing men with the means their ne-

* A course of lectures on the obstetric art, are delivered in New York, explaining the anatomical, physiological, and practical parts of midwifery, as far as is necessary to enable *females* to exercise that profession with judgment and science; this establishment (with a lying-in-ward) is particularly and *exclusively* devoted to their education.

cessities

cessities require, of advancing their fortunes, and providing for their families, and giving justness of perception, and accuracy of judgment, in all the various demands of a reciprocal intercourse.

On the cultivation of the mind every man depends for an adequate relish of his enjoyment; for these give him, according to his station, a proper taste or sensibility of happiness; or, at least, afford him a sentimental relish of true pleasure, which is in its nature innocent, and opposite to vice, and soften and refine his passions so as to enable him properly to regulate them. In short, upon the due culture of the mind, every man depends for fixing a principle of virtue in his breast, (entwining it, as it were, with the fibres of his heart) and for giving his nature, originally made for virtuous use and enjoyment, that feeling which may, and should, be impressed on all.

It is a very desirable part of moral education, that such a view be exhibited of the anatomy of the human frame as may be calculated to inspire sentiments of veneration and love for the supreme Artificer; and it is a circumstance peculiarly happy and desirable, when the contemplative mind is enabled alternately to associate with books, and society, for enlarging the capabilities of the mind, and for furthering the chaste improvements of intellect. Gross, indeed, are all the objects of sense compared with such sublime pursuits—pursuits which exalt, and really enoble human nature, and which should be sedulously explored by every young observer. Zeal, an eager desire for improvement, and an attentive investigation, speedily surmount little difficulties, and, perhaps, unfold abilities highly valuable to the possessor.

In this chapter (of an introductory nature) it may be desirable to take a slight notice of those sciences connected with anatomy, and then give the general outlines of that science.

The ancients, especially the Greeks, far excelled us in the finer arts of statuary, architecture, and painting—the beautiful specimens they have left sufficiently testify for them—but in the salutary science of medicine—in the investigation of the properties, and uses of plants and flowers—in chemistry, that deep research into the properties and essences of matter, and of its laws and combinations, in these, as well as in anatomy, (and in the veterinary art*) the moderns

* Veterinary Transactions; containing Observations on the Effects and Treatment of Wounds of Joints, and other circumscribed

derns are, with reason, thought to claim the palm—the ancients, for any thing that now appears, could boast of nothing equal to us in these respects.

We perceive astronomy, in these latter times, unfolded and improved; and improving in its turn, geography and navigation. We may observe mechanics, multiplying the efforts of man, and reducing all nature, as it were, to submission. Machines disengaging us from toil; and water and fire itself compelled to serve as drudges, in the prosecution of our labours. The telescope brings distant objects nearer to view, and unfolds to us planets unknown to our ancestors. The microscope opens a new province within her empire, and becomes as it were the bond which unites us to an immense portion of the creation.

Anatomy hath withdrawn the veil from the face of humanity; it hath discovered an innumerable quantity of machines, all silently co-operating to celebrate the glory of the Artist. This science, at once terrible and useful, hath

cnmscribed Cavities, No. I, 8vo. was published by order of the subscribers, 1801, and which has been followed by many valuable works on this important branch of knowledge, by Dr. Blaine, Mr. White, and others.

taught

taught weapons, accustomed to destroy, the new art of preserving it; and by tracing out a dark, but certain road, even in our entrails, hath enabled the operator to remedy those disorders which he could not see.

Chemistry (which may be considered as the anatomy of unorganised bodies, but which, with the power of dividing, can unite the power of combining and regenerating) hath been carried in our times to a very high state of comparative perfection; especially since mankind have learned how to extend its use throughout every department of the arts, and to render it peculiarly subservient to medicine.* It was reserved for Descartes to discover the laws of dioptrics; and to Newton, the laws of optics; another great and magnificent discovery has been made in our times, and that is electricity; the terrific effects of which have placed mankind on an equality with the far-famed gods of antiquity; whilst *Franklin*, like another *Prometheus*, was emboldened to steal the celestial fire, and acquired the art of rendering it docile to mechanical laws.

* I do not hesitate to pronounce, (says Fourcroy) that modern chemistry has done more, in twenty years, for medicine, than all the united labours of preceding ages.

A close attention to the powers of nature, also, produced the *microscope*, which gives us an insight into the minute, but no less wonderful works, of God, in the creation around us; unfolding the admirable structure of plants and animals, and displaying to us the exquisite texture of their constituent parts. By means of these instruments, the bounds of human knowledge have been amazingly extended, and by the same helps new and exhaustless sources of information and pleasure are continually open to us; so that a person who is possessed of these proper instruments, and who has a taste for the right use of them, can never want copious objects of rational entertainment.*

Franklin, who created a philosophical light and energy in the western hemisphere, unknown before his time, happily reduced science to practical uses. His countryman, Count Rumford, adopted the same principles; and those ample views, which his great archetype suggested, he has explained, enlarged, and confirmed; and, with a facility of elucidation, rendered familiar to the artizan and mechanic; and thus, whilst he instructed philosopers in science, he has ren-

* Dr. Priestley on Vision, Light, &c. Vol. I. 4to. p. 56.

dered the useful arts subservient to public benefit, and domestic comforts.*

Thus has science been familiarly adapted to the purposes of common life and domestic economy; to blend whose object and uses still more intimately, the *Royal Institution* was established in 1794; an establishment that will reflect eternal lustre on its founders. Chemistry has, by its analysis of the hidden properties of air, been enabled to introduce a new mode of rational practice in the medical application of vital and other airs, which, when conveyed into the system externally, or internally, by the lungs or stomach, have been often productive (according to highly respectable testimonies) of the most salutary effects in disorders of the most pernicious nature.†

The

* Dr. Lettsom's Hints to promote Beneficence, &c. 3 vols. 8vo. A work which does honour to National Philanthropy, and to a continuation of which, the public look forward with an anxiety proportioned to its benevolent design.

† The pneumatic doctrine of physic has met with great patronage in England as well as abroad; and in Madrid a pneumatic hospital has been lately established.

The vital, or oxigene air, properly diluted with common air, promotes insensible perspiration, aids digestion, exhilarates the spirits, The principles of that newly discovered process, called Galvanism, and the successful operation of the metallic tractors, deserve attention also; at least a candid investigation should precede their adoption, or rejection. The very singular discovery of balloons, and the useful art of conveying intelligence by telegraphs also, are respectable monuments of modern genius, and concur to place it in no mean point of view.—Cabinets and museums have been opened as sources of an intellectual treat for every mind; and, in short, history, poety, music, &c. &c. are cultivated with a degree of ardour and success that challenges our admiration, and may be almost said to rival antiquity. To the high honour of

---

spirits, and relieves difficult respiration, and is found of the highest advantage in most nervous cases. *Azotic air* abates inflammation, and is the only remedy, with the *hydrogene air*, that is found capable of arresting the progress of consumption. And *carbonic acid air* is the most powerful antiseptic,

REV. MR. TOWNSEND.

The *gazeous oxyd of azote* may be considered (says Dr. Beddoes) as a more powerful form of *oxygen gas*.

Hydrocarbonate weakens the stroke of the pulse, occasions vertigo, and sometimes excites nausea; disposes to sleep, abates cough, and eases the respiration in some asthmatic affections; in hemoptoe it effects a speedy and pleasant cure.

DR. WITHERING.

of the present day, the progress of science and medical research is associated with the extension and propagation of the genuine feelings of Christian philanthropy; not content with arresting the baneful dominion of disease, by the most judicious applications of art, it boldly attempts to extirpate disorders, hitherto the most fatal and most subversive of public and domestic happiness. Such are those salutary and beneficient plans formed at Chester, Manchester, and recently also in London, for the prevention of the progress of contagious fever. And it is a curious and interesting fact, that in districts where its havock was previously unbounded, contagious disease is now nearly annihilated; in short, the success of these institutions has been truly astonishing, and forms a most delightful epoch in the annals of humanity, affording, at the same time a very conspicuous example of what active and intelligent benevolence can accomplish. These societies have been attended with many other advantages, besides the diminution of general mortality, in securing the domestic comfort, and well-being of the poor.*

The

* See an account of these institutions, 8vo. 1801. Price 6d. Also, the Reports of the Society for Bettering the Condition of the

The pleasing and scientific knowledge of botany and chemistry has thrown a new lustre on the art of medicine, as well as added to its utilities. Botany is become a fashionable study, and will, doubtless, continue to increase in usefulness. Science too has been enlisted under the banners of an elegant imagination, and the irresistible charms of poetical genius.*

Chemistry will naturally follow the progress of botany; it is a science peculiarly adapted to women—suited to their talents, to their character, and to their situation. Chemistry is not a science of parade, it affords proper subjects of occupation, and teems with infinite variety; it demands no bodily strength, it can be pursued in retirement, and applies itself immediately to useful and domestic purposes.†

---

the Poor;—publications pregnant with interesting details in the cause of humanity.

* As in Darwin's Botanic Garden,—Dr. Thornton's splendid work on botany, &c. &c.

† Among the most valuable elementary, and systematic treatises recently published on this subject, may be mentioned—Gmelin's History of Chemistry, 3 Vols. 8vo.—Green's Principles of Modern Chemistry, 2 Vols. 8vo.—and Dr. Thompson's System of Chemistry, 4 Vols. 8vo. 1802.

Hippocrates, the Greek physician, (who lived three hundred years before our Saviour) was a total stranger to the science of chemistry. The Egyptians, however, were famed, in high antiquity, for medical knowledge. The Greeks, as usual, improved upon them, and carried to great perfection the art of compounding of simples. The writings of Hippocrates give a pretty accurate idea of the state of physical science, as it then existed among the Greeks. The Coan sage doubtless had a deep insight into nature, but his prescriptions, to the modern physician, appear strangely complicated.

The discovery of the East Indies, and the western world, has brought to light several valuable simples, to which all the herbs of Hippocrates must yield.—A long period intervened between that celebrated naturalist and Galen, whose labours, in many respects, are not to be compared with those of the moderns. The Roman physician Celsus, who lived in the reign of Tiberius, appears not to have practised physic professionally, but he studied it as a philosopher, and descanted with considerable reputation on the art. That medicine never arrived at any great eminence among the ancients is little to be wondered at, if it be true, that they paid little respect

respect to professional men. Among the Romans, the practice of physic is said to have been almost entirely in the hands of slaves. During the reign of Augustus, the most respectable physician we read of was Antonius Musa. The Roman empire could boast no physician of transcendent abilities—no such super-eminent display of talents, of judgment, of skill, and of experience, as modern Europe has produced within a very recent period. In the arts of surgery and anatomy, the ancients could not enter into competition with us.* They knew not how to dress a fresh wound properly; to which, indeed, the loss of such numbers after a battle must be attributed. Their want of skill, in the treatment of wounds, was owing to their ignorance of anatomy; without an accurate knowledge of which no operations can be directed with success. The early practice of sacrificing animals to the Deity, and likewise that of killing them for food, must, however, have afforded the ancients an opportunity of acquiring some knowledge of the

* The reader inclined to pursue "Memoirs of Medicine, including a sketch of Medical History to the Eighteenth Century;" may consult Mr. R. Walker's work, published under that title; a judicious and elegant compendium of medical history, 8vo.

internal parts; and battles, and accidents, could not fail to give them farther opportunities of examining the human structure. The Egyptians learned from the Chaldeans the art of embalming the body, to preserve it; a mode which is still practised on deceased sovereigns, when the internal viscera, being first taken out, the cavity is replenished with proper preservatives.* But the ancients appear not to have availed themselves with skill and sagacity of such occurrences as might have extended their knowledge in anatomy or medicine.

It was not until the flowing in of riches, and its attendant, the luxury of the table, had intro-

* The practice of embalming was originally founded on a prevailing opinion, that after a lapse of a certain number of years the soul should be re-united to the body. Whether such practice could really have any salutary influence on the morals of the Egyptians, by keeping in remembrance the virtues of their ancestors, (as some have imagined) is a matter not easy at present to determine.

Bodies by embalming, have been tolerably well preserved more than two thousand years. In the breast of one of those corpses, or mummies, a branch of rosemary was found, scarcely dried. This art has only been known in Europe during the latter ages. Formerly it was customary to make deep incisions in the body, then to salt it, and, lastly, to enclose it in a tanned ox's hide.

duced

duced diseases among the Romans, that the art of physic, for which they had before expressed so little veneration, began to appear necessary to them; for, according to some authors, they had been long unwilling to admit it; and, from superstitious, or other motives, tolerated it only in the time of the plague. They considered it, perhaps, as a superfluous art. In the five hundred and thirty-fifth year from the building of the city, certain physicians came from Greece to Rome, but it does not appear that they had any fixed establishment there until about the year six hundred. These physicians compounded medicines, and performed operations. As long as the Romans led hardy, frugal, and laborious lives, they dispensed with the aid of physicians, without, it should seem, having beenthe worse in consequence.—Had the Greeks been acquainted with anatomy, we may well presume, that Hippocrates would not have been silent on the subject. The Grecian physicians, however, certainly first paved the way to the culture of medical knowledge; but Hippocrates is believed to be the first who united anatomy to physic, as he doubtless displays more knowledge of the art in his works than any that preceded him. It is, however, suggested by some writers, that he never dissected animals; and that the dissection of

bodies

bodies was not so much as attempted in his days. The following anecdote tends to confirm the probability of such a supposition: Democritus, the philosopher of Abdera, while dissecting a brute, was surprised in the very act by Hippocrates, who expressed great astonishment that *his friend* could perpetrate so foul an action, it being then considered as a contempt of God's works; and added, that it was fortunate no other person witnessed his impiety. This is the first dissection on record. The Greeks, then, we may infer by analogy, would scarcely have presumed to have dissected the bodies of *men*; nay, even in the present enlightened age, a considerable degree of prejudice prevails on this subject, tending to intercept the progress of anatomical improvements. The feelings of delicacy and sensibility start at the idea of being disembowelled, and shrink still more at the thoughts of dissection. The law itself seems to sympathize with our tender emotions, and permits, as prey for the surgeon, only those, whose bodies have been exhibited on the scaffold for their crimes, with every mark of public infamy.* In Galen's time (about the end of the second

---

* See Act 25th, Geo. II. entitled "An Act for the better preventing the horrid Crime of Murder:" and, by the charter of

second century,) we do not find that anatomy was practised from any thing that now appears. The Romans even considered it as unlawful, or impious, to behold the human bowels; Tiberius was allowed to touch the dead body of Augustus, the first emperor of Rome, and to whom he succeeded; but it was under the impression of this idea, that what would be wrong in another, was no crime in him.

In the ages following, Tertullian and St. Augustine, (fathers of the Latin church,) and likewise Pope Boniface, endeavoured to suppress the

---

of the Royal College of Surgeons in London, dated March 22, 1800, is the following clause, "that the said college shall, and by these presents they are required to, purchase, or provide, a proper room, house, or building, with suitable conveniences, within four hundred yards, at the farthest, from the usual place of execution for the county of Middlesex, or the city of London, and the suburbs thereof; for the purpose of more conveniently dissecting and anatomising the bodies of such murderers as shall at any time hereafter be delivered to them, by virtue of the last mentioned act."

The state of physic is at a low ebb among the Chinese. There are no public schools, nor professors of the healing art. They are totally ignorant of the anatomy of the body, and hold dissection in horror.

Embassy to China, 8vo. 1797.

study

study of anatomy—indeed, a general prejudice seems to have prevailed against dissection, even until the sixteenth century.

The emperor Charles V. ordered a consultation of divines, to determine whether it was lawful, in point of conscience, to dissect dead bodies; and in Muscovy, till latterly, the science itself and the use of skeletons were forbidden by law.

But the prejudice against dissection seems gradually wearing away, we know many private families (and mention it to their credit) who have permitted their nearest departed relatives to be opened, for the advancement of medical knowledge, and consequent future benefit of the living: these laudable examples, cannot be too often followed.

From this cursory review of the infant state of anatomy, we recur to its maturer state at the present day, when so great is the alteration, that an eager thirst for its knowledge overleaps the barriers even of strict law, and its votaries will at every risk procure for instruction daily, bodies of every age; if, on the one hand, we accuse the

the ancients of being culpably negligent and inattentive, in not venturing to inspect dead animals—on the other side, we may lament and condemn the unfeeling keen curiosity of modern times, that opens the bodies of various animals, even when ALIVE, to satisfy its philosophic thirst.

Although we are convinced that the obtaining of human bodies to society at large, is a measure pregnant with the greatest advantages, yet we do not wish to defend any illegal act, or to encourage any violation of private feelings, for purposes the most laudable and beneficial. The time may come, when the higher ranks of society may suffer the influence of reason to surmount minor considerations, and the legislature authorize more frequent dissections among the priviledged orders, as the most likely means of propagating the practice among the lower classes of the community.

Perhaps if custom had not reconciled us to the common mode of interment, we might have thought it equally as repugnant to delicacy, and even less rational, that dissection, or suffering the body to be consumed to ashes on the funeral pile, as practised in the times of Paganism. Dr. Smyth*

Smyth* observes that he never knew contagion propagated from the dissection of bodies, unless it was by *innoculation* of the matter.

It is not our intention to trace the science here, from one great professor to another, until the present day.†

Harvey by his discovery of the circulation of the blood, lighted-up the way for the advancement of the science; and numerous and highly respectable are those who have since adorned, and thrown additional lustre, on the profession.

It is perhaps singular, that this important discovery should have been so long dormant: it is unquestionably the most important object that has been attained in the knowledge of animal bodies, and may be considered as the foundation

* Smyth on Contagion, 8vo. 1799.

† A Concise History of the Principal Discoveries in Anatomy, will be found in Sprengel's History of Medicine, vol. 3. The reader may see translated extracts from this work, in Medical and Physical Journal, vol. 2. et subs.——The first anatomical work published in the English language was, "Englishman's Treasure; or, the True Anatomy of Man's Body, by Thomas Vicary, surgeon, in London." It was printed, and reprinted three or four times between the years 1548 and 1633.

and

and corner-stone of all the discoveries of the moderns. This took place in the year 1616. Recent writers however seem disposed to believe that the whole merit does not rest with Dr. Harvey, any more than some later discoveries in chemistry, appertain to the names which are generally attached to them.*

" Learning did ne'er this secret truth impart,
To the Greek masters of the healing art:
'Twas by the Coan's piercing eye unviewed,
And did attentive Galen's search elude.
Thou wond'rous Harvey, whose immortal fame,
By thee instructed grateful schools proclaim
Thou Albion's pride, did'st first the winding way,
And circling life's dark labyrinth display.
Attentive from the heart thou did'st pursue,
The starting flood and keep it still in view;
'Till thou with rapture saw'st the channels bring
The purple currents back, and form the vital ring."

This together with the discovery of the receptacle of the Chyle, and of the Thoracic duct, contributed essentially to explode many errors

* It appears by Dr. Yeat's publication entitled " Observations on the Claims of the Moderns to some Discoveries in Chemistry and Physiology"; 8vo, 1798, that many of our apparent discoveries have been long since delivered and explained, by writers whose works from length of time have been neglected ! !

of

of long-standing in physic. About this period a considerable revolution had likewise taken place in the theories of natural philosophy.

In the course of the seventeenth century, *Galileo* had introduced the chain of mathematical reasoning, and Lord Bacon having started the method of induction, had thereby excited an eager propensity to observe facts, and to make experiments.* These new modes of philosophizing, it might be supposed, would operate collaterally on the state of medicine, but the progress of this art was yet slow. The knowledge of the circulation, did indeed necessarily lead to a clearer view of the organic system in animal bodies, which led to the application of the mechanical philosophy, towards explaining the phenomena of the animal œconomy, and it was applied accordingly, and continued, till very lately, to be the fashionable mode of reasoning on the subject.†

* A new and uniform edition of Lord Bacon's Philosophical, Moral, and Political works is just published in small 8vo. by M. Jones, Paternoster-Row, and may be purchased separately, or together. 1802.

† Philos. of Medicine, 8vo. 1800, 5 vols.

In surveying the history of medicine, as far as it may be traced into antiquity, in the annals of Egypt, Greece, and Italy, the care and solicitude of those illustrious nations for the preservation of human life, is apparent enough, but no vestiges of any regular system, or of any public regulations, are discoverable, for the giving a new impulse to animation, when its course was arrested, and its functions suspended by those unfortunate casualties which must have been common in that, ànd every other period of human existence.

In the middle ages, when all the sciences were plunged in the darkness of barbarism, superstition, and ignorance; that of medicine was involved in the general calamity, and we cannot trace either in public acts, or individual studies, any attempts to preserve from final death those unhappy persons in whom the *vital principle* was suppressed, but not absolutely extinguished This holds up another remarkable instance of modern improvement; for, since the establishment of the Royal Humane Society, in England only, nearly *three thousand persons* have been restored to life, to their families, to their friends, and to the public.

"T' unfold the enliv'ning art divine,
Deserves a more than mortal shrine;
It long lay hid in nature's laws,
'Till late she gave the key to HAWES."*

The benefits therefore to society, derived from such exertions must ultimately be incalculable!

It would occupy too large a space to dwell on the particular progress of newly discovered facts, or to mention the illustrious catalogue of names who have so recently enlarged the boundaries of medical and anatomical knowledge.

* Dr. William Hawes, the founder of that benevolent institution. National gratitude must surely be asleep, that it does not acknowledge the incessant labours of this philanthropist.— That the vital principle may remain for some time, after all the signs of the vegetable life disappear, every day's successful experience now happily establishes; and that the common signs of death, such as the rigid limb, the clay-cold skin, the silent pulse, the breathless lip, the livid cheek, the fallen jaw, the pinched nostril, the fixed staring eye, are found uncertain and equivocal; for persons under all these appearances *have been recovered!* What an important, what a happy fact! In scripture, we find such efforts sanctioned by the examples of Elijah, *who revived* the widow's son, and Jesus, who *re-animated* the daughter of Jarius, the widow's son of Nain, and the soul of Lazarus from the tomb! The clergy, and it is spoken to their honour, have ever been ready to exert their valuable services in this cause.

The

The names of Cullen, Brown, and Hunter,* reflect honour on the British nation. The Brunonian system of practice has its zealous advocates, and learned patrons, and certainly deserves an attentive and candid examination.

The recent discovery of *vaccine* inoculation is now become the fashionable practice of the day. It is earnestly hoped and expected, that it will continue to answer the wishes of its promoters.

The progress of the cow-pox is rapid and extensive; and this discovery of Dr. Jenner, will, in the opinion of many eminent writers form a new æra of benefit in the contemplation and gratitude of posterity.†

Let us now proceed to a more immediate investigation of the subject before us.

Anatomy, in an enlarged sense, applies equally to plants, to men, and to beasts; which last, however, is termed COMPARATIVE ANATOMY.

---

* Dr. Hunter's Discovery of the Absorbent System may be considered as the greatest discovery that anatomy hath suggested since Harvey's discovery of the circulation of the blood.

† See Dr. Lettsom's Hints, ut Supra. On the Cow-Pock, consult the works of Jenner, Woodville, Pearson, Lettsom, Ring, Waterhouse, Addington, and Aickin.

Human anatomy falls under three divisions; a description of the parts, called anatomical; explaining their functions and uses, termed physiology; and describing their diseases, termed pathology.

The human body is composed of firm and liquid parts, commonly called solids and fluids: of the solids, some are hard, others soft and flexible, they are the chief subjects of anatomy, properly so called; by which term, from the Greek, is understood, not only an artful decomposition, but also a methodical demonstration and description of the parts when dissected. The history of the fluid parts more properly belongs to the animal economy. The solid parts, are bone, cartilage, ligament, fibre, membrane, vessel, artery, vein, nerve, muscle, gland, fat, viscus, organ, &c.—*Bone* is the hardest, most solid, and most inflexible part. *Cartilage* is a whitish, or pearl coloured substance, softer than a bone, smooth, polished, pliable, and elastic.

A *ligament* is a white, fibrous, compact, substance, more pliable than a cartilage; difficult to

be

be broken or torn ; and yielding but very little, when drawn out with force.

By *fibre*, is meant small filaments, which are the most simple parts of the body, and which compose all other parts ; they differ in substance, direction, and size, according to the parts they compose.

By *membrane*,* we mean a pliable texture of fibres interwoven together in the same plane;

* The curious enquirer may see in Phil. Tran. (1800) an Investigation on the Component Parts of Membrane, by Charles Hatchett, Esq.

Membranes are, in general, composed of gelatin, in its different states from that of soluble mucilage to strong glue : the more flexible the skin, the more readily and copiously is the gelatin extracted. The cutis of the human body seems to be almost wholly formed of it. The cuticle evinces it, but in a minuter degree. Hair contains gelatin; and to this principle its flexibility is owing, for the harder and less flexible hair yields it in a small proportion, while the softer loses, in the preparation or boiling, both strength and flexibility, unless boiled with caution. Feathers and quills, contain little or no gelatin ; they are apparently elongations and modifications of the cuticle only. Tortoise-shell, human nail, &c. are of the same nature.

For an account of the *different kinds* of membrane, see *Bichat* on the subject, Med. and Phy. Journal, 1801.

 these

these planes are termed laminæ. Small portions of membranes, when very thin, are called *pelliculæ;* and this, when united to thicker membranes, is termed the cellular or spongy substance. The adipose membrane is the same as the cellular, but the former is rendered impervious by the distention its contents occasion.

Vessels are tubes, composed of different membranes; the strata of which are termed tunica, or coats: they are named according to the fluids they contain, as blood vessels, vasa lactea, lymphatics, &c. The smallest extremities of all vessels are generally termed capillaries. The blood vessels are of two kinds; *arteries*, which carry the blood *from* the heart to every part of the system; and *veins*, which bring it back again *to* the heart. The arteries are thicker and deeper seated than the veins; the veins have valves which open towards the heart at different distances to prevent the blood from returning, but are not irritable like arteries, except the large ones near the heart.

By *nerves* are meant the white ropey parts which proceed from the brain and spinal marrow, and are spread over all the parts of the body, by small ramifications. They are the seat and origin of all our faculties, of sensation and motion.

The

The *muscle* is what we commonly call *flesh*, which is composed of various distinct portions: its white ends are termed tendon.

Glands are clustered bodies distinguished from other parts by their form, consistence, texture, and connection.

The kidneys, and the sweet bread, are properly denominated glands.

Fat and marrow, is that oily substance composed partly of cellular, partly of membraneous, and partly of an unctuous matter; it is entirely deprived of sensibily, like all liquors secerned from the blood. Marrow differs only by its fineness, and from its being situated within the bones.*

By viscera, is meant all the internal parts contained in the cavity of the body. Every part capable of any function is termed an organ.

In this work, all the leading divisions will be the subject of a particular chapter, and some

* For an investigation of the various properties and uses of the marrow, which cannot be discussed here, refer to *Isenflam* on the subject, in Med. and Phy. Journal, No. 33. Nov. 1801.

pages will be added, particularly treating of *comparative* anatomy; for this, it is universally allowed, has been a source cf the most useful discoveries in the human subject.

It may not be improper in this place to make some cursory observations on the animal economy in general, preparatory to an examination of its detached branches.

The *animal* and *vegetable* kingdoms are readily and naturally distinguishable, as while they both grow, feed, and perhaps feel, the vegetable is inert, and the animal only, possesses *volition*, or the power of performing certain motions at pleasure.

Volition implies that some principle, superior to mere matter, actuates the machine. The inactive parts is composed of solids and fluids, which are liable to waste and corrupt. It was, therefore, necessary that animals should be enabled to derive a supply for the parts that are continually wasting; and, as few are formed to be able to take in their support from the surrounding element, it is necessary that they should be endowed with means of judging of their proper aliment; and it appears equally requisite, that

some

some parts of the body should serve as a basis for the rest—these are the bones. The bones, for their easier motion on each other, are tipped at their ends with a substance called cartilage, or tied together by a substance, called ligament. Thus the basis of our body is fitted for being moved.

To perform the motion, it is necessary that a contractile substance should be tied to each of the bones to draw them nearer together; this is exactly the office of the flesh, which is divided into certain portions called muscles.

As the muscles must be soft and flexible to allow of these motions, they must necessarily be composed of a great number of fibres, and this makes them bulky; and, in order to fix them more strongly to the bones, they are at their ends converted into a thinner and firmer substance, called *tendon*. By the single property of contracting themselves, they are fitted to perform a great variety of motions: thus, in providing food, the muscles of the arm extend and contract to catch the food, and convey it to the mouth, and after this the muscles of the jaw chew it: when taken down, the stomach, a muscular organ, prepares the food for entering into the system. From the power which animals possess, of taking in food, and lodging it in a proper receptacle, another difference of character from vegetables may be observed, as the body is supported from food taken into the stomach, it may be inferred, that vessels go from thence to all other parts: it is, therefore, matter of some surprise, that those vessels which take the nourishment into the system were not sooner discovered. The nutritious parts pass from the intestines to the mesentery, by minute vessels, which have valves to prevent their return: these running through the substances called *glands*, at length all meet in one tube called the *thoracic* duct, which runs along the back bone, and opens into a vein constantly on the left side, and from thence the contents are conveyed directly to the heart.

Upon the first view of the veins and arteries, an observer would be at a loss to determine which of them carries the blood from the heart; but from injections it is satisfactorily ascertained that the veins have a contrary use. If an injecting tube be fixed into any trunk of a vein, and he injection be pushed on towards the extremities, it will appear that a resistance is made

 which

which will prevent the injection from passing; owing to the valves in the veins.

Upon tracing the substance called CHYLE, and the vein into which it opens into the heart, we shall perceive that it agglomerates or joins with a number of other veins, and forms the *vena-cava* superior; this passing along with the other inferior cava, they both together open into a small cavity called the right auricle, which communicates with the right ventricle; from this cavity the blood is carried by a canal, called the pulmonary-artery, *into the lungs*, from which, after being sub-divided into a number of minute branches, it returns by the pulmonary veins into the left auricle, whence it passes into the left ventricle, and there empties itself into a large canal, or duct, called the *aorta*, or great artery; from which, as from a grand reservoir, the blood is distributed to all parts of the body.

Nature has found it necessary, in our system, to send all the blood *through the lungs, before it circulates through the other parts;* the use and intention of this it is very difficult to ascertain, but from an observation that has been made viz. that the air, when discharged from the lungs, is found poisonous to animals, it seems reason-

able

able to conclude that something *noxious is discharged* from the blood by them, and that something necessary or salutary to life *is, at the same time, imbibed.**

---

* Of the atmospheric air only, twenty-seven constituent parts out of a hundred, contain pure air, the rest is aliment for vegetables, but not fit to maintain flame nor animal life. Water is composed of pure and inflammable air, it is now demonstrable (what was anticipated by the great *Newton*) that water contains an inflammable body, it also contains an infinitely greater quantity of vital air than the atmosphere, containing eighty-five parts in a hundred of pure air. It is unnecessary here to expatiate upon the necessity of breathing this pabulum as pure as possible.—all appear sensible of it, all feel its necessity and use; yet with double doors and curtains do we strive to keep it from our apartments, as if it were *a public enemy*. Many disorders, to which our hardy forefathers were strangers, date their number and malignancy from this effeminate delicacy. Why are pulmonary complaints so prevalent in large cities? Is it not from the soot, smoke and putrefactive vapours we inhale? Nature has guarded the lungs by a variety of preservatives, first by an outwork of hair, situated at the first pass, where the air enters the human frame, there its groser impurities are protruded after it has entered the nostrils;—a crooked road to the mouth is lined with a viscous matter that arrests small particles, but should any of those pass these different guards there still remains a centinel at the portals of the lungs of so irritable a nature, that should but an atom touch him, he would throw the whole frame into convulsion and resistance. WALKER'S LECTURES, 1801.

Modern

Modern discoveries have very much contributed to clear up this point, and convey a pretty satisfactory idea of what is ejected, and what is received in return.

The manner in which the action of the heart is performed, may be thus explained: the blood, when introduced into the right auricle, by its irritation, causes that vessel to contract, and this contraction propells the blood to the ventricles. These become contracted likewise, and this motion forces the blood into the arteries, from whence it reaches the remotest part of the system.

Let us next proceed to a cursory view of the brain, glands, &c.

The brain appears to be the principal gland in the human body;—one of its properties is to secrete a liquor which, by means of the nerves, is considered as the impulsive cause of all motion and sensation. The brain is generally divided into two parts, the *cerebrum* and *cerebellum;* from both or which issue certain cords, or ropey substances, called nerves. All the small cords, are distributed about the head, but the large one, called medulla spinalis, proceeds through a cavity in the bones, and, as from a storehouse, supplies all the body with nerves. The nerves, as to their structure and appearance, are fibrous substances:—towards their extremities, branching off into innumerable partitions to every part of the body. The nerves are the grand organs both of motion and sensation.

The large congeries of nerves that proceed from the spinal marrow are generally covered with thick coats, which serve for their defence. A very plain and simple experiment may suffice to shew some of the principal uses to which the nerves are applied: divide the nerves that go to the hind leg of a frog, and it will render the animal incapable of the least sensation in the muscles; nor will it be able to move that limb, although the circulation be not thereby impeded, but still goes on as before. We may consider the nerves, therefore, as conducive to two primary purposes; first, that of rendering the conscious faculty sensible of any injury done to the body, and secondly of being themselves subservient to the motions of the body.

In consequence of the violent motion constantly carried on in the vessels, the fluid part will be continually subject to waste, and the solids

solids have a tendency to decay by the perpetual friction that arises; some means must therefore be adopted for renewing those parts,—this nature has provided for by the food we take for sustenance, which being received into the body undergoes an operation, which assimulates it to the system. Even in those animals that derive their support from the surrounding element the nourishment is not imbibed by pores, as in the case of vegetables, but is first taken into the stomach.

The manner in which the food is assimulated, will be spoken of hereafter; it doubtless undergoes a sort of trituration in the stomach, and becomes mixed with several fluids, as the bile, saliva, &c. It is also assisted in this operation, by the animal heat. It is further evident that the unprofitable noxious parts of our aliment must be carried off, and this is done by perspiration, &c.

To facilitate the motion of the parts of the body on one another, they are provided with an adipose or fatty membrane called the cellular substance, and the skin over this is extremely sensible, so as to give warning of danger, yet not of so great sensibility as to occasion pain. It

is

is also covered with a cuticle which is very thin and deprived of the power of sensation. It may be observed here also, that all animals being subject to decay, it becomes necessary that means be furnished for their reproduction and this we see provided for, by the contrivance of nature.

Anatomy, in the theory of it, especially when joined by physiology can seldom fail to excite the curiosity of persons of taste, as a branch of philosophy, since if it affords gratification to acquire some insight into the structure of the body, it is certainly more so, to trace all the latent springs, which give life, vigour and motion to the machine, and to observe the admirable mechanism, by which so many different functions are executed. The most renowned philosophers before the Christian era, even from the slight acquaintance they had with the structure of animals, expressed their firm conviction, of the existence and attributes of a deity, more from this consideration than from any thing else around them. Let your soul, says Antoninus, (the pagan philosopher) receive the deity, as your corporeal frame does the air; for the influences of the one, are no less vital than the other; this intimate correspondence is very practicable, for there

there is an omnipresent spirit, which lies as open and pervious to your mind, as the air you breathe does to your lungs; but then you must remember to be disposed to draw it.

The study and observation therefore of anatomical facts, will lead to the best purposes. It will excite admiration of, and gratitude to, the supreme Author of our being: it will create an enthusiastical, yet rational desire, *to live again*, with more expanded faculties—and gift us with the means of comprehending the whole plan of the beneficent author of nature, in so forming the universe, and regularly directing all its operations. It will lay a foundation for acquiring such a knowledge of our physical temperament, and of the various medicines adapted to it by nature and art, as will constitute us more unerring guardians of our own health and happiness; an art in some degree indispensible as the author of the Spectator observes, for every one to learn.

Man indeed of all animals, is possessed with the greatest facilities of accommodating his constitution to all seasons and climates; from thence it seems not unfair to conclude, that most of our diseases are brought on by a careless or imprudent

prudent management of ourselves; aud our progression in the knowledge of natural and artificial remedies will of necessity keep pace with our knowledge in anatomy, and the laws of the animal œconomy—Thus the seed of disease may be discovered, and destroyed ere it has time to take root.

In fine, on this science, the interests of society are immediate and strong.

In the ensuing chapters, it is intended to trace the operations of nature, through the intricate labyrinth of man, the most sublime and complicated being, in the visible productions of the Almighty.—

Let us then proceed to observe, as Garth, beautifully expands the idea:

" How she unfolds, the faint, the dawning strife
Of infant atoms kindling into life:
How ductile matter now meanders takes
And slender trains of twisting fibres makes
And how the viscous seeks the closer tone
By just degrees to harden into bone;
While the more loose, flow from the vital urn
And in full tide of purple streams return;
How lambent flames from life's bright lamp arise,
And dart in emanations through the eyes;

How

How from each sluice a gentle torrent pours
To slake a feverish heat with ambient showers.
Whence their mechanic powers, the spirits claim
How great their force, how delicate their frame
How the same nerves are fashion'd to sustain
The greatest pleasure and the greatest pain,
Why bilious juice a golden light puts on,
And floods of chyle in silver currents run,
How the dim speck of entity began
T' exert its primo-genial heat, and stretch to man."

God of perfection! How benevolently hast thou displayed thyself in man!—Behold the human body! that fair investiture of all that is most beautious.—Unity in variety! Variety in unity! What elegance, what propriety, what symmetry through all the forms, all the members! How imperceptible, how infinite are the gradations that constitute this beauteous whole.*

* Holcroft's Lavater. 8vo.

CHAP.

CHAP. II.

A FAMILIAR VIEW OF THE STRUCTURE OF THE HUMAN BODY.

Anatomy reveals great nature's plan,
Displays on earth the majesty of man
Whose curious frame betrays the pow'r divine
With God's own image stamp'd on every line.

THE object of this chapter is to convey generally an appropriate idea of the wonderful fabric of Man—to infer analogically from his curious structure, the existence and perfections of the supreme architect, and by such moral and philosophical observations, as will naturally suggest themselves, endeavour to impress the useful tendency of social duties on the mind.

From even an imperfect analysis of the human frame, we shall every where find the strongest traces of HIS HAND who made it.

A more

A more accurate research into the nature and use of the organs of the body, might be further considered as a moral hymn to the Creator: the passions which are the organs of the mind, would not be barren of praise to him, nor unprofitable to ourselves: referring to his superintending agency and providence whatever is found of right, or good, or fair in ourselves, we discover his strength, wisdom and tenderness, in our weakness, ignorance, and imperfections, thus honoring his gracious purposes where discovered clearly, and adoring their profundity when lost in the research; we may at once be inquisitive without impertinence, and elevated without pride, we may be admitted as it were into the councils of the Almighty by a consideration of his works.*

The whole creation, however, is replete with *arcana*; by the word of the Almighty were the rest of the creatures called into being; at his bare *fiat* they started out of nothing, but in the mechanism of the human frame he seemed not so much to *create*, as to *form*; when he had compounded the materials of other creatures there resulted at once the *figura* and the *anima*; a form and soul, but having moulded the exterior of man, he inspired an immaterial substance like

* Burke.

himself,

himself, an incorruptible and immortal spirit, a particle of the divine breath.

Galen, contemplating the order disposition, and conclative uses of the different parts of the body, exclaimed, "herein I acknowledge and praise our Creator, that he has been pleased to adorn his works beyond the power of art."

In all those curious parts, which compose the human fabrick, there does not appear to be any fit organ, instrument, or receptacle for the mind or rational soul, in the brain. which is generally considered as the seat of reason, not any thing of moment can be discovered, more than in the *Cranium* of a brute; the same observation applies to the *pineal gland*, wherein the *Cartesians* placed the seat of intelligence; this is found to be precisely the same in beasts and in men. An argument this, which affords no inconsiderable proof as to the inorganity of the soul: at least in that sense we usually conceive the term. Thus we are men we know not how, a compound of matter and intelligence; there is something implanted within us, that can yet subsist without us, and will exist after us. These walls of flesh, wherein the soul is now, as it were a captive, prior to that grand era of Christian hope the resurrection,

surrection, are nothing but a composition of elementary particles, and a fabric, that must of its own nature fall to ashes.—That all flesh is grass, is an aphorism, not only metaphorically but literally true.

> " See dying vegetables life sustain,
> And life dissolving, vegetate again."

All that immense variety of living creatures which we behold, are nothing but the herbs of the field digested into flesh in them, or more remotely carnified in ourselves!

From the helpless state of Infancy, and progression* from thence to mature age (says Bishop Butler) the general law of Nature is that the same individual should exist in different degrees of life and perfection, with capacities of action, enjoyment, and suffering, at one period, greatly different from those appointed them in another

* Philosophers of all ages seem to have imagined that the great world itself, had likewise its infancy and its gradual progress to maturity: this seems to have give norigin to the very ancient and sublime allegory of *Eros* or divine love, producing the world from the egg of night, as it floated in Chaos. Darwin's Botan. Gard. vol. 1.

period of it. Worms are changed into flies; birds and insects bursting their shells, entering as it were into a new world, with new accommoda-tions, and a new sphere of action assigned them and a variety of transformations in the animal world. But the states of life in which we existed formerly in the womb; and in our infancy, are almost as different from our present in mature age, as it is possible to conceive any two states, or degrees of life can be. The conclusion to be drawn is, that man is *to exist hereafter*, in a state as different supposed from our present, as this is from our former, according to the analogy of na-ture; according to a natural order or appointment of the very same kind, with that we have already experienced.

It is morally and presumptively evident, that we are in our present state, an inferior part of the creation of God. A variety of natural ap-pearances denote our being in a state of degrada-tion. Nature does not qualify any of her living subjects wholly, much less at once for a mature state of life. Maturity of *body* and *mind* in our species is arrived to but gradually, and is after all, much owing to our habitual exertions and exer-cises of both from our infancy. But were we to suppose a person brought into the world, with all

his

his mental and corporeal faculties in a perfect state as far as this is conceivable, he would plainly at first (unless supposing a divine inspiration) be as unqualified for the functions of mature humanity, as an idiot. He would be distracted and bewildered with different emotions of curiosity, suspence, astonishment, and difficulty of apprehension, nor can we easily conjecture, how long a space would intervene ere he would become familiarized to himself, and the objects about him, so as to set himself about any thing.*

It may be questioned, whether the natural information derived from the senses of sight, feeling and hearing would be of use before the trainings of experience. There is reason to think that Men would be headstrong, self-willed, and impetuous in action; society itself would perhaps be insupportable, and living in it impracticable, were it not for some moderation and self government previously acquired, some habitude and readiness in restraining themselves, and conceal-

* The curious reader who may be desirous to investigate facts and observations, leading to the developement of the powers of nature as adapted to wild or civilized life, will be gratified with the History of the wild Boy of Aveyron, 12mo, 1801.

ing their sense of things. Want of every thing of this kind, which is only learned by tutoring and experience, would render a man as ungovern-able in society, as want of language would, or as his natural ignorance of any of the occupations of life would render him incompetent to provide for the common conveniences, or supply the neces-sary wants of it. In these respects, and probably in more of which we have not at present any pre-liminary notions, man seems to be left by nature an unformed, unfinished creature, utterly defi-cient, unqualified, and unequal to himself, until the gradual acquirements of observation, disci-pline, and self government, enable him to see what is necessary, and form him for that mature state of life which was the primary end of his creation, considering him only as a being related to this world.

It is easy hence, to infer how necessary is that so apparently tardy progression from infancy to childhood, from childhood to youth, from youth to manhood; it may at least serve to impress our minds, with sentiments of grateful wonder at the mysterious operations of nature in our origin, &c. and teach us to observe with pious awe, how fearfully and wonderfully we are made.

"How the first Embrio fibre, Sphere, or Cube,
Lives in new forms; a Line, a Ring, a Tube;
Clos'd in the womb, with limbs unfinish'd laves
Sips with rude mouth, the salutary waves;
Seeks round its cell, the sanguine streams that pass,
And drinks with crimson gills the *vital* Gas;
Weaves with soft threads, the blue meand'ring vein
The heart's red concave, and the silver brain;
Leads the long nerve, expands the impatient sense,
And clothes in silken skin the *nascent ens.*"

Dr. Darwin.

In organization nature continually acts from within to without, from the center to the circumference. The same vital powers that made the heart beat give the finger motion; that which roofs the skull arches the finger nail. Art is at variance with itself, not so nature. Her creation is progressive.—Each part of an organized body is an image of the whole, has the character of the whole. From the size of the smallest part, the dimensions of the whole may be found; every thing is congenial—form, stature, complexion, hair, skin, veins, nerves, bones, voice, walk, manner, style, passion, love, hatred. One and the same spirit is manifest in all.*

* Lavater, by Holcroft, vol. 2, p. 92.

Before the substance after conception has attained any regular form the immature child is termed an *Embrio;* and in the space from thence, which is about six weeks, until parturition, it is denominated a *fœtus*.

> "To how minute an origin we owe
> Young Cæsar, Ammon, and the great Nausau."
>
> PRIOR.

About the fifth month of conception, when the bodily conformation is perfected, and a complete circulation of the humours introduced, the action of quickening takes place in the mother; an instantaneous act of the vital principle, performed the very instant that the fœtus has acquired a competent degree of animal heat, and is completely formed; then does this principle rush like the shock of electricity, conducted by the sanguiferous and nervous fluids, from the heart and brain of the mother, to the heart and brain of the child. At this important moment the entire circulation begins; the infant fabric is then a complete *automaton*, and the child yet unborn becomes a living soul. As soon therefore as the act of circulation commences, the child starts into life, and it is hardly necessary to add, the instant the circulation ceases, life ceases. This internal act of quickening, apparently derived from an impulse of of the blood, is so sensibly felt by the mother, that she often faints, when it takes place.*

The size of a new born infant is about twenty-two inches; the little bubble or *ovum*, is now transformed into a child weighing about 12lbs. The head is large in proportion to the body, and continues so through the whole period of infancy: its surface or skin is extremely red, because it is so fine and transparent, as to allow the color of the blood to shine through it—the body and other parts at the time of parturition appear swoln; as the infant grows, this puffiness gradually diminishes; and any subsequent appearance of fatness, produced by immoderate or improper feeding is generally brought down by teething, and those accidental attacks to which childhood is invariably subject. The mother's milk is the only proper aliment for the child, and sucking is itself very conducive to her health. It seems appointed by the order of providence, and it is the law to which all the viviparous part of the creation is subject except mankind, who often treat their young as

* Dr. Soemerring has published on two large plates, twenty figures, exhibiting the appearance of the human embrio, from the earliest period in which it assumes a distinct form to the seventh month. 1799. Imported by Escher.

the crocodile does its eggs, to drop them, and leave chance to hatch them.

In this state, man forms a striking picture of imbecility, inertness, and incapability, hence he needs assistance of every kind; is not unseldom an image of pain and misery, and is to all intents and purposes, more helpless and dependent than the young of any other animal.

Passing from the tranquil fluid the warmth of which, as with a mantle, envelopes us in the womb, we now become exposed to external impressions of every kind; in particular, we instantly feel the effects of that active circumambient element the air, which acting on the olfactory nerves, and on the organs of respiration, produce a concussion not unlike that of sneezing, by which the breast is expanded, and the air rushes at once into the lungs; the infant now respires and cries, which latter action, it seems rational to suppose, has a beneficial influence on its health and life. The greater part of other animals are blind for some days; this is not the case with infants, who open their eyes the moment they are born; but yet the sight is dull, and fixed, and the eyes commonly blue. They cannot distinguish objects, because they are un-

able

able to fix their eyes steadily on them; the organ of vision is yet imperfect: the *cornea* is wrinkled, which occasions an irregular refraction of the light, and the *retina* is perhaps too delicate to receive the impressions of external objects and communicate them accurately.*

In about forty days infants begin to hear and smile, and look at bright objects, as the window by day, or candle by night. Now likewise they begin properly to weep, for their smiles and groans before, were not attended with tears.

Smiles and tears are the effects of two internal sensations which depend on something that passes in the mind. They are peculiar to man; they express mental pain or pleasure, while the brute can only express, and that by other means, bodily pain and pleasure. In adolescence, or when boys and girls are growing, their stature increases gracefully, more in height than in breadth or bulk. The limbs are slim, the muscles are disentangled, and the whole ex-

* M. Petit accounts for this imperfection of sight in infants, to their eyes being compressed by the fluid in which they are immersed previous to birth. In dogs, cats, &c. it is the same, the cornea is thick and flacid and the aqueous humour not sufficiently copious. Priestley on Vision.

ternal frame, by degrees developes the fair mould wherein it was cast without a blemish. When the full natural size is attained, a comely complexion acquires fresh beauty, gracefulness and polish, from a cheerful temper, good living, and an even flow of spirits. Having reached the *acme* of sublunary enjoyments, and surrounded with all the pleasing endearments of life (for as Archdeacon Paley observes—"it is a good world after all") man then displays the perfection of his nature, a vigorous and majestic form pre-eminent in the creation, and a mind capable of appreciating the importance of his own character.

"The *seven* first years of life, man's break of day,
Gleams of short sense, a dawn of thought display:
When *fourteen* springs have bloom'd his downy cheek
His soft and bashful meanings learn to speak:
From *twenty-one* proud manhood takes its date
Yet is not strength complete, till *twenty-eight*,
Thence to his *five-and-thirtieth*; life's gay fire,
Sparkles and burns bright in fierce desire:
At *forty-two* his eyes grave wisdom wear,
And the dark future dims him o'er with care:
With *forty-nine* behold his toils increase
And busy hopes and fears, disturb his peace;
At *fifty-six*, cool reason reigns entire
Then life burns steady and with temp'rate fire,
But *sixty-three*, unbends the body's strength
Ere th' unwearied mind has run her length;

And when from *seventy*, age surveys her last
Tir'd she stops short, and wishes all were past."

Thus we see the life of man in its different stages; it begins from the cradle; pleasing childhood succeeds; then active hot-blooded youth—afterwards manhood, firm, severe, deliberative, and intent upon self-preservation; lastly debilitating old age, steals on with silent steps and render us a fœtus of eternity!

Human life, by temperance, is certainly capable of a longer duration than is observable at present; *Conaro* and others, are strong proofs of this; by attention we have wrought a variety of changes on the *frame of animals*, and it is of considerable importance to consider, whether man could not be formed with such a constitution, as to exist vigorously for *twenty or thirty years longer* than at present; an object of the greater magnitude, as it is conjectured, the modern habits of society, tend to diminish the *stature and duration* of each successive generation.

Until the access of maturity, nature has no supplies but what tend to the preservation and increase of its own work; makes no provision but what tends to the life and growth of the infant, has no powers, but what relate to its own existence; but when arrived at maturity, its views are enlarged, and a power given of communicating existence to other beings.* The faculties of life are multiplied, and reason unfolded at the same time.

Besides those materials, which compose the human fabric, divided into solids and fluids, may be added a sentient and vital power, which accompany these.

The vital principle of life, in animated bodies, possesses greater degrees of force and perfection in proportion as their organization is complete.

How great is the difference between the fire and vivacity of the fœtus, and an animal, arrived at maturity!

Whatever may constitute the living principle in animals, it is clearly manifest, that the pro-

* If the construction of the body without this, proves intention and art to have been employed about it, how much stronger is that proof, with the knowledge of this further property the crown and perfection of all the rest. Paley's Nat. Theol.

duction

duction of life, is, the most noble effort of omnipotence, and the centre in which all its other operations terminate.

We shall now take a general view of the various contrivance, and harmony worthy notice in the human frame, as preparatory to that separate discussion of its leading properties, which the ensuing chapters will present.

THE BONES.

THE use of the bones is to give shape and firmness to the body, to be levers for the muscles to act upon, and to defend those parts that are of the greatest consequence to be preserved, as the brain, heart, &c.

Bones are cast into a variety of moulds, and sizes, strong to bear up the body, yet light not to depress by their weight: bored, to contain the moistening marrow; and perforated with exceeding fine ducts; to admit the nourishing vessels, insensible themselves, they are covered with the periosteum, a membrane that warns of approaching injury, and preserves the muscles from being fretted by their action. Their figures are most precisely fitted to their uses; they fitted to their uses; they are generally larger at the extremities than in the middle, that they may be joined more firmly, and not so easily dislocated; and the manner of their articulation is particularly curious.*

The feet compose the firmest, and neatest pedestal, far beyond all that statuary or architecture can accomplish; capable of altering its form, or extending its size, as circumstances require. They contain a set of the nicest springs, which help to place the body in a variety of graceful attitudes, and qualify it for a multiplicity of advantageous motions. The heel has under it, a tendinous substance, so tough as not to wear, and at the same time, to prevent the weight of the body from pressing too much on the finer vessels.

The legs, and thighs are substantial columns, articulated in such a manner as to administer most commodiously to the act of walking: they swell out at the top, and are taper towards the bottom, which lessens their bulk at the same time that it encreases their beauty.

---

* The Rev. Mr. Hervey's description with alterations and additions; is adopted in this part.

The

The ribs form a regular arch, gently moveable, for the act of respiration, they form a secure lodgement for the lungs, heart, &c.

The back bone is intended not only to strengthen the body, but also to bring down the spinal marrow from the brain. It guards in a well closed case, this vital silver. This fluid, is thus communicated to each part of the body; had it been large, strait and hollow, it might have done this, but then the loins would have been inflexible, and we should have been as it were impaled alive: to prevent this it consists of short bones knit together by intervening cartilages. This prevents dislocation, and gives this main pillar of our frame the pliancy of an osier, while it possesses the firmness of an oak. It is a kind of continued joint, capable of various inflexions, without injuring the medullary contents, and without intercepting the nervous fluid, which is to be detached from this grand reservoir; or diminishing the strength necessary to support the whole. A structure so singular in any other of the solids, would have been attended with great inconveniences, but is here a master-piece of creating skill, The arms pendent on each side are the guards that defend the whole body, and are fitted for the most diversified operations; firm with bone, yet not weighty with flesh, capable of performing with expedition and ease all useful motions; they move inwards, outward, upward, and recline downward; they wheel round, and can be placed in every situation we please. To these are annexed the hands, and both are terminated by the fingers, which are not like the arms, of equal length and bigness, but in both respects different; which adds to their graceful appearance and utility. Were they all flesh they would be impotent; were they all one bone they would not be moveable; but consisting as they do of various small bones and muscles, they answer every possible use, and being placed at the end of the arm their sphere of action is considerably enlarged—the extremities of the fingers, are an assemblage of fine tendinous fibres most acutely sensible; and notwithstanding this delicacy are in constant employ; but to protect them they are overlaid with nails, a horny expansion which hinders the flesh from being ungracefully flattened, and like a sheath preserves the tender parts from injury.

Above all is the head; a majestic dome, designed for the residence of the brain; it is framed in exact conformity to this important purpose; ample to receive it—strong to uphold it—and firm to defend it—It is screened from heat and defended from cold, by a copious growth of hair; which also adds to its beauty, which nature is always attentive to, in subordination to usefulnesss.

The bones are tied together, those that have motion by *ligaments;* a tough and strong arrangement of fibres, which also bind down some of the tendons, and give origin to the muscles; and render what would otherwise be an unweildy jumble, a well compacted and manageable system. The fleshy parts are often separated or connected, by membranes, which are compages of fibres expanded, to cover or line other parts; such as the *Mesentery* and *Mediastinum* are membranes; the first connects the intestines; the last divides the thorax.

The ancients called the human body, the microcosm or little world: and the arteries may be called its rivers; the blood is conveyed by the arteries to the head and every part of the system. When the left ventricle of the heart contracts the blood is forced into the arteries, which then swell, and form what is termed the pulse;

the

the heart and arteries dilate eighty times in a minute, which act occasions the beating we feel—The arteries carry their stream of vital fluid from the heart; the veins run all in a stream towards it; and because a wound or any impediment to the circulation in arteries would be fatal, they are placed deep in the flesh, and can seldom be seen; so that the bending of the limbs does not stop their course.

In bleeding, the bandage is tied above the elbow, to prevent the blood passing towards the heart; and the median vein is cut; whereas, if it were an artery, the band must be tied below the wound, for the tide would be going downwards, or from the heart—The humeral artery lies under this vein, which it is dangerous to wound. Where the arteries *end*, the veins *begin:* small at first, but gradually enlarging; they are void of pulsation, and as the force of the blood is not so strong in them, so their substance is thinner. When the blood is forced upwards, valves are provided to prevent its return; and these open only one way like the valves in pumps.

The glands have the office of straining from the blood various fluids, as the bile, saliva, urine, &c.

The muscles ase those fleshy parts which perform the motions of the body; and these are acted upon by nerves, which are surprizingly minute vessels, which pervade every part, and are the immediate objects of sensation. The white part of a muscle, is called a tendon, which is composed of fibres, more compact and in less space.

The body is covered with a skin of the most delicate net-work, through the pores of which is discharged an insensible fluid continually; the pores of the skin are so minute that a grain of sand would cover 125,000 of these little funnels, which are incessantly employed in carrying off a superfluous vapour from the blood. The discharge from the skin is upwards of three pounds daily of excrementitious fluid, and in quantity the evacuation by its pores exceeds that of the urine.

Nature does not forget beauty in her operations, and what can beautify our form more than the veins lying parallel to the skin, in those parts most

most conspicuous to public view—The pliant wrist, the taper arm, they variegate with an inlay of living sapphire. They spread vermillion over the lips, and plant roses in the cheeks—While the eye tinged with glossy jet, or sparkling with cellular blue, rolls in polished chrystal.

All these parts are in incessant action, which exhausts the fluids, and wastes the solids—to obviate this, the frame is endued with the powers of nutrition. The teeth prepare our food, for this purpose; those in front sharp and thin to receive and cut the food; those behind broad and strong, indented like the surface of a millstone, with small cavities, the better to fit them for grinding it; as milk is our food for some time after we are born, and as teeth would hurt the tender nipple, nature has wisely postponed the appearance of teeth, until they become necessary. All our other bones are covered with a very fine skin, but this covering is omitted on the teeth, as chewing would then have been attended with exquisite pain. Had they been uncovered they would have been subject to injuries from the air, and to the penetration of liquors that would destroy them, to guard against which they are curiously covered with a fine white enamel harder than the bone itself.

Growing as they do, in rows; numerous, and none rising higher than the other, they form a regular and beautiful addition to the mouth. To their aid, they also call in the tongue and lips, the latter keep the food in the mouth, while the tongue returns it to the renewed attrition of the grinders; the motion of the cheeks at the same time, with the stimulus of food in the mouth, press out from a variety of resevoirs a moistening liquor necessary to prepare the food for digestion, as well as to soften and facilitate its passage into the stomach—when the mouth is inactive, these fountains are mostly at rest, but when we eat or speak their assistance is always ready.

As the food passes the wind-pipe, before it enters the gullet, there is a valve provided, which shuts on the approach of any substance, but the moment it has passed, it opens again; we all know what uneasiness is created by the smallest morsel going the wrong way; which if not thus guarded would expose us to instant death, by admitting any substance on the lungs.

The muscles of the gullet, are contrived to pass our food quickly, but the stomach is constituted to retain its contents, which are lodged

in

in the centre of warmth, and concocted by the most kindly combination of heat and humidity. From whence after being reduced to the most nicely mixed pulp, they are dislodged by a gently acting force, and pass into the intestines; where meeting the bile and pancreatic juices, it is passed by the vermicular, or *peristaltic motion* of the intestines, through its various windings, and the nourishing parts of it all sucked up by the *lacteals*, and by them conveyed into the blood. These vessels are arránged in countless multitudes along the sides of the winding-passage—they are so framed as to admit the nutrimental parts, and reject the gross and useless parts. The bowels are about eighteen feet long, lined with a soft muscus, and having valves to prevent the aliment from returning back to the stomach; the subtance of the bowels though thin to a delicacy, is strong to a wonder; the skin of an ox-gut is said to bear the blows of a gold-beater's hammer for years.

The *Chyle* drawn off by all the secretory orifices, is carried along millions of the finest ducts, and lodged in several commodious glands from whence it is conveyed to a common receptacle, and mounts thro' a perpendicular tube. As this is the principal nourishment of the whole system its conveyance is guarded with peculiar caution. The tube not having sufficient force of its own is laid contiguous to the great artery: whose *strong pulsation drives on the creeping fluid*, enables it to overcome the steep ascent, and unload its precious treasure at the very door of the heart. Here it enters a large vein most conveniently opened for its reception in an oblique manner, by which the refluent blood assisted by a valve, expedites, instead of obstructing its passage. This milk, this manna of nature, must be very acceptable to the blood, which has now been supplying every gland in the system, and farther impoverished by supplying myriads of vessels with matter for insensible perspiration, yet tho' thus kindly recruited it is not refined. In its present state it is unqualified to perform the vital tour; therefore by a grand apparatus of muscular fibres, it is wafted into the lungs, and pours a thousand rills into either lobe in the spongy cells of their amazing laboratory, it imbibes the influences of the *external air*, giving out some useless part, and imbibing some more necessary, and thus its heterogeneous parts are thoroughly incorporated, here its *red colour* commences, from the change it undergoes fiom the action of the air; and its whole substance is rendered cool, smooth, and florid. Thus improved it is transmitted to the left ventri-

cle

cle of the heart, a strong, active, unceasing muscle, placed in the centre of the system.* Impelled by that beating engine, part shoot upwards, and sweeps with a bounding impetus into the head, where it impregnates the prolific fields of the brain, and forms those subtle spirituous dews, the animal spirits, which impart sense to every nerve, and communicate motion to every limb—Part flows downward, and rolls the reeking current through all the lower quarters; and disperses the nutrimental stores, even to the meanest member, and the minutest part. Thus this human river, with its incomparable rich fluid, laves the several regions of the body, transfusing vigour and propagating health through the whole. When this vital fluid has pervaded every part, and given each his proper juice, it is met by the ends of veins, and by them reconducted back to the salient cistern. There it commences the same round; and the same force, that darts the crimson wave from the heart, drives it also back again to it. Where opposite currents would

* This wonderful machine will go night and day for eighty years together, at the rate of 100,000 strokes every twenty-four hours, having, at every stroke, a great resistance to overcome; and continues this action for the length of time without disorder and without weariness.

be

in danger of clashing, as in the ascending and descending great trunks of the veins, a fibrous excrescence intervenes, which like a projecting pier, breaks the stroke of each, and diverts both streams into their proper receptacle. Thus modelled by the most judicious rules, and guarded by the wisest precautions, the living flood never discontinues its interchangeable tide, but night and day, whether we sleep or wake, still perseveres to sally *briskly* through the arteries, and to return *softly* through the veins. These are a few and but a very few instances, of that contrivance, regularity and beauty, which are observable in the human frame. Attentive enquirers discover deep footsteps of design, and more refined strokes of skill; discover them not only in the grand and most distinguished parts; but in every limb and every organ; in every fibre that is extended, in every new discovered system of vessels, and in every globule that flows!

Having thus developed an organized body, endued with a principle of motion, and furnished with the power of nutrition; the sensitive faculties are now to be displayed. The functions of the mind are the effect of stimuli, as well as those of the body; and the more the mind is excited to action, the more is the vitality exhausted. The mind has a very great influence upon the body; and impressions made upon the one, instantly affect the other; the principle that gives all our sensation, when much affected by the operations of the mind, becomes weakened, if the intellectual faculties are acted upon by reflection, or impressions of any kind to excess. It is not surprising therefore that debility of the system is induced, from too much thought and intense study.

The creation abounds with objects fitted to yield the most refined entertainment—The *sun* impurples the robe of morning; and *stars* bespangle the curtains of night. *Flowers* of silver whiteness, and golden lustre, enamel the the ground. *Fruits* of every radiant hue, and every delicious taste, hang dangling on the boughs, but all in vain to us, if kind providence had not endued us with the powers of sense; without which the breath of fields, must lose its reviving fragrance; the whispering grove must degenerate into sullen silence, and nature's book of knowledge, all fair and instructive, would be no better than a vast unmeaning blank; but providence profusely gracious, has presented us with *senses*, the inlets of various delights, innumerable

innumerable pleasures, and the most valuable advantages.

What though we trace each herb and flower
That drinks the morning dew;
Did we not own *Jehovah's* power
How vain! were all we knew!

HANDEL.

In an elevated situation, like a sentinel, on a watch-tower, high in the head is placed the *eye*, bright and conspicuous as a star in the brow of evening, commanding the most enlarged prospects. Consisting only of simple fluids, inclosed in their turnicles, it conveys to our apprehension, all the graces of blooming nature, and all the glories of the visible heavens. An image of the hugest mountain, and a transcript of the most diversified landscapes, enters the small circuit of the pupil. Its tender nature is guarded with most solicitous care—it is intrenched deep in the head; and barricadoed on every side; with a strong fortification of bones. To guard its polished surface from the smallest fly, it is defended by two substantial curtains hung on a most slender cartilaginous rod: these are closed in sleep, and on the approach of any danger, fly together quicker than thought. They are lined with fine moist sponges, which lubricate the eye-balls, and keep them fit for unwearied activity. The eye-lashes keep off the smallest mote, and moderate the too potent rays of the sun. The brows also break the force of the light; and prevent the perspiration from offending them. The arches are so finely coloured, and so elegantly turned, that they set off the whiteness of the forehead, and bestow additional grace on the whole countenance.

The ear:* consists of the porch, or semicircular lodge, which stands prominent from the head; and is not soft and sinking as flesh, lest it should absorb the sound, rather than promote the repercussion; not hard and stubborn as bone, lest it should be painful when we repose, but is cartilaginous, with a tight expansion of skin, and wrought into irregular bends and hollows, which collect the sound, and transmit it to the finely stretched membrane the *tympanum*, so called because it resembles a drum in figure and use; being a fine skin expanded upon a circle of bones, and over a polished reverberating ca-

* Peter Rainier B. A. of Oriel College, is about to publish the anatomy of the ear, and the physiology of hearing, with plates; from Proff. Scarpa's Dis: Anat.

vity.

vity. It is affected by the vibrations of the external air; as the covering of the drum is by the sticks. It is also furnished with braces, which strain or relax it at pleasure, and accommodate its tension either to loud or languid sounds.

The avenue of the ear is secured by a viscous and bitter matter from the approach of insects. The winding labyrinths and the sounding galleries, &c. are all instrumental to the power of hearing, and are beyond description curious. The auditory tube softens and qualifies the rushing sound, lest if the incursion were direct, it might by its impetuosity, injure the delicate expanse of the tympanum; while, however, this is designed to moderate, the inner parts are prepared to heighten and invigorate the sounds, by means of an echo. Amazingly nice, and exact must be the tension of the auditory nerves, since they correspond with the smallest tremors of the atmosphere, and easily distinguish their most subtle variations. They give existence to the charms of music, and reciprocate the rational entertainments of discourse. The eye perceives only the objects before it, but the ear warns us of transactions on every side. The eye is useless amid the gloom of night, but the ear admits her intelligence through the darkest medium. The eye is always on duty in our waking hours, but the ear is always ready to communicate any pleasure or danger.

Smelling, conveys by an expansion of the olfactory nerves, an idea to us of the quality of the particlties wafted in the air.—The nostrils are wide at the bottom, that a large quantity of effluvia may enter, narrow at the top that they may there act in a more vigorous manner; fine beyond all imagination are the streams which exhale from fœtid or fragrant bodies. The microscope that can discover millions of animalculæ in a drop of putrefied water, cannot bring one among all those evanescent legions to our sight—Yet so judiciously are the olfactory nets spread, that they catch the roaming perfumes which emanate from the opening woodbine, and suck in the stationed sweets, which envelope the expanded rose. They imbibe all the balmy fragrance of spring, all the aromatic exhalations of autumn, and enable us to banquet on the invisible dainties of nature.

By *Taste*, the food that supports our body, feasts our palate, first treats us with a regale, then distributes its beneficial recruits. The sa-

liva

liva flowing upon the tongue, and moistening its nerves, quickens them into the liveliest acts of sensation.* Temperance sets the finest edge on its faculties, and adds the most poignant relish to its enjoyments. These senses are not only so many sources of delight, but a joint security for our health. They are vigilant and active inspectors.

To render the whole complete is added *Feeling*:† while other senses have a particular place of residence, *this* is diffused through the whole body, and is peculiarly fine at the extremities. Our feeling is finely tempered between the extremes; neither so acute as in the eye; nor so obtuse as in the heel: for the one would produce continual pain, and the other would quite benumb the body, and almost annihilate the touch. Indeed all our senses are most precisely fitted to

---

* Some animals owing to the particular structure of the papillæ of the tongue, have the sense of taste more acutely than the human species. When the papillæ are diseased, or hurt by the repeated action of violent stimuli and narcotics (as opium and tobacco) their sensibility is much diminished, and the taste impaired.

Dr. A Ferguson; Essay on Fevers Vol. I. 1801. 12mo.

† That there is a distinct set of nerves for the taste and feeling has been ingeniously suggested by a modern medical writer.

our exigencies; were any strained higher, they would be the avenues of anguish; were they relaxed into greater insensibility, they would be useless incumbrances.

The *Taste; Touch;* and *Smell;* are straitened in their operations, and perceive nothing but what is brought to their very doors. The *ear* indeed, has a larger circle of objects; but the sight most amply supplies, whatever is wanting in the others, spreading itself into an infinite number of bodies, and bringing to our notice some of the remotest parts of the universe.

The eye extends its observations as far as the orbit of the Georgium Sidus: nay glances at an instant of time to the inconceivable distance of the stars—

" O'er all surrounding things, that curious roves;
That loves the sky, uplifts its look sublime,
The stars peruses, and can clearly read,
In nature's various volume round it spread
In radiant letters writ; the Name Divine."

FAWCET.

But the crowning gift, which improves the satisfaction, and augments the beneficial effects accrueing from all the senses, is *speech;* this makes

makes us gainers from the eyes and ears of others, from the ideas they conceive and the observations they make. The tongue has neither bone nor joint; yet fashions itself with the utmost volubility, into every shape and posture, which can express sentiment, or constitute harmony.

By this little collection of muscular fibres, we communicate the secrets of the breast, and make our thoughts audible. By this we instruct the ignorant, comfort the distressed; we glorify God, which is its noblest employ, and we edify each other.

The following *Sonnet* on this subject, was obligingly presented by A FRIEND.

TO THE HUMAN VOICE.

A SONNET.

In cheerful *sound*, or plaintive *moan*
The Birds and Beasts on Nature's plan,
Their wants or their delights make known,
The voice of Reason, dwells with Man.

2

Organization sweet, that binds,
In harmony, congenial minds;
Can accents form, that friends approve
Or fondly breathe, in faithful love.

3

But ah! should erring pride confound
Or flattery sooth with artful tongue;
Or veil'd deceit with snares surround,
Or scandal whisper studied wrong—

The Human Voice prophaned the wise deplore,
And pray that reason, may her right restore.

A.

London 1802.

As the tongue requires a full scope and easy play, it is lodged in an ample cavity, and surrounded with reservoirs of spittle, always ready to distil the lubricating dews. It moves under a concave roof which serves as a sounding board to the voice, giving it much the same additional vigor and grace, as the shell of a violin adds to the strings. That the notes of the human voice* so far as they can reach, are the most agreeable of all musical sounds, will be abundantly evident to any person who shall try the experiment of sol-fa-ing some of *Corelli's* composi-

* The Rev. S. Darxy's Letters on Literature, &c. 8vo. 1787.—Lavater considers the human voice as an indication of Character, see Vol. I. p. 49. Vol. II. p. 54. 8vo. edition. Robinsons, 1789.

tions,

tions, designed for instruments only, which as they were the first attempts amongst the moderns, to give sentiment to mere sounds, so they will be found, perhaps, the most perfect of their kind.

However we admire, this multiplicity of animated organs, their finished form, and their faultless order; yet admiration must rise higher when we recollect the mysterious power and sway the soul has over them. Ten thousand reins are put into her hands; she is not acquainted with their offices, their use, or their name, yet she manages all without perplexity; the manner in which the will acts upon the system, or how, or by what means, so many functions are managed independent of the will, or that a variety of exertions should be made without inconvenience to us, we know not*—all we can do is to exercise our wonder and gratitude for

* "The principle of muscular motion, viz. that is upon what cause the swelling of the belly of the muscle, and consequent contraction of its tendons, either by an act of the will, or by involuntary irritation, depends, is wholly unknown to us. The substance employed, whether it be fluid, gazeous, elastic, electrical, or none of these, or nothing resembling these, is also unknown to us. We see nothing similar to this contraction in any machine which we can make, or any process which we can execute."

for so many circumstances, which all administer to our comfort.

A celebrated poet remarks, that the proper study of mankind, is man: and this study originates from the smallest beginnings; enlarges as the faculties of the mind unfold themselves; and comprehends in its progress all the powers and principles which actuate human nature, through the successive stages of existence. In infancy, the appetites and senses are developed, exercised, and strengthened; they give information of surrounding objects; excite attention, complacency, surprise, and admiration; and the notices they bring are treasured in the storehouse of the memory. By the frequent repetition of agreeable impressions, certain objects become pleasing and familiar to the young spectator. He distinguishes his parents, brothers, and sisters; is uneasy when they are absent, and delighted to see them again. These emotions soon constitute a moral attachment, which reciprocal endearments heighten; gratitude confirms; and habit renders indissoluble. The amusements of *childhood*, and the active pursuits of

---

execute." *Cuviers* Lectures Translated by Mr. Ross, 2 vols. 8vo. Longman, 1802. A work displaying an infinite variety of facts, relative to *Comparative* Anatomy.

youth,

youth, add, every day, some new link to the great chain of social love.* Connections are multiplied, common interests established, mutual dependencies created; and the principles of sympathy, friendship, generosity, and benevolence, acquire vigour by exertion, and energy by being uncontrouled. The powers of the understanding, and imagination now expand themselves; curiosity is awakened, and directed to other objects besides these of sense; emulation rouses; the thirst of knowledge stimulates; and the taste for beauty, in all her varied forms allures the mind to study and contemplation. The scenes of nature, at this period of life, are viewed with peculiar admiration and delight; and the signs of order, wisdom, and góodness, which are every where discerned, elevate the ideas to the great parent of the universe. Devotion glows in the heart; reverence fills the thoughts, and piety exalts the soul to an intercourse with God.

Cherish generous youth, the sacred flame, thus kindled in thy breast—it will be a light to thy feet, and a lamp to thy path; will illuminate thy faculties; sublime thy virtues; add

* Percival.

lustre to thy prosperity; and dispel, with cheering beams the gloom of sorrow and adversity.

In manhood, the pursuit of wealth, or of honor, the duties of marriage, and the diversified offices of each particular rank and station, call forth into exertion other passions, or vary the force and direction of those already experienced.

Old age at length, creeps slowly on*: the generous affections abate in their vigour and warmth, and anxiety, suspicion, fearfulness, and the love of money, by insensible degrees, too often take possession of the mind. Life increases in value, the nearer the conclusion of it approaches; and the means of enjoyment become most prized, when the end, for which they are designed, ceases to be attainable. Such are generally the weaknesses of declining nature; which though wisdom condemns, she forbids us not to pity.

---

* According to a calculation founded on the burial registers, only one man out of 3,125, lives to an hundred years of age.
Chronolog: Tablets. Vernor and Hood, 1801.

It is calculated that on the globe 500,000 human beings die every day!

Happy is he, who having studied the complicated history of man, knows the subordination, and holds the balance of his several moral and intellectual faculties: who can gratify and yet regulate his appetites: indulge but moderate his passions, and setting bounds to all, maintain inviolate the supremacy of reason.

To conclude—there is a variety and elegance in the texture of the human frame; in the formation and arrangement of the bones and muscles—the arteries and veins, far beyond any comparison, all acting together in such a mysterious way as to render us a wonder to ourselves.

How sublimely does Shakespeare express himself—

"What a piece of work is man! how noble in reason! how infinite in faculty! in form and moving how express and admirable! in action how like an angel! in apprehension how like a god!—the beauty of the world, the paragon of animals!

CHAP. III.

ON THE BONES, &c.

Say what the various bones so wisely wrought,
How was their frame to such perfection brought?
What did their figures for their uses fit,
Their number fix, and joints adapted knit;
And made them all in that just order stand,
Which motion, strength, and ornament demand?
What for the sinews spun so strong a thread,
The curious loom, to weave the muscles spread?

The Atheist, if to search for truth inclin'd,
May in himself his full conviction find,
And from his body, teach his erring mind.

THE pursuit of knowledge when properly directed, and under due influence, is of the greatest importance to mankind. It is to the honor of the present age, that it has extended the empire of science, and of the arts, so far beyond its ancient boundary. The spirit of literary enterprize has gone forth, and has already won large domains from the regions of darkness. The improvement of the mind, if not carried beyond a certain point will not interfere with mercantile accomplishments. It will afford a grateful recess from the trouble and attention of business, and hereafter give a man the habit, and the means of filling up whatever leisure he may command, in the most agreeable manner. It will give him respectability and consequence, even upon the exchange: and chear his retirement, if in the evening of life, he should wish to decline or diminish, the multiplicity of cases, which may then press upon him.

Science and the arts, are of no political or religious party. They tend in the happiest manner to destroy those little prejudices, which alienate one man from another. By opening the soul to wider aims, they improve our charity, our morals, our christianity, and by necessary consequence exalt our truest happiness.

However elevated, and curious, the study of any part of the visible creation may be; and though every branch of natural philosophy alike displays the benevolence and perfection of the Deity, yet of all the parts of Science, our present researches are justly entitled to a pre-eminence.

Consider the parts and structure of the body! Is not the body of man the noblest piece of animal mechanism possible in nature? does it not really transcend the power and thought of man to imagine any form or structure more perfect, more elegant, more grand and commodious? What do you judge of man's erect posture? his beauteous shape? his proper stature? the structure and accuracy of its parts? the fitness of every part to its office and end. What sparkling brightness in the eyes! what sweet melody in the voice! how quick the ears to receive all manner of sounds! how nicely adjusted are the palate and taste to all sorts of food! What a noble instrument is the tongue! hence speech and eloquence; oratory and persuasion, what wonders appear in *the hand* of man! its formation and astonishing variety of uses! what majesty in the *face*, how immensely different are the countenances of men! what endless differences in their voices and hand-writing! What a striking proof of God in the *soul* of man!

The powers of man's mind shew him to be almost a divine existence—he thinks—he is conscious of internal acts—he forms ideas of all things—he reasons on his thoughts—he perceives an infinite variety of objects—he reflects on these images of things in his mind—he recollects his thoughts, and surveys their agreement with objects and their difference from each other—he brings all past ages, and time present, to his mind,

and

and views the transactions of men and resolutions of empires for thousands of years—he can recollect a thousand, ten thousand, a million facts at once; he makes them pass in a quick succession before the eyes of his mind—he marks the different natures, and tendency of men's actions; sees how one kind have a direct influence upon his peace and happiness, while others issue in ruin, devastation and death. He commands the future time, to the present view of his vast and mighty mind, foretells the consequences of actions; penetrates the dark veil of future ages, and dives into the condition of men for ten thousand years to come. He pursues a mental tour round the earth; and ranges his thoughts all over the skies; he roves from planet to planet, from sun to sun, from world to world, almost to infinity! How great is the resemblance of the human soul to God! His existence and omnipresent agency is clearly seen in it. The invisibility of the soul, demonstrates the invisible God.

Animals also supply most amazing proofs of a God. Their structure is more complete than that of vegetables, their growth is an effect superior. Does not animal life depend on fresh food, as well as air and water? Is not animal growth the effect of a proper digestion, and a regular distribution of the nutritious particles to every part? How suitable are the provisions for every kind of animals *! How nicely and well adjusted their apparatus to receive and digest their food, see the mouth to receive! the teeth to chew, the glands to moisten, the tongue to assist in chewing! the gullet to transmit to the bowels! the stomach to digest! the intestines to strain off by means of the lacteals.—Mark the progress of the chyle into the blood; see the colour and texture of this grand stream of life! how delicate the system of the nerves for feeling! how divine the structure of the eyes! how accurately formed are the ears for sound! how exact the nostrils! and what a rich silver cord is the spinal marrow.

The bones the subject of this chapter, are the great outline of man, and the foundation of Phy-

* A generic difference between man and beast is particularly conspicuous in the structure of the bones. The skull of the ox expresses (says Lavater) patience, resistance, difficulty of being moved, a great desire of feeding—the elephant has an increase of skull, alike in the back part, and the forehead. How true, how natural, an expression of wisdom, power and delicacy. For plates of various skulls, with characteristic remarks, on animals. See Lavater, Vol. 2. 159. Heads of much bone and flesh have little brain, large bones with abundance of flesh and fat, are impediments to mind. (Huart.)

siognomy

siognomy *. Lavater observes, that the system of the Bones, were it properly studied would make such discoveries, that an able Physiognomist, might find out in great measure, a character that had bid defiance to all researches, merely by handling properly his jaw-bone—certain it is, that this single part, well studied in profile, has served as a clue for unfolding extraordinary faculties in some, whose other features were not sufficiently expressive, nor proportioned to their mental power.

The knowledge of *osteology* is of great import to the artist, particularly an intimate knowledge of the Bones constituting the head; and of their relative situations in the delineation of national characters, *in the changes made by advancing age*; and also in the production of ideal beauty, and in marking the peculiarities which characterise individuals. A principle of dissolution is given by the Deity with the living principle, and from the instant of a child's receiving life, the means of death is interwoven with it: the rise, progress and perfection of the human fabric is no

---

* No one man is perfectly like another, either in external construction (as in the features of the face) nor in the internal parts.

less

less gratifying, than its declension and annihilation is mortifying to human pride.

Putrefaction is the great process, appointed by the Creator, for the resolution of animal and vegetable substances, into the elements from which they were first formed. By this process, the oak, and the bramble, the cedar and the hysop, fruits whether delicious or nutritive or acrid or poisonous, the most beautiful of the human species, and the most frightful of the other tribes of animals, are all reduced to one common lot: they finally return back to their original and primeval elements! This resolution of bodies, when philosophically considered, is equally wonderful with their formation; and is alike governed by regular and invariable laws. In viewing a skeleton therefore we may exclaim. "*Look there, my dear friend, behold to what is reduced all the majesty of the high and mighty, the low and humble, consider that this is the end of loveliness, of virtue, and of human grandeur, determine now within thyself, which it is thou wouldest follow, whether the world, or the faith as exemplified in* JESUS *."

* A MS. Novel unpublished, 1802.

A ske-

A skeleton of five feet high, is about thirteen inches broad; the human skull is generally eight inches long, and one foot seven or eight inches round. Men under five feet high are of a low size: Buffon estimates the middle size five feet four inches, French measure, from that to five feet nine inches he considers as tall: women are generally shorter by two or three inches: and they attain their full growth so much the sooner. Haller makes five feet five inches, the standard, in temperate climates, when the constitution is not impaired by a two sedendary life, or a bad habit of body.* Without controverting the truth of stories of the immense size of human bones, and even of human skeletons, many persons have been known to measure from six feet and a half to seven feet and a half—a Swede in the service

* The bones and joints of corpulent people remain nearly in the same state, however preposterously the other parts may be encreased in size. But if providence made the bones and joints strong enough to bear with ease the weight of ten stone, they are seldom sufficient to bear well the addition of sixty-three pounds more, but sooner or later they will sink under their burden and become weak and painful.

See Dr. Wilkins on Asthma.

of

of William Frederick, king of Prussia measured eight feet and a half, and *Goliah* is supposed to have measured nine feet.

The intellectual powers do not advance after a certain degree, with the growth of the body: and a gigantic stature (common observation will tell us) does not indicate any superior strength, of mind, or prowess, unattainable by individuals of a smaller bulk; the poet, indeed yields the palm to the latter.

> " It is strange to assert, but 'tis truth tells the story
> That your *small* individuals are dearest to *glory*.
> It should seem that the souls of diminutive men
> Are too vast for their brittle corporeal den ;
> And impel their possessors o'er mountains to leap,
> While the *big-race* of mortals half petrified sleep :
> Hence Berlin's late lord, made the world kiss his rod
> And the victim of India, was hail'd as a god ;
> While chiefs full as valiant are kept from the fray
> As their minds are depress'd, by the weight of their clay."
>
> ANT. PASQUIN.

Unhappy feelings are said to spring from the consciousness of deformity. If the remark be just, these feelings should, (says Dr. Beddoes) be ascribed to slight or insult, rather than, as they commonly are, to envy. Whenever young persons, that have unwarily been suffered to deviate

viate into crookedness of growth, are kindly treated, they do not yield in temper any more than in talents, to those of more erect figure. Malignity is not, I hope, supposed to have any particular affinity with dwarfishness.* Yet superiority of stature must be felt as an enviable distinction.

The hard parts when taken together, are called the SKELETON; when covered by the muscles, they are called the bones; when external to the muscles they get the names of shell, crust, scales, &c. according to their different degrees of hardness. In all cases the hard parts surround and protect the proper viscera, and give form and proportion to the body. In regard to stature, living subjects are more to be depended upon than skeletons, for two reasons: first the bones may be

* The little people of Madagascar, seem to have had nothing dwarfish in the constitution of their minds. They are described as a warlike people and a match in genius, in conduct and enterprize, for the other natives of the island. No author has described that measure of animal strength, that symmetry of outward proportion, or that natural term of existence, which in the course of human life, is found most connected with the largest endowments, and accomplishments of the species. In every age and country, these combinations and assemblages are too dissimilar and various, to form the basis of any theory.

changed in preparing or in mounting them; and secondly the stature of the skeleton is entirely governed by the manner of putting together the bones of the spine.* The bones are the solid parts of all bodies. They are found to contain a considerable quantity of calcareous earth, and calx phosphorata, these abound in the human body, introduced by our food. In Lapland, fish-bones are powdered and eaten.†

Bones are made of hard fibres, tied by transverse fibres. The fabric of the bones, professor Scarpa asserts to be entirely articulated; even in their hardest and most compact parts, they are covered with a thin strong membrane, called the Periosteum: each bone is bigger at the ends than in the middle, that the articulations might be firm and not easily put out of joint; in the middle of the bone, the fibres are more closely knit together to sustain its allotted weight, and the

* White on the Gradation of Man. 4to.

† Count Rumford in England, has shewn us the way to convert animal bones into nutritive diet, by the use of digesters; the power of which was long since known to Papin, who invented them, but they were not brought so familiarly before he public eye, as at present.

bone is made hollow; therefore, not so easily broken, as if it had been solid and smaller. The sensibility of the *periosteum* prove it to be provided with nerves: vessels pass through it to the marrow, and muscles pierce it, to be inserted into the bone; the muscles by its means slide easily on the bones. The periosteum affords convenient insertion for many muscles; and warns us of injury offered to the part, which otherwise from its insensible state might be totally destroyed, without our knowledge.

Bones are all, more or less, cavernous internally. The spungy internal part is called *cancelli*, or lattice-work, and sustain the membraneous bags of marrow. The bones are provided abundantly with arteries: they are so insensible, that in a living animal bones may be cut, rasped, or burnt, without pain: their vessels have a constant circulation of fluids, and are subject to a considerable exhaustion and supply. Very young subjects are the best for showing the *vascularity* of bones by injection. But the vessels of bones are not more numerous at their formation than at their full growth; for the natural bony stucture of the body is always liable to be absorbed, and therefore must be profusely supplied with secreting vessels, so as still to be within the action of the system. Were not this the case, their absorption would be marked by their total decay, instead of the bone being perpetually renovated.

But the waste exceeds the supply in old age, when they grow lighter, and are more brittle. Their vascular texture makes them subject to a variety of diseases. Exposed to a strong fire they yield phlegm, spirit, volatile salt, fœtid oil, and black caput mortuum. This earth, seems to be the proper constituent part of bones, the other principles give it firmness and tenacity. The increase of the proportion of earth in old people's bones is the reason of their being more brittle, than those of young people. Bones sustain and defend the other parts of the body; they are lined also within, with a very fine membrane, called the internal periosteum. The marrow is the only part of the blood, separated by small arteries; it yields as well as the other fat of the body, oil and water, a considerable portion of an acid liquor, but no alkali. This may be the reason of its being less putrescent than the blood, which is a necessary quality in a substance that is constantly exposed to a considerable degree of heat, and is more in a stagnating condition than the other liquors. There is besides the arteries mentioned, at least one for

each

each bone, they divide into branches. The blood returns by veins through the same holes.

Minute anatomy, that pleasing part of the science, unfolds and explains the internal structure of the bones, shows their myriads of vessels; and proves them to be as full of blood, as the most succulent and fleshy parts; having like them, their periods of growth and decay; being as liable to accidents, and as subject to internal disease. The diseases of the bones are frequent, and it is impossible to express how much a surgeon is concerned in obtaining true ideas of the structure, constitution, and diseases of bones; how tedious, how painful, and how loathsome these diseases are; how often the patient must lose his limb, or endanger his life; art is useful, but nature daily performs wonders in recovering the bones from their diseased state.

The marrow appears bloody in children; oily and balmy, in middle age; and thin and watery in old people.

The use of the marrow is to soften and connect the fibres, and thereby preserve them from becoming brittle; as in burnt bones, or those long exposed to the air; in old age, scurvy, &c.

In which cases, the oil is either in too little quantity, or has its natural good qualities exchanged for worse. Besides this, their articulations receive no less benefit from it; from hence butchers on seeing the quantity of marrow in the bones of cows, can from thence determine whether they have travelled much or little, before they were slaughtered.

The bones very obviously differ, as to magnitude, situation, substance, connection, uses, &c.

Some are broad and flat, others long and round. The *broad* bones have their sides, by which they afford a large surface for the muscles to rise from, and move upon, and defend sufficiently the parts which they inclose. The *round* bones have thick strong walls in the middle, and become very thin towards the ends. Their hollowness increases their diameter, and consequently their strength to resist forces applied to break them. Since then, the strength of the bones depend on the number of fibres, or quantity of matter, and the largeness of their diameters, one may conclude that the part of a bone formerly fractured, and re-united by a *Callus* must be stronger than it was before; because both these advantages are thereby obtained. Bones have protuberances

protuberances or processes, which are called by *different* names, and serve for the advantageous origin and insertion of muscles, and render the articulations firm and stable; most of these in children are *epiphyses*, or distinct bones; which are afterwards united; as the styloid processes of the temporal bones, processes of the vertebræ, trochanters of the thigh, &c. But in the adult no vestige remains of their former dis-union. The surfaces of the bones are distinguished into *cavities*, *pits*, *furrows*, *nitches*, *sinuosities*, *fossæ*, *sinuses*, *forminæ* or *holes*, &c. to describe the particulars of each, would be uninteresting here.

The softness of the ends of bones, may be of some advantage before, and at birth, after which, the ossification begins at different points to form epiphyses, before the ossification can extend from the middle to the end of the bones.

However solid and compact the bones are, yet they were once cartilages, membranes, nay mere jelly. This is proved by *embrios* on dissection. The muscular substances of the heart, has sometimes been found ossified, and the arteries of old men become, often bony. The cartilages of the larynx are generally ossified in adults.

In beasts of burthen, the cartilages between the vertebræ of the back, very often change into complete bones, and being intimately united with the vertebræ, the whole appears one continued bone; nor is the periosteum exempt from such an induration.

The prints of the muscles, &c. are stronger on the bones of persons of active labor, than of indolent people, owing to the pressure on them. A variety of observations might be introduced on the copious subject of this chapter, which would be incompatible with our plan, or the limits of a single chapter, or indeed a volume.

It is impossible for a naturalist, or an anatomist, to be an atheist, for they have constantly before their eyes, so many living machines, differently wrought, yet so completely fashioned, and all tending to one great point, the preservation of themselves and their species; in which, there are so many orders of vessels, one depending upon another, yet complete in themselves; capable of repairing injuries they may sustain, and even of restoring lost substances; that men who daily see such

such objects, must be convinced that these admirable fabrics cannot have proceeded from chance; but must have been the work of an omnipotent Creator, who has formed them with the most perfect wisdom, and the highest attention to their several interests and happiness.

Who can refrain from reverential awe, on examining the magnificent structure of the human body? We see enough to surprise us—the great visible effects, proclaim the majesty of the invisible cause.

" My reins, my fabrics, every part,
The wonders of God's plastic art,
Proclaim and prompt my willing tongue
To meditate the grateful song:
While yet a stranger to the day,
Within the burthen'd womb I lay,
My bones familiar to thy view,
By just degrees to firmness grew:
Day to succeeding day consign'd
The unfinish'd birth—thy mighty mind
Each limb, each nerve, 'ere yet they were
Contemplated distinct and clear;
Those nerves, thy curious finger spun,
Those limbs it fashion'd one by one;
And as thy pen in fair design
Trac'd on thy book each shadowy line
Thy handmaid, Nature, read them there,
And made the growing work her care,
Conform'd it to the unerring plan
And gradual wrought me into man."

When we contemplate the human bones, as exhibited in the skeleton, the contrast it presents to our social feelings, must depress and mortify worldly vanity. It is this poor, forked remnant of ourselves; this unsubstantial image; this melancholy ghost of dead renown; that gives the hiss at human pride, and becomes our monitor, as well as an object of philosophical utility, and curiosity.

The number of bones are, 67 in the head; in the trunk 56; 64 in the superior extremities, and 60 in the inferior, (each hand consists of 27 bones) in the whole body 247 bones. The 7 vertebræ of the neck, 12 of the back, and 5 of the loins make 24, which is the regular proportion of the spine. But the number sometimes varies according to the proportions of the body; for where the loins are long, there are 6 vertebræ of the loins, and but 11 in the back, or the number of pieces in the back is sometimes increased to 13; or the neck, as it is long or short, has 8 pieces, or sometimes only six.

There are three views under which the bones forming the spine ought to be regarded, and in all which cannot fail to excite our admiration. These views relate to their articulations, their ligaments,

ligaments, and perforation; and to the corresponding advantages which the body derives from them for action, for strength, and for that, which is essential to every part, a secure communication with the brain.

Dr. Trew at Nuremberg, had a curious collection of skeletons of men, animals, and plants; with this inscription, "Mortal, if ignorant of the structure of thy own body, and that of the animals, &c. created for thy sake, if thy sight be good, and thy mind inclined to knowledge, stop here awhile. Hither, for thine, and his own benefit, an abstracted mind and curious hand have collected the skeletons of men, animals, and vegetables, with the various kinds and forms of minerals. Every particle of these is a kind of natural hieroglyphic, which delineates the infinite goodness, bounty, and glory of the Creator, much more distinctly than those invented by the Egyptians; and at the same time teaches thee to celebrate the unsearchable power of the Deity, to admire the inimitable, and wonderful formation of all things, to confute the absurdity and obstinacy of the wicked atheist, to observe the sudden change of vain beauty into loathsomness, and from thence, and the frailty of human life, *to learn true wisdom.*"

Mr. Hunter's museum is now one of the grandest in the world; wherein an attempt is made to expose to view the gradations of nature from the most simple state in which life is found to exist, up to the most perfect, and most complex of the animal creation, man himself.

By the powers of his art, this collector has been enabled to expose, and preserve in spirits, or in a dried state, the different parts of animal bodies intended for similar uses, that the various links of the chain of perfection are readily followed and clearly understood *.

The names of the bones are ingeniously thrown into latin verse; thus—

Occipitis, frontis, parietaliæ, temporum, malæ,
Ethmoides, ungues, spenoides, palati, nasi,
Maleolus, incus, stapesque, orbiculare,
Dentes, molares, ominos, incisoresque,

* This museum has been purchased by government, and presented to the College of Surgeons, who are engaged to furnish a proper place for its reception, as well as to give annually a course of lectures thereon for the benefit of students. Since Dr. Trew's time, many grand cabinets, with anatomical and natural curiosities have been formed, both in public and private; among the most distinguished of the latter in London, is the Museum of Mr. Heaviside, which is most liberally open to the inspection of his friends, or strangers, properly introduced.

Hyoides, vomer, maxillaria, manidibulumque
Vertebræ, sacrum, coccygisq : costæ, sternumq :
Scapula, claviculæ, humeriq : radius, ulna,
Carpi, metacarpi, digitorum. sesamoides,
Innominatum, femoris, fibula, tibiaq : patella
Tarsi, metatarsi, digitorum, sesamoides *,

Professor Scarpa, whose great merit and discoveries are generally acknowledged, has lately published at Leipsic, a 4to. vol. on the structure of the bones, with plates. The prevailing opinion that bones consisted of fibres, plates, or laminæ, lying in different strata one upon another, appears good only of the bones of children, which though *improperly*, may be said to be formed of fibres and plates; for on examining them by a microscope, they are observed to be recticular, and ramifying amongst themselves; it may therefore generally be asserted, that all bones are of a reticular and cellulous texture.

No one bone is perpendicular to another, so that a person cannot stand upright without some exertion of the muscles; the use of this position is, that the viscera do not pass directly on those immediately under them; and that by this wise disposition also, our motions are rendered more

* Gents Magazine,

quick

quick and various than otherwise they could have been.

Bones are classed into, 1st, broad and flat, as in the scapula, 2d. cylindrical, as the humerus, 3rd, anomalous, as in the wrist and instep.

The shape of the *cranium* is formed partly by custom, by the disposition of nature to shoot out osseous fibres in that direction, and partly from its contents. Different nations have different shaped skulls, this has been supposed owing to binding the heads of children, and lying them in particular postures *. The Turks, who bind their children's heads very tight with turbans, have globular heads. The Germans lying their children to sleep upon their backs have the occiput flattened; whereas the Dutch and English lying their children alternately on their sides have oblonged shaped heads. Yet certainly there are distinctions of form in some bones, which are *national*, and independent of any local custom.

* Parents, tutors &c. should be very cautious of striking children on the head, as the consequence may be a fatal stupidity for life. Boys at school also, should not be permitted to use exertions beyond their strength, before the bones are properly or solidly formed; at play, using each other for horses, is particularly injurious.

Thus the width of the nasal aperture in negroes, produces broad nostrils, and the extention of the jugalia occasions that flatness of the face observable in them. In Tartars the bone of the nose is so flat, that it scarce projects beyond the others. The number of bones increase the strength of the cranium. From different *central points* of ossification, nature shoots out the *fibres in the form of rays.* Therefore the farther from the centre the weaker must be the bone; nature has by giving a spherical shape, also given in consequence, greater strength by it. When the ossific matter does not push itself out enough, to meet each other; small ossifications forming distinct bones fill up the incomplete part, these are called *ossa triquetra*, and are oftenest found in the lambdoidal suture in the skull.

Lavater remarks, (after speaking of other nations) that Englishmen have the shortest, and best arched foreheads; that is to say, they are arched only upward; and toward the eyebrows, either gently decline, or are rectilinear, they very seldom have pointed, but often round, full, medullary noses. English women (says he) whom I have known personally, or by portrait, appear to be composed of marrow and nerve. They are inclined to be tall, slender, soft, and as distant

from

from all that is harsh, rigorous, or stubborn, as heaven is from earth. An Englishman (observes a foreigner) is distinguished from all other men by the roundness and smoothness of the muscles of his face.

An extensive cranium and a small face, indicate a large brain, with little developement of the organs of taste and smell; a small cranium and a large face, point out the opposite proportions, a brain of a small volume, with very perfect organs of taste and smelling.

All the bones without exception are more or less hollow; and the cartilages adhere to them as lime to a wall; the spongy bones of the nose, are conjectured to be of use in smelling.

The teeth are the only bones visible in the body, the first 20 teeth, consisting of 8 incisores, 4 canine, and 8 grinders, are all shed between the age of 7 and 14 years, these are replaced by the like quantity, and 3 grinders added to each side in both jaws; a complete case of teeth therefore consists of 32.

The skeleton of a monkey tends to shew the affinity of this race to man: the ourang-outang, however

however has thirteen ribs on each side. The 11th and 12th or the floating ribs are exceeding small and delicate, in the human subject, and their cartilage terminates in an acute point unconnected with the sternum. In a horse the jaws bear no proportion in length to the human, and the back bone of a dog, and most animals, is stiff and immoveable, but in ours, we have an easy and convenient motion.

In the skeleton of a bear, it is curious to remark the great strength of the jaws, the neck, and forefeet, and the shortness of the uppermost ribs which renders the animal so strong, as to grasp any object with the utmost force, and is therefore its principal means of defence.

In the skeleton of a hedge-hog we see what a remarkable property the animal has of folding his body round. In a rabbit, perceive the bones to be so constructed, as to bring the hind-feet under the centre of gravity of the whole body, while the animal digs its hole; and for this reason the forefeet are bent from the earth to pass easily underneath them, and their jaws are particularly constructed for their feeding on the bark of trees, as well as on grass. In the mole, the vast strength of the forefeet, is obviously for dig-

ging;

ging; the slenderness of the head; the back bones with small processes, and the posture of the hind legs, all contrived for their passing easily along the holes they dig. In an ostrich, the bones of the legs are made exceeding strong, for running or walking, and when standing strait, unlike other birds, almost under the centre of gravity.

The bones in the head of a pike are loosely connected, and the lower jaw composed with an additional bone on each side, like the jaw of a viper, whereby they are capable of a vast extension, when they swallow their prey, which they do whole, and often things of a greater diameter than themselves.

From a large collection of bones of that prodigious unknown animal, called *Mammoth*, lately obtained in America, new light is thrown upon its osteology and form *. It is remark-

* There is at present (1802) a complete skeleton of an animal of this kind, exhibiting in London; which was recently dug up at New York; the dimensions of which are truly astonishing: several of the bones, particularly of the legs, resemble the human; its height is 11 feet;—from the point of the tusks to the end of the tail following the curve 31 feet: length of the tusks 10 feet; circumference of one tooth or grinder 18 inches, and the weight of the same 4 pounds 10 ounces; the whole skeleton, which appears from the tooth to be *carnivorous*, is near 1000lbs. weight.

able, that some bones in the posterior extremities, have a great likeness to human bones, as the patella, tibia, &c.

But to return—as long as we remain in the same posture, a considerable number of muscles must be in a state of contraction, which we know from reason and from experience, must soon create an uneasy sensation. This we call being weary of one posture; an inconvenience that we should not have had in standing erect, if the bearing of all the bones to each other had been perpendicular; but it is more than compensated by other advantages.

The method by which nature has joined the bones together, is very curious, and varies in almost every different bone.

Where they are articulated for manifest motion, it is called *Diarthrosis*; for obscure motion *Sychondrosis;* and without motion *Synarthosis.* *Diarthrosis*, is subdivided into *Enarthrosis*, where a round head is received into a round cavity, as the femur with the innominatum: and *Ginglimus*, where a bone receives and is received, as the oblique processes of the vertebræ of the loins; or as in the other vertebræ; the

ulna

ulna with the humerus; radius with the ulna, or any whose property is to bend and extend, as the knee, ancle, &c. *sychondrosis* is a joining by intervening cartilages or ligaments; as between the bodies of the vertebræ, the ribs with the sternum: and the ossa pubes. *Synarthrosis*, is divided into *sutur*, and *gomphosis*; the first is the mutual indentation, as in the bones of the skull; gomphosis, is where the bones are received like a nail in a board, as in the teeth.

The bones are connected by cartilages where small motion is intended, and where the separation of them would be attended with danger always so, as in the spine. Where freer motion is intended, the connection is by ligaments, and tipped with cartilages. In children the ends of the bones are cartillaginous *. The bones and

* In some animals, ossification is never complete, and whose skeletons are always cartilaginous. As in Sharks, Sturgeon, &c. Animals that can only *crawl* have their muscles attached to different parts of their skin, on which they alternately produce dilations and contractions, which are the only motions of which they are susceptible: but those which are capable of moving themselves by steps or otherwise, either wholly or partially, have their muscles attached to *hard parts* placed externally or internally. Those parts perform the office of levers, and have points of support on each other, which are called their *articulations*.

cartilages are surrounded with a thin embrane, called perichondrium, a sort of continuation of the periosteum. Where no motion is intended there is a third kind of immoveable articulation, of which there is no example in the human skeleton. It is that in which a bone or other hard part inserted in one cavity, receives in a cavity, in its own base, an eminence arising from the bottom of that in which it is placed. The nails of *cats*, and of several other quadrupeds that have strong claws, are joined in this manner to the last phalanges of the toes.

Connection by cartilages is nearly alike. In those tied by ligaments and tipped with cartilage are, first, where motion is in all directions, as in the humerus, by ball and socket, secondly, where motions are in two directions only, as the knee and elbow, and is like that of a door upon its hinge; thirdly, where there is a degree of motion every way, but very inconsiderable, owing to the surfaces being almost plain. The motion of the hinges are, first, a bone on a centre-pin, as the head on the dental process of the sound vertebræ. Secondly, where the surface has an oblong shape, as the knee and elbow, which hinders them moving to any side. Thirdly, where the bones have different concretions, and

and are not included in one common capsule, as in the fore arm.

OF LIGAMENTS AND CARTILAGES.

THE intervening substance *between* the vertebræ is, (at least in the loins) nearly equal in thickness to the body of the vertebræ; there is nothing in the system entirely similar to it, being neither ligament, nor cartilage, but something of an intermediate nature. It is soft and pliant, curiously folded, and returned upon itself, like a rolled bandage with folds. In any violent shocks its elasticity prevents harm to the spine, while other less important joints are luxated and destroyed.

If the bones were not connected and kept firm by some strong substance, they would be luxated at every motion, and if their hard, rough, unequal surfaces were to play on each other, their motion would not only be difficult, but the loss of the substance from attrition would be great. Therefore ligaments are made to obviate the *first*, and cartilages to prevent the other inconvenience. But because, ligaments and cartilages turn rigid, inflexible and rough, unless they are kept moist, a sufficient quantity of proper liquor is provided to preserve them flexible.

Ligaments are white flexible bodies, thicker and firmer than membranes, without any remarkable cavity in their substance, difficultly stretched, and with little elasticity; serving to connect one part to another, or to prevent the parts from being removed out of that situation. Besides the capsular ligaments of the joints, there are cross and lateral ones, in the knee; the round one of the thigh, &c. Where they are few, long, and weak, the motion is more free and quick; but luxations frequently happen. They supply the place of bones in several cases to advantage; thus the parts of the pelvis are more safely supported below by ligaments than they could have been by bone. The ligaments placed in the great holes of the innominata, and between the bones of the fore-arm and leg, afford convenient origin to muscles. Immoveable bones are firmly connected by them, as the sacrum and innominatum. They afford a socket for moveable bones to play in, as part of the astragalus does on the ligament stretched from the heel-bone.

Cartilages are solid, smooth, elastic, white substances, between the hardness of bones and ligaments, and covered with a membrane named perichondrium. Cartilages are the hardest parts of the body except bones, and seem to be kept from ossifying either by their motions of flexion and extension, or by being constantly moistened. Those of the ribs and larynx, are often ossified. The cartilages are also part of the living system of the bones: and we see in the bones themselves, how unphilosophical it must be, to deny organization and feeling to any part of the living body, however dead or insulated it may appear; for every part has its degree of life; the eye, the skin, the flesh, the tendons, and the bones, have successive degrees of feeling and circulation. Where even the lowest of these, the bone, is deprived of its small portion of life, it becomes a foreign body, and is thrown off from the healthy parts, as a gangrened limb is separated from the sound body; and we speak as familiarly of the death of a bone, as of the gangrene of soft parts *. Organization of life is given to the cartilages, though surely in respect of feeling, they must stand in the very last degree.

* Bell's Anatomy, 8vo.

Their

Their uses as far as they regard bones, are to allow them to slide easily, while by flexibility, they accommodate themselves to the different motions, and by elasticity recover their natural figure and position as soon as the pressure is removed. This springy force, may also assist the motion of the joint to be more expeditious, and may soften the shocks in running, jumping, &c. To these we owe the security of the moveable articulations, for without them the fibres of the bone would shoot out, and immediately coalesce with the adjoining bone.

The cartilages sometimes serve as ligaments, either to fasten together bones that are immoveably joined, as between the sacrum, ilium, pubes, &c. or to connect bones, that enjoy motion, as those between the bodies of the true vertebræ. They often do the offices of bones to greater advantage than those could, as in the cartilages of the ribs, those which supply brims to cavities, &c. The liquor which serves to moisten the cartilages, and ligaments of the articulations is supplied by glands, situated within the joint so as to be gently pressed by its motions; it is termed *synovia*, and is composed of oil, mucilage, and lymph; most admirably adapted to lubricate the joints, and preserve the parts from over-heat-ing by their mutual action. The knee-joint is one of the most superficial joints, and one of the weakest, so far as relates to the bones; its means of strength is derived from its great ligaments, with which its bones are joined; by means of these it is the strongest joint of the body, the most oppressed by great loads, the most exercised in continual motions, yet less frequently displaced than any other. But this complication of ligaments, which gives it mechanical strength, is the very cause of its constitutional weakness; makes it very delicate, and very liable to disease.

The ancle-joint, on the contrary, owes less of its strength to ligaments than to the particular forms of its bones. It is a hinge-joint secured between two points of bone: while the strong lateral ligaments of the knee guard it so that it cannot be dislocated, till they are torn; the lower heads of the tibia and fibula, so guard the foot that it cannot be luxated sidewise without such violence as breaks these bones.

After the synovia* has done its office, it is re-absorbed into the system; from a depravity of blood,

* The office of the synovia, to the joints, may be compared to that of the conical patent pipe-boxes, affixed to the mail coach

blood, or diseases in the organs that furnish the synovia, it may be greatly changed from its natural state; it may be purulent after inflammation, mucous in the white swelling, gelatinous in the rheumatism, chalky from the gout, &c. hence a great variety of disorders in the joints. The quantity supplied of this liquid is very considerable.

In looking at the skull, it naturally occurs, that it might once, have been of a sweet and winning aspect—that it might have inherited an eye that outshone the diamond's brilliancy,* and glanced its lightning to the most guarded heart! Alas! where is it now? Where shall we find the living diamonds—their darting lustre is for ever eclipsed! The tongue that once commanded the sweetness of harmony, or all the powers of eloquence, has forgot its cunning—where is now the blushing cheeks? where the coral lips? where the ivory neck, with flowing locks! with

coach wheel, which by their uniform exudation of oil, lubricates the axle, facilitating attrition, and thereby preventing the ill consequences, which would otherwise ensue.—This remark was written before Dr. Paley published his last work, wherein the same idea is expressed; but the archdeacon farther remarks, this distinction between the *animal*, and the *machine*, that in the former the oil is supplied by powers within itself.

* Rev. Mr. Hervey.

 a thousand

a thousand other beauties of person, and delicacies of action! amazing alteration!

Should the haggard skeleton lift its clattering hand and point it full in our view; should it open the stiffened jaws, and with hoarse tremendous murmur, break this silence; the warning delivered in so striking a manner must strongly impress our imaginations, but the express declaration of the majesty of heaven, that we shall surely die, ought with greater reason to summon our attention. In scripture the royal preacher speaks of man, as composed of two parts, a body and spirit: the first in death, undergoes a revolution into its elementary principles; and (what sense could never ascertain) he teaches us, that the latter, liable to no such dissolution, returns to God, who gave it, which is perfectly consistent with the history of the creation as delivered in Genesis, and which accords with other parts of holy writ, particularly that of Job. None who compares these passages, can doubt, that the breath of life in Genesis, is the same thing with the spirit "which God gave," mentioned in Ecclesiastes. And that this spirit is the immaterial intelligent principle is evident; because it is spoken of as a distinct thing from

from the body, not partaking of the body's fate, but surviving its putrefaction, and returning to its beneficent and kind giver.

The union of these two principles, we find the immediate cause of animation. God's inspiration of the breath of life, his infusion of the immaterial principle, the union of the soul to the body, was the means by which man became a living person. By the explicit assertion therefore of Moses and Solomon, man is a compound of body and soul, and that philosophy is vain which teaches the contrary.*

Since then this body, so fearfully and wonderfully made, thus falls to pieces; since each of us, must soon resign all our bodily powers to darkness, inactivity and corruption, let it be our constant care to use them well, while we possess them. Let our *hands* be stretched forth to relieve distress, and our *knees* be ready to bend before the throne of grace; our *eyes* cast down in penitent confusion or elevated to the throne of heaven for mercy.

" May the law of kindness dwell upon our *lips*, and the gospel of peace flow from our

* Bishop of St. David's, 1789, Dis. to Humane Society.

tongues, for a sweet *voice* suits ill with scolding, and delicate features ought not to be disfigured with passion. May our *ears* be ever shut to slander, or improper conversation, but ever open to the instructions of wisdom. May our *feet* ever walk in the paths of pleasantness and peace, and all our members devoted to the glory of him whose gift they are. At length may we lay down in sweet hope, that God will give commandment concerning our *bones* (Heb. ii.) and one day fetch them up from the dust, as silver purified from the furnace."

The following beautiful lines by Miss Carter: will not improperly close these reflections.

ON THE DISSOLUTION OF THE BODY.

The sun's too quick revolving beam
Apace dissolves the human frame,
And brings the appointed hour;
Too late we catch his parting ray,
And mourn the idly wasted day,
No longer in our power.

2

Then happiest he whose lengthen'd sight
Pursues by virtue's constant light
A hope beyond the skies;
Where frowning winter ne'er shall come,
But rosy spring for ever bloom,
And suns eternal rise.

CHAP. IV.

ON THE MUSCLES.

Knowest thou the nature of the human frame,
That world of wonders more than we can name?
Say, has thy busy curious eye survey'd
The proofs of boundless wisdom there display'd:
How ranged each *fibre* with amazing skill
That every *muscle* may attend thy will;
How every *tendon* acts upon its *bone*,
And how the *nerves* receive their nicer tone;
Convey the keen vibration of the sense,
And give the wakeful mind intelligence;
How some strong guard each *vital* part sustains
How flows the *purple balsam* through the *veins*!

WISDOM, A POEM.

WHILE the knowledge of our frame, may be productive of numerous good consequences; it is not intended to plead for it, as a branch of science absolutely requisite to our happiness, or essentially necessary; for the Prophets and Apostles were sufficiently qualified to be teachers of that wisdom which "*maketh wise to salvation*," although in the structure and mechanism of the material world, they were less informed than

 Newton

Newton or Herschel, and less knowing than the moderns, in the *animal œconomy*, and the various branches of natural philosophy.

In whatever light we contemplate the form and organization of man, he appears designed to be lord of the whole creation. A glorious work in the supreme designer, to animate a mass of clay, and to stamp on it, thought, feeling, and moral character. *Art* only matches pieces of work design'd by human genius: but in the great and marvellous mould every creature, seems to have been *cast at once*—all the parts are compact, the stock rises into a stalk, that produces branches bearing fruit and flowers, the whole being united down to the roots.

The contrivance of every animal, and especially of the human body, says the great Mr. Boyle, is so curious and exquisite, that it is almost impossible for any one, who has not anatomically considered or examined it, on dissection, to imagine or conceive, how much excellent workmanship is displayed in this admirable engine. Even the meanest living creatures of God's making, are far more wisely contrived, than the most excellent pieces of workmanship, that human heads or hands can boast of.

As an object of the mixed kind, partaking both of the beautiful, and the picturesque, we admire the human figure. The lines and surface of a beautiful human form are so infinitely varied; the lights and shades, which it receives, are so exquisitely tender in some parts, and yet so round and bold in others; its proportions are so just; and its limbs so fitted to receive all the beauties of grace, and contrast, that even the face, in which the charms of intelligence, and sensibility reside, are almost lost in the comparison.

This observation of Mr. Gilpin's, Lady Montague's letters sanction, where, speaking of the beautiful figures of the Turkish ladies bathing; "I was here, (says she) convinced of the truth of a reflection, I have often made, that if it were the fashion to go naked, the face would be hardly observed. Ladies of the most delicate skins and finest shapes, had the greatest share of my admiration, though their faces were sometimes less beautiful, than those of their companions."

But although the human form, in a quiescent state, is thus beautiful; yet the more its smooth surface is ruffled, if we may so speak, the more picturesque it appears. When it is agitated by passion, and its muscles swoln by strong exertion, the whole frame is shewn to most advantage, natural exertions only, is here meant, not an affected display of Anatomy, in which the muscles though justly placed, may still be overcharged. Lavater has a chapter on the harmony of moral and corporal beauty; he thinks it infinitely more conformable to supreme wisdom that a harmony between physical and moral beauty rather should, than should not exist, &c. his chapter on the universal excellence of the form of man (vol. 2.) is interesting, moral, and sublime.

It may not be amiss to mention the different tints, which under certain circumstances, the human body assumes.

A child in health, is of a rosy colour; a man, of a warm and glowing colour; and a woman, of a fair colour.—In sickness, a child, inclines to a yellowish pale; a man to dark pale or sallow; and woman to a milkish or yellowish white colour *.

* Lairesse 4to. A body when deprived of life, appears heavier to raise than when living, the latter having a springyness in the muscular fibre, that naturally assists in life, independent of the will and the loss of this, is probably the reason, why a dead body appears so weighty. Fat persons with small bones, are supposed to float most easily upon water. See Robinson on the specific gravity of bodies. Philos. Tran. 1757.

The

The dead body of a child is violet; of a man more grey, yet somewhat yellowish, and the woman like the child, but more beautiful, as having the whiter skin; the reason of which is, the child having a thin skin, and being full of blood, must appear ruddy; a man being more yellow, and his skin thicker, must appear more grey, since the blood can shine less through it; and woman having a white and smooth skin must therefore shew herself more ruddy.

In the last chapter we observed, the wonderful artifice of nature, in the construction of the bones that are the support of the body; and how well they were adapted to bear great burthens, or be employed in strong exercises, being formed hollow for lightness and stiffness; for a body that is hollow, may be demonstrated to be more rigid and inflexible, than a solid one of the same substance and weight.' The ribs being formed for no great weight and only for a defence to the breast, have no cavity, and towards the breast are broad and thin, that they might bend and give way, without danger of fracturing, and when bent return by their elastic property to their figure again.

The muscles * being attached to the bones, the latter may be considered as levers that are moved in their various directions by the contraction of those organs—certain it is, that the mechanism by which nature † performs the *muscular* motion, is exceeding small and curious: and to the performance of every muscular motion, in greater animals at least, there are not fewer distinct parts concerned, than many *million of millions*, and these visible through a microscope. The muscles are the organs of motion. The parts that are usually included under this name consist of distinct portions of flesh, susceptible of contraction and relaxation, the motions of which in a natural and healthy state are subject to the will, and for this reason they are called voluntary muscles. But besides these, there are other parts of the

* Gavard's Treatise on Myology 8vo. Paris 1798, is spoken of, as replete with sound and original remarks, on account of which, it may be ranked among the classical books on the subject. Deverney published some years since, plates of the muscles, as large as life, coloured from natnre, they appear faithful representations. Pross. Dumas's volume on the Classification of the Muscles 4to. Montpelier; would if translated be a very acceptable present to the Students of Anatomy: Mr. Carpue's Description of the Muscles as they appear on dissection, with coloured plates, every Student should possess, 4to. Longman, 1802.

† Ray.

body,

body, that owe their power of contraction to their muscular fibres. These are called involuntary muscles, because their motions are not dependent on the will. The muscles of respiration, being in some measure influenced by the will, are said to have a mixed motion. That end of a muscle, which adheres to the most fixed part is usually called the origin, and that which adheres to the more moveable part, the insertion of the muscle.

Each muscle is inclosed by a thin covering of cellular membrane, which has been sometimes improperly considered as peculiar to the muscles, and described under the name of *propria membrana musculosa*. This cellular covering dips down into the substance of the muscle, connecting and surrounding the most minute fibres, and affording a support to their vessels and nerves. Lewenhoek fancied he had discovered, by means of his microscope, the ultimate division of a muscle, and that he could point out the simple fibre, which appeared to him to be an hundred times less than an hair; but he was afterwards convinced how much he was mistaken on this subject, and candidly acknowledged, that what he had taken for a simple fibre was in fact, a bundle of fibres!

It

It is easy to observe several of these fasciculi or bundles in a piece of beef, in which, from the coarseness of it's texture, they are very evident. The muscular fibres, it is agreed among anatomists, have fixed limitations, both in size and number *.

The red colour which so particularly distinguishes the muscular or fleshy part of animals, is owing to an infinite number of blood vessels that are dispersed through their substance. When we macerate the fibres of a muscle in water, it becomes of a white colour like all other parts of the body divested of their blood. The blood vessels are accompanied by nerves and they are both distributed in such abundance to these parts, that in endeavouring to trace the course of the

* The animals that have not distinct and separate nerves, have no visible fleshy fibres, and irritability and sensibility do not in them appear to belong exclusively to any particular system of organs. The existence of vessels, and a cellular substance, are neither so necessary nor so general ; for the muscles of insects, though very distinct and very powerful, contain neither the one nor the other. The fibres which compose these muscles are simply contiguous and parallel, and have no adhesion. As they are only fixed at their extremities, if we cut them at the part by which they are attached, the fibres separate like the threads of a piece of cloth when the woof is unravelled.—Cuvier ut supra.

blood-vessels in a muscle, it would appear to be formed altogether by their ramifications; and in an attempt to follow the branches of its nerves: they would be found to be equal in proportion.

If a muscle is pricked or irritated, it immediately contracts. This is called its irritable principle, and this irritability is to be considered as the characteristic of muscular fibres, and may serve to prove their existence in parts that are too minute to be examined by the eye. This power which disposes the muscles to contract when stimulated, independent of the will, is supposed to be inherent in them; and is therefore named *vis insita*, this property is not to be confounded with elasticity which the membranes and other parts of the body, possess in a greater or less degree in common with the muscles; nor with *sensibility*, for the heart, though the most *irritable*, seems to be the least *sensible* of any of the muscular parts of the body *. After a muscular fibre has contracted, it soon returns to a state of relaxation, till it is excited a fresh, and then it contracts aud relaxes again, such a con-

* The ramification of nerves in the heart, seem to bear a small proportion to those of other parts. See Scarpa's Tabulæ Neurologica for some beautiful plates of the distribution of the nerves, 1794. Duverney's Tables, &c.

traction

traction may likewise be produced by irritating the nerve leading to a muscle, although the nerve itself is not affected.

This principle is found to be greater, in small than in large, and in young than in old animals.

In the voluntary muscles these effects of contraction and relaxations of the fleshy fibres are produced in obedience to the will, by what may be called the *vis nervoso*, a property that is not to be confounded with the *vis insita*.

Although these properties are stated as distinct, agreeably to Haller &c.* yet Dr. Monro has

* The illustrious *Haller*, so deservedly quoted by all writers on physiology, was a native of Switzerland. He died in 1777, aged 70. Reason and religion in him rose superior to the gloomy despondency of sickness, and *Haller* met death with the calmness of a philosopher, and the faith of a christian. He continued his literary labours, and preserved his senses and composure to the last moment; he beheld his end approaching without fear or regret; "My friend" said he to the physician who attended him, "I die, my pulse is stopped" and then expired. Michaelis, the eminent orientalist, applied an observation to him, which had been made of Aristotle "he left nothing unexplored, either in the heavens, or the earth, or in the sea, and was of such wonderful capacity, that he seemed born for the immediate object of his pursuits."

Coxe's Switzerland, 4to. 1794. vol. 2.

questioned it, and Dr. Whytt has contended, they are the same, and that sensation and muscular action, are occasioned by the same principles. In this idea also many anatomists agree.

The *vis nervosa*, or operation of the mind if we may so call it, by which a muscle is brought into contraction, is not inherent in the muscle, like the *vis insita*, neither is it perpetual, like this latter property. After long continued or violent exercise, for example, the voluntary muscles become painful, and at length are incapable of further action; whereas the heart and other involuntary muscles, the motions of which depend solely on the vis insita, continue through life in a constant state of action without any inconvenience or waste of this inherent principle. The action of the vis nervosa on the voluntary muscles, constitutes what is called muscular motion; a subject which has given rise to a variety of hypotheses. No subject has employed more time than muscular motion, and after all the only knowledge we have of it is, that it is animal matter, endowed with a certain power of contraction, so as to serve the human will.

A weight may be suspended on it while alive which would destroy its arrangement when dead.

The

The muscles we term *irritable;* the nerves *sensible;* the irritability of the muscles survives the animal, as when it is active after death; survives the life of the part, or the feelings of the whole system, as in universal palsy, where the vital motions continue entire and perfect: but sensibility, the property of the nerves, gives the various modifications of sense, as vision, hearing, &c. gives also the general sense of pleasure or pain, and makes the system according to its condition, feel vigorous and healthy, or weary and low. The voluntary muscles are unwearied in their motions: after great fatigue we are sensible of cramps and irregular contractions, showing that they are still active, but more loosely governed by the nerves, and not so fully under the command of the will. But the nervous system is more subject to weariness and to decay; the senses become tired; the feelings of the system are exhausted. Hence sleep is required, during which the heart and all the involuntary muscles, unwearied pursue their orderly course.

Some have undertaken to explain the cause of contraction, by supposing that every muscular fibre, forms as it were a chain of very minute bladders, while the nerves which are distributed through the muscles, bring with them a supply

of

of animal spirits, which at our will, fill these bladders, and by increasing their diameter in width, shorten them and of course the whole fibre.

Mr. Elliot undertook to account for the phenomena of muscular motion, on principles very different from those just now mentioned. He supposed that a dephlogisticated state of the blood is requisite for muscular action, and yet a communication of phlogiston to the blood is a necessary effect of such action.

The muscular fibre is apparently shortened, and yet the muscle itself is swelled, in action, but how produced we are unable to determine. We know that the nerves are essential to muscular motion; for upon dividing or making a ligature round a nerve leading to a muscle, the latter becomes incapable of motion. A ligature made on the artery of a muscle produces a similar effect, a proof this that a regular supply of blood, is also equally necessary to muscular motion. The cause of the palsy is usually not to be sought for in the muscle affected, but in the nerve leading to that muscle, or in that part of the brain, or spinal marrow from which the nerve derives its origin.

It has been asserted, that though in action the muscles appear to be shortened, yet that in fact, it is not so, with the muscular fibre, which, when the limb is in a state of contraction, is supposed to take a *spiral form*, and is thereby in fact, lengthened.

When any person loses the power of muscular action whether erect or sitting, he sinks down upon the ground; as in fainting and other instances of great debility.

Hence it follows, that some exertion of muscular power is necessary to preserve our perpendicular altitude. This is done by exerting the antagonist muscles of the trunk, neck, and limbs.* If we incline on one side we restore the equilibrium, by the efforts of the muscles on the other side, or by moving one of our feet extend the base which we rest upon, to the new centre of gravity.

---

* Standing is solely the effect of the continued action of the *extensor* muscles of all the joints; the *flexor* muscles contribute nothing to it. This is one of the causes which renders it more fatiguing to stand long, than to walk an equal time; as in walking the extensors and the flexors act alternately.

The

The strength of the actions in muscles, is very considerable, especially in strong men; since frequently with the use of a few muscles only, they will easily raise a weight greater than that of the whole human body itself.* Yet a greater part of the force used by a muscle, is always lost without producing any visible effect: for all the muscles are inserted nearer the point, or centre of motion, than the weights they are applied to, and therefore their action is weaker, in the same proportion, as they move a shorter part of the lever than that to which the weight is applied. The losses of power being computed, make it evident, that the force exerted by muscles, in their contraction, is exceeding great, beyond any mechanical ratio or proportion whatever, since the effect is scarce one-sixtieth of the whole

* There is no positive information respecting the comparative trength of different men. It would be well to make trial of the burthens, which the inhabitants of countries, where nature has not been debilitated by effeminacy; and the customs adopted in polished nations, are able to carry, and of the ground they can pass over in a given time, both walking and running. (*Perouse's Voyage.*) The muscular strength of some men is almost incredible: Augustus the Second, King of Poland, could twist and break horse-shoes by the force of his hands! and some men have stopped the motion of two, four, and even six horses, when in full career. Even in diseases, especially madness, muscular exertions are astonishing,

 force,

force, exerted by the muscle, and yet only a small number of these muscles, weighing but a few pounds, are able not only to raise some thousands of pounds, but also with a considerable celerity. Nor is this to be reputed any defect of wisdom in the Creator; for all those losses of power were necessary towards a just symmetry or proportion of the parts, with the various motions and celerities required by the muscles to act in different directions; all which have no share in the composition of engines mechanically. But we may, conclude from hence, that the action of the nervous, or animal fluid, is very powerful, since in an engine so small it can exert a force equal to some thousand pounds for a considerable time, or even for many days together, by the incredible celerity with which this fluid obeys the will. How, or from whence it requires such a velocity, is not in our power to say: it is sufficient, that we know the laws of its motion are such, that a given action of the *will* produces a new and determinate celerity in the nervous fluid or juice.

Nature has surrounded the muscles on all sides with fat, which is spread also betwixt their bundles of fibres, and the small fibres themselves which lie contiguous together; which fat being pressed

pressed out by the turgescence of the muscles and the fibres, renders them soft, flexible, slippery and fit for motion.

By the muscles variously assisting, and opposing each other, are performed walking, standing, flexion, extension, deglutition, and all other offices of the several parts of the living body. But the action of the muscle contributes also to a more general use. They hasten the return of the *venal blood*, by pressing it out from the veins, both of the muscles themselves, as well as of the veins, which lie betwixt them; for the blood in these vessels distributed betwixt the turgid bundles of a contracted muscle, is by the valves determined towards the heart only; they likewise return the fat to the blood, and they shake, grind or densify the arterial blood, and return it quicker to the lungs. Again in the liver, mesentery, &c. they promote the course of the contained blood, bile, and other juices, so as to lessen the danger of their situation: they serve also, to increase the strength of the stomach, by adding their own strength to it, whereby digestion is promoted, insomuch that all sedentary and inactive courses of life, are contrary to nature, and pave the way to diseases, from a

stagnation

stagnation of the humours, or from a corruption or crudity of the aliments.

But by too much exercise or action, the muscles themselves grow hard and tendinous on all sides, render the parts on which they are incumbent, cartilaginous, or else change those which are membranous into a bony nature; at the same time they increase the roughness, protuberances, and processes of the bones, flatten their sides which lie next to them and dilate the cells seated in the diploë or spongy heads of the bones themselves, towards their stronger action.

The muscle is a fleshy fibrous part of all animals, destined to be the organ or instrument of motion; it consists of a number of thin paralle plates, and is divided into a great number of *fascicula* or little muscles, as before said, each inclosed in its proper membrane—The best and most simple division of a muscle is, into the body or fleshy portions, and the extremities whether tendinous, aponeurotic, or fleshy. The several parts of a muscle, the belly and tendons of it are composed of the *same fibres*,* their only difference consists in this, that the fibres of the

* This has been questioned and denied lately.

tendons are more firmly and closely knit together, than those of the belly which are more loose. Tendons are nourished like other parts, but the vessels supplying them are so small as to be incapable of transmitting red blood; and the most subtle injections, do not pervade them; their nerves also are extremely small, and very few in number, and therefore tendons have little or no sensibility. A bone sometimes breaks before a tendon gives way, as in the patella; but they are not so strong as the muscles in a state of action.

Where a muscle is not implanted directly into a bone, tendons are seldom required; and thus there are no tendons in the heart, the tongue, the œsophasus, the stomach, intestines or bladder.

While vegetables grow, feed, and perhaps feel in common with animals; the animal only has volition, or power of performing certain motions at pleasure. Volition implies that something superior to matter enlivens the machine. The inactive part is composed of solids and fluids liable to waste and corrupt. It is necessary therefore that animals should take in a supply for the parts which are continually wasting; and as few are so formed as to be able to take in their support from the immediate surrounding elements, it is requisite they should be endued with the means of judging of their proper aliment; and for this purpose that there should be a part of the body to serve as the basis to the rest. These are the bones, which for their easier motion, are tipped with cartilage, or fastened by ligaments. Thus the basis of the body is fitted for being moved. To perform the motion, it is necessary that a contractile substance should be tied to each of the bones to draw them nearer together—this is the office of the flesh, divided as above stated, into distinct portions termed muscles. As these must be soft and flexile to allow of motions, they are composed of a great number of fibres, which makes them bulky.

By the single property of the muscles shortening themselves, they are fitted to perform a great variety of motions—thus in providing food, the muscles of the arm extend, and contract to catch the animal, and convey the food to our mouth; and after this the muscles of the jaw chew it. When it is taken down the stomach prepares the food for entering into the system. Thus the wisdom and œconomy of nature is in every thing conspicuous. Though the muscles are generally of a red colour, they are in some animals *white;* and in those in which they are red, the external muscles are more so, than the internal; the utility of muscles being terminated by tendons is obvious, as thereby a greater number of muscles can be inserted into the bones, and room allowed for motion and beauty, as in the fingers, where the tendons are carried a long way up the fore arm. These though generally allowed to be the fibres of muscles, collected into small masses, yet it has allowed room for doubt, as in some parts *the fibres of tendons run in a different direction,* from those of the muscles; but in general, they may be considered as continued from the muscles. Tendons however, have not the property of muscles as they have no contractile power, and have not the same degree of sensibility, so that they are to be considered as inert chords. Every muscle is connected to another by cellular substance, and there is no exception to this rule. Muscles in action (says Dr. Monro) endeavour to shorten, but we can only say they endeavour, for in many cases they are not at all shortened, and in some are even lengthened. Most of the muscles do not shorten above one 5th, and very few above one 3d, hence anatomists have supposed that they have not the power of contracting more, but this is a mistake, as in

 many

many cases of muscles inclosing a tube, they shorten a great deal more. To understand the action of a muscle, consider the two points to which it is fixed, one of these is almost always immoveable; and hence it is a mistake to suppose their action analogous to that of a rope, fixed to a large and small boat, and suddenly shortening in the middle, by which the boats will move in proportion to their size: whereas in the muscle the action is not immediate, and upon both points of resistance, but the lesser resistance is by degrees overcome by the greater.

Does there appear any principle in all nature, (says Hume) more mysterious than the union of soul and body, by which the spiritual part possesses such an influence over the material, that it is able to direct the motion of any muscle, or even sometimes a part of a muscle? Were we empowered by a secret wish to displace mountains, or controul the planets in their orbit, this extensive authority would not seem more extraordinary or more unaccountable.

It is surprising to consider, how many hidden springs must be called into action, to produce operations apparently simple; for instance in *bursts of laughter*; in this case, the veins of the neck

neck and face swell; the muscles are puffed up; the eye-brows rise from the middle of the upper lid, and fall downwards about the nose; the eyes are almost shut, the mouth half open discovers the teeth; the corners of the lips stretch upwards, the cheeks are strained, and the eyes appear to dissolve in tears; the blood flies up to the face, and while the head is kept backward, the whole body bends a little forward, and the arms extended, fall upon the flank.

All the muscles (says Dr. Thornton) even in a relaxed state preserve a certain tension of their fibres, which when they are cut, *contract*, and enlarge the wound. A paralytic muscle lengthens; its antagonist then contracts the more; which shews that repose of the muscles depends on the equilibrium of strength, betwixt the different muscles, and betwixt their different fibres. The powers *thus balanced* destroy and renew themselves at every instant, without producing any motion or sensible change. This *natural tension* of the muscular fibres, arises either from the *nervous electricity* or from the exact distribution of well *oxygenated blood*, or if the arterial blood be distributed with an unequal quickness and energy amongst them, the equilibrium of the mutual efforts of the muscles is immediately destroyed; the strongest of them contract; and hence arise convulsions and agitations of the whole frame.

In 1794 Mr. Gibbs of Oxford discovered a process for converting *muscle* into a substance like spermaceti *. And in 1798, Mr. Crooks of Edinburgh discovered a mode of making soap from the refuse of fish.

Muscular action is awakened by the stimulus of light; (though we cannot as yet, shew the combination of light with our bodies) and thereby opens an inlet to the stimulus of the various passions.

* This idea has been taken up on a very large and expensive scale in the vicinity of Bristol, of which an intelligent friend says (Feb. 1802) " that the scheme is given up, and the premises advertised. There is a considerable quantity of the animal substance (of horses, &c.) collected, great part of which is in a progressive state towards *Spermaceti.* From what I have seen of it I much doubt whether it can ever be made to resemble the Spermaceti obtained from the Whale, either in external appearance, or in insipidity and freedom from odour." A singular instance of the production of animal oil from the lean or muscular part of animals, is presented by the conversion of muscle into this substance, resembling Spermaceti. See Henry's Epitome of Chemistry, 12mo. 1801, for the process. It has been attempted to render this substance useful in those manufactures which require *Tallow;* but the fetid odour which it constantly exhales was an insurmountable objection.

sions. To conclude—in every part is discovered equal power and equal wisdom; that all the bones, muscles and vessels should be so admirably contrived and adapted, for their several uses, and *that* most geometrically according to the strictest rules of mechanics, that if in the whole body you change the figure, situation and conjunction of but one part, if you diminish or increase the bulk and magnitude: in fine, if you endeavour to make any innovation or alteration, you mar and spoil instead of mending. How can these things but excite wonder and astonishment! In the muscles alone there is more geometry (says the great Mr. Ray) than in all the artificial engines in the world; and therefore the different motions of animals are a fit subject for the greatest mathematicians.

That under one skin there should be such an infinite variety of parts, variously mingled, hard with soft, fluid with fixt, solid with hollow, those in rest with those in motion, some with cavities or mortrasses to receive, others with tenons to fit those cavities; all these so packed and thrust so close together, that there is no unnecessary vacuity in the whole body; and yet so far from clashing, or interfering one with another, or hindering each other's motions; that they mutually assist in one general end and design, the good and preservation of the whole—are arguments and effects, of infinite wisdom and council; so that those must be worse than insane, that dare to attribute all these to casualty; and deny the design of a wise and intelligent Creator.

> Whose essence fills this breathing frame
> And glows in every conscious part;
> Lights up my soul with livelier flame,
> And feeds with life my beating heart;
> Unfelt along my veins it slides
> And through their mazes rolls the purple tides!

Man's life is compounded of the life of the intellect and the animal life. The life of the intellect is simply intelligence, or the energy of the intelligent principle. The animal life is itself a compound, consisting of the vegetable life combined with the principle of perception. Human life therefore is an aggregate of at least three ingredients: intelligence, perception and vegetation. The lowest and the last of these, the vegetable life, is wholly in the body, and is mere mechanism which any human ingenuity may imitate, or even to any good degree explore; but the exquisite mechanism of a divine artificer. Still it is mechanism; consisting in a symmetry and sympathy of parts, and a correspondence of motions conducive, by mechanical laws, established

lished by the Creator's wisdom, to the growth, nourishment and conservation of the whole. The wheels of this wonderful machine, are set agoing as the scriptures teach, by the presence of the *immaterial* SOUL; which is therefore not only the seat of intelligence, but the source and centre of man's entire animation.

On such a subject, who can refrain from invoking the Deity, in terms of the warmest adoration.

> To THEE, from whom my being came,
> Whose smile is all the heaven I know,
> Replete with all my wondrous theme,
> To thee my votive strains shall flow:
> Great Archetype! who first design'd
> Expressive of thy glory—all mankind!

CHAP. V.

ON THE NERVES.

Nor less contrivance, nor less curious art,
Surprise and please in every other part;
See how the *Nerves*, with equal wisdom made,
Arising from the brain, our frame pervade:
Form'd of the finest complicated thread,
These numerous chords are through the body spread;
A thousand branches from each trunk they send,
Some to the limbs, some to the bowels tend;
In strait, in transverse lines, they may be found;
One forms a crooked figure, one a round;
The entrails *these* embrace in spiral strings,
Those clasp th' arterial tubes in tender rings;
The tendons some, compacted close, produce,
And some thin fibres for the skin diffuse;
These subtle channels (such is every nerve)
For vital functions, sense and motion serve.

BLACKMORE.

THE knowledge of the sciences, of languages, and of those pleasing arts which have a tendency to render conversation agreeable, is pursued with a perseverance, which secures a great proficiency; but it often happens, that the attention which these require, so occupies the mind, as to leave it, amidst all the illumination of science, ignorant of of God, and of his revealed will; of that knowledge, compared to which the science of a HUNTER, or the accomplishments of a PRINCE, appear to be little better than ignorance and deformity.

If the scholar and philosopher pay their first attention to the knowledge of God, and the duties it involves; they may then expatiate with delight and safety in the fields of human science, and cull every flower whose fragrance and whose colour shall invite selection.

All the harmonic expressions are combined in the Human Figure. Observe the form of the head of man, which approaches to the spherical; *the form*, by way of excellence. This configuration is not common with that of any animal whatever.

On its anterior part is traced the oval of the face, terminated by the triangle of the nose; and encompassed by the radiations of the hair. The head is supported by a neck of considerable less diameter than itself, which detaches it from the body by a concave part.

This slight sketch presents, at the first glance, the five harmonic terms of the elementary generation of forms*. The hair exhibits lines; the nose the triangle; the head the sphere; the face the oval; and the void under the chin the parabold. The neck, which, like a column, sustains the head, exhibits likewise the very agreeable harmonic form of the cylinder, composed of the circular and quadrilateral. These forms, however, are not traced in a stiff and geometrical manner, but imperceptibly run into each other, and mutually blend, as parts of the same whole.

The following poetic address to the HUMAN COUNTENANCE *was obligingly presented by Mr.* W. A——†.

TO THE HUMAN COUNTENANCE.

MYSTIC source of strange expression,
Fairest link of nature's chain,
Stamp'd with God's divine impression
O'er his mighty works to reign;

Whence, O say, thy magic treasure?
From what wide, unknown abyss,
Ever yield'st thou endless pleasure,
Speechless, gentlest, wildest bliss?

* St. Pierre.

† A Student in Painting, of very considerable promise in the historical department of the art.

Is it in thy front aspiring,
  Where the virgin lily blows,
While, with living purple firing,
  Spreads the gentle, blushing rose?

Or, with pensive lustre streaming,
  Where yon sparkling glories rise,
Sweetly sad, like Cynthia beaming,
  In thy love-inspiring eyes?

Is it in yon bed of roses,
  Breathing thousand odours round,
Lucy's lip, where love reposes,
  In ethereal fetters bound!

Or in yonder winding dimples,
  Magic cells of fairy art,
Where the elfin, culling simples,
  Brews his spell upon the heart?

" Cease, O cease thee, sightless creature,"
  Thus I hear thee stern reply,
" 'Tis not in *one* wizard feature
  " My enchanting sources lie;

" Neither yet, where gently flowing,
  " Each in each congenial run,
" Softly blending, fading, glowing,
  " Sweetly struggling into one.

" But in that mysterious union,
  " Secret source of strange control,
" In that sweet, divine communion
  " Of the Features and the soul.

" Ponder

"Ponder then, O child of pleasure;
"Haste to seize on *Virtue's* grace,
"Wou'dst thou have the magic treasure
"Of a love-inspiring face."

W. A.

Titchfield-street, October, 1802.

If the body be an admirable machine, the SOUL is a substance yet more wonderful! The body indeed exists * independent of the soul, but it is the soul which animates it. This is that invisible agent which actuates the limbs, which produces that harmony of motion, and all those rapid and surprising movements we discover in the body. It is the soul which varies the physiognomy, and by turns impresses thereon grace, majesty, fear, meekness, innocence, and love. This renders

* The period of *corporeal existence* is however very limited; as the following calculation tends to shew:—Of 1000 persons, 23 die in the birth; 277 from teething, convulsions, and worms; 80 from smallpox; 7 in the measles; 8 women in childbed; 191 of consumption, asthma, and other diseases of the breast; 150 of fever, 12 of apoplexy and lethargy, and 41 of dropsy, omitting other diseases not so well ascertained: so that only 78 of 1000 attain what may be deemed old age. Or, if we take it in another point of view:—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.

the

the countenance the index of the mind, so that we read thereon the thoughts which the tongue refuses to reveal. Without the soul, the body would be like a plant, separated from the soil whence it drew its nourishment, and would perish as soon as delivered from the womb, notwithstanding its admirable structure, from its inability to select the aliments by which the decays of nature might be repaired. But however great this power of the soul, it is not confined to this. The body is undoubtedly a sensible being; but it is by the soul only that we are enabled to judge of the union of both, and become conscious of that intimate communication by which they are reciprocally sensible to the impressions of each other, and are indeed two distinct beings united in one*.

The soul renders man an intelligent and free being, by its innate energy, dissipates the darkness in which nature had involved him, whereby he becomes acquainted with other beings, his fellow-inhabitants of this earth, and soaring above into the celestial regions, makes him comprehend nature in all his ideas; and is, in fine, the cause

* Marat.

of that amazing knowledge and sagacity wherewith he is endowed.

It is the soul which assembles all the beings in nature before him; and, calling back past times, in some sort extends his existence throughout all ages; raises him above sensible objects; transports him into the vast fields of imagination; enlarges, so to speak, the boundaries of the universe, creates new worlds, and enhances his enjoyments by the possession of objects which never had a being.

In a word, the soul, by its knowledge and passions, enables this weak imperfect creature, Man, to change the face of nature; and, at his will and pleasure, to become either its tyrant or benefactor.

Thus we have no immediate knowledge of the soul; all we know of it is by its *faculties*, which are known only by their *effects*.

But to describe the *Nerves*, the medium of sense and motion to our frames—

The order and uses of the ten pair of nerves are thus explained by a French poet:

"On

" On viewing nature's noble plan of things,
We find five senses mov'd by double strings;
While every fibre aids the lively sense,
Ordain'd by wisest laws of Providence.
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 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."

Neurology, or a knowledge of the nerves, is of great utility to the artist, in the representation of the emotions of the mind: an attainment confessedly the most difficult, as well as the most interesting and sublime *.

The nerves are a part of the system framed from the *blood*; they grow from this parent source; and whatever be the *nervous fluid*, it cannot but be connected with the blood, being constantly expended and renewed, and therefore to be considered only as a branch from the parent

* Proff. Camper's Connect. 4to. 1794-

stock.

stock. Deny, therefore, parts of their due proportion of blood, or increase the quantity, or let this blood be deficient in its *oxigene*, and the NERVES will immediately indicate the change.

But to an anatomical definition—A nerve is a long and small bundle of very fine pipes or hollow fibres, wrapped up in a membrane called *Pia Mater*, which not only covers them all in common, but also incloses every fibre in particular *. The nerves are composed of a great many threads, lying parallel to each other, or nearly so, at their exit from the medulla. This fibrous texture is evident at the origin of most of the nerves within the skull; and in the cauda equina of the spinal marrow can be divided into such small threads, as to be scarce perceivable; and these, by a microscope, appear to be composed of a great number still smaller. How small one of these fibrils is, we know not; but when it is considered that every, even the most minute part of the body is sensible, and that this must depend upon the nerves (which all conjoined would not make a cord of an inch diameter) being divided into branches or filaments, to be dispersed through all these minute parts, it must prove that the

* MS. Lectures of Dr. Monro.

nervous

nervous fibrils are extremely small. For each fibre in the retina of the eye, or expanded optic nerve, cannot (astonishing to contemplate) exceed the size of the 32,400th part of *a hair!* *.

The medullary substance of the brain is the beginning of all the nerves; and it is probable that each fibre of the nerve answers to a particular part of the brain at one end, and to a particular part of the body at its other end; that whenever an impression is made on such a part of the brain, the soul may know that such a part of the body is affected. The nerves do ordinarily accompany the arteries through all the body, that the animal spirits may be kept warm and moving, by the continual heat and pulse of the arteries.

They have also blood-vessels, as the other parts of the body; these vessels are not only spread upon their coats, but they run also among their medullary fibres, as may be seen amongst the fibres of the retina. Wherever any nerve sends out a branch, or receives one, or where

* The diameter of a nerve might be taken with accuracy with a micrometer: which has been brought to great perfection by Mr. Coventry of Southwark; and for an account of which see last edition of Ency. Britt. also Priestly on Optics, 4to. &c.

two join, there is generally a *ganglion* or plexus, either less or more, as may be seen at the beginning of all the nerves of the medulla spinalis, and in other places of the body.

The nerves are divided into those which issue from the medulla oblongata in the head, and those, which come from between the vertebræ, or medulla spinalis.

The nerves are medullary chords differing from each other in size, colour, and consistence.

Nine pair arise from the medulla oblongata of the brain; and thirty-one pair from the medulla spinalis, which is a continuation of the oblongata. They appear to be perfectly inelastic, and to possess no irritability. If muscular fibres are irritated, they immediately contract; but a nerve does not.* Their outer covering is cellular membrane, which is very thick where the nerve is exposed to the action of muscles; but where

* The nerves of the involuntary muscles are generally smaller than those of the other muscles. It was long doubted whether the heart really had any nerves; yet the irritability of the involuntary muscle is more durable, and more easily excited than that of the voluntary kind.

it runs through a bony canal, or is secure from pressure, the tunic is extremely thin or wanting: as in the portio mollis of the auditory nerve, and in the nerves of the heart.

By elevating gently the brain from the basis of the cranium, the first nine pair are found arising in the following order.

1. *Nervi olfactorii* distributed through the pituitary membrane, which constitutes the organ of smell.

2. *The optici* which go to the eyes, where they receive impressions of visible objects.

3. *The oculorum-motores;* distributed to the muscles of the eye.

4. *The pathetici;* going to the superior oblique muscles of the eyes, the motion of which is expressive of certain passions of the soul.

5. *Divide into three branches;* 1 Opthalmicus, which goes to the eyes, eye-lids, forehead, nose, and integuments of the face. 2 and 3 to the superior and inferior maxilla.

6. *Abductor*

6. *Abductor* muscle of the eye, receives those which draw the globe of the eye from the nose.

7. *Auditorii;* distributed to the organs of hearing.

8. *Pay vagum*, which has its name from the great number of parts to which it gives branches both in the thorax and abdomen.

9. *The linguales*, or hypo-glossi, which go to the tongue, and appear to contribute both to the organ of taste, and to the motions of the tongue.

The spinal marrow sends off 31 pair of nerves; chiefly distributed to the exterior parts of the trunk, and to the extremities. These are divided into, cervical, dorsal, lumbar, and sacral nerves. The cervical from the neck are 8 pair; the dorsal 12; the lumbar 5; the sacral 5 or 6, depending on the holes in the sacrum. The knots or ganglions of nerves are met with at their exit from the spine and in various other parts. Some have considered these as so many little brains; Lancisi fancied he had discovered muscular fibres in them, but they are certainly not of an irritable nature. Dr. Johnstone imagines, they are intended to deprive us

of

of the power of the will, over certain parts; the heart for instance; if this was true we should meet with them only leading to involuntary muscles; whereas it is certain that the voluntary muscles receive their nerves through ganglions. Dr. Monro from their structure supposed them new sources of nervous energy. The nerves like blood-vessels communicate with each other; and these communications form what is called a *plexus*, from whence branches again issue. The most considerable of these are the semilunar plexus, the pulmonary plexus; the hepatic, cardiac, &c. A late author (Dr. Wallis) observes, that the nerves may be traced to their origin, either in the brain or spinal marrow, except where they form a bundle of fibres or ganglions, then you can trace it no further; these ganglia are never found in the nerves of sense, and very rarely, or in a very *inconsiderable* degree, in nerves going to voluntary muscles, but in such as supply the *involuntary* muscles, they always occur; thus their office is supposed to be, that of intercepting the influence of the will; assuming this to be the fact, then, it furnishes an additional instance of the wonderful wisdom, and contrivance of our frame, in thus preventing the *will* from arresting the vital functions, and destroying the machine.

The nervous system is allowed to be greatly enfeebled and debilitated by the too copious use of tea; that there is something in the fine green teas that produces effects, peculiar to itself, on the nerves, is generally admitted, and felt, after a plentiful use of this liquor. And the finer kinds of bohea teas, produce a somewhat similar effect: causing tremblings, and such a state of the body, as subjects it to be agitated by the most trifling causes, such as shutting a door too hastily, the sudden entrance even of a domestic, and other like causes.*

Through the nerves we feel pleasure or pain. It is not necessary here to enter more particularly into their general distribution—The few remarks which follow, come sanctioned as facts, relative to this division of the human system.

If a large nerve be laid bare in a living animal and an incision made into it, the animal shews signs of the greatest pain; and the partial division of a small nerve by irritation may be the occasion of death.

* Dr. Lettsom on tea, with coloured plates: 4to. 1779.

If a nerve in the muscular part be divided, the muscles under the place of incision lose their power of contracting, and performing the motions of the several joints. You have proof of this, that if by sitting on any uneasy seat, a pressure is made on the sciatic nerve, the limb loses its motion and sensation, and becomes very dull.

From this it is enforced that the office of the nerves is to render the mind sensible of impressions upon the organs of the body, and to assist, if not to enable, the muscles to perform their motions. It is wrong to suppose, when a body has lost all feeling and motion that it is dead; the nerves indeed have ceased to do their office; all feeling and consciousness is gone; but the mere animal power survives the nerves, and through it the whole system may be recalled into perfect life: *sensibility* depends upon the nerves; *motion* on the muscles; both are equally admirable and inscrutible; the one conducing to all the enjoyments and all the sufferings of life, and to the intellectual faculties of man; the other being the chief support of animal life, and the source of all the bodily powers. It has been alledged besides this, that the nerves perform a secretion which nourishes the body, from observing, that a limb of which the nerves are divided, loses its bulk and becomes shrivelled. The sudden fattening of an animal upon gross food renders this improbable, as its particles would not pass through such very minute vessels; and it is allowed that the arteries perform the secretions of the bile, saliva, &c. Why then are we not to suppose the same with regard to the nutritious fluid; a limb will lose its bulk, if an artery be compressed as well as the nerve, as is frequently the case in laxations of the os-femoris, where the head of the bone may compress the artery, but cannot compress the nerve: it is observed that the legs of dragoons are small in proportion to their bulk and other parts of their body, which is probably owing to their posture on horseback, compressing the arteries. We may therefore safely say that the arteries secrete the nourishment of the body, and the nerves only serve this purpose in a secondary way by causing motion and sensation.

Though the nerves serve for sensation, they are not sensible themselves; that would be inconsistent with our ideas of matter; they serve only to convey to the mind the ideas of pain or pleasure. But there is a further point not so easily

easily conceived, which is that sensation is only felt at the extremities of the nerves, so that in many cases of injuries of the nerves, the feeling will not be in the place injured but in a distant one. This is a circumstance from whence many curious opinions may be explained—thus if a nerve be divided near the brain, the parts of it below the incision have no sensation, and what is a very curious fact, after a leg has been amputated, the pain of the stump will seemingly be felt in the toes; so that the nerves are not the organs of sensation in themselves, but only as they terminate in the brain. The nerves serve for the contraction of the muscles; the general notion of which is, that the contraction of muscles is as much depending upon the influx of something running through the nerves, as the motion of a mill, supposed to depend on a fall of water; or as some explain it, that there are a number of bladders in a muscle, which are nearly oblong, but when the muscle acts, are filled by something from the nerves, and so become round; but others, suppose that the muscles have a power of contraction in themselves, or a *vis insita;* and that the nerves only serve to bring a message as it were from the mind when the muscles should act; in favour of this, Haller observes, that the heart in animals contracts after the head is cut off, hence he supposes that something is sent into the nerves to occasion this motion. But there is reason to think the nerves and muscles are both necessary to motion; for whatever affects the nerves, affects also the muscles.

The opinion of the muscles deriving their power from the nerves is the most rational, and that they are passive; to explain this—a single thread of flax, does not shorten when wetted, but when a number are twisted into a rope, that rope when wetted has a power of shortening itself. Now the muscles may be compared to the rope, and the twisting of the rope to the transverse fibres of muscles which make them liable to be shortened, and the water which when applied to the rope makes it shorter, may be compared to the nervous influence. Some have supposed the nerves to be solid cords; others tubes; that they were strings communicating a tremor like the strings of a harpsichord; but this is improbable from several circumstances.

The nerves are soft in their parts where they perform their office, having only hard coats to protect them in their course from injuries; then the nerves are not stretched out tense, but lie loose

loose in the cellular membrane, nor do they run singly, but in bundles, whence the tremor of one would probably be not distinguishable from that of another; and they have numerous branches during their course, which tie them down to the neighbouring parts, which would alter their different tones, in the same manner as tying down the strings of an harpsichord. Then although nerves grow together again, when divided, and unite in the most accurate manner, yet no sensation is afterwards conveyed through them: and even their growing together again is a proof, that they are not tense and elastic, but that they lie loose; if a nerve be tied, the sensation is destroyed, though we should not think if it communicated a tremor only that it would be much injured. Thus this supposition does not destroy the utility of the brain and cerebellum, and of the great quantity of blood conveyed into these parts more than along the course of the nerves.

There is very little reason to suppose the nerves to be solid bodies acting by tremor or sensation; and therefore by disproving this, the other opinion is rendered probable, that they are *tubes*, conveying fluids, but we cannot only reason negatively but positively, in support of this opinion. The brain very much resembles several glands, particularly the kidnies; between all parts of which there is a strong analogy.

If a compression be made upon any part of the brain, a distant organ suffers, and after lying upon the sciatic nerve, upon rising, a pain is produced seemingly like the rushing of some fluid into the extremities of the nerves. Upon the whole, it seems probable that the nerves contain a kind of fluid, which is acted upon immediately upon the mind: of the nature of this fluid (says Dr. Monro) we have yet to learn.*

We are not only unacquainted with the nature of the nerves, but are much at a loss to discover from whence any particular one has its origin: we only by dissection discover nervous fibrils coming out of the brain in a chord, and a great number of them composing one bundle; we can only then perceive the place from whence this bundle comes out, and cannot even distinguish from what side of the brain the nerves composing it come. Some suppose they rise from the same side as their course in the body, and others on the opposite side. Both have facts to support

* See Note, p. 83.

them.

them. In several animals and particular in fishes, a decussation of several nerves is visible particularly the optic. If a wound is inflicted on the brain, sometimes the same side of the body, and sometimes the opposite, suffers; the opposite however in general most: and hence it may with reason be supposed that they come from the same, or from opposite sides, or from both, which is the most probable.

From what has been advanced, it appears that the nerves are destined to convey the principles of motion and sensibility to the BRAIN from all parts of the body. To this important part of the system, the following lines are addressed, presented by the friend * to whom obligation is due, for the verses, inserted page 81, on the *human voice.*

TO THE BRAIN.

A SONNET.

I.

Sensorium of the soul, that dost dispense
Each nerve that vibrates to the feeling heart;
Organ of life, of reason, and of sense,
Bright form that wisdom did from love impart.

---

* The much respected editor of the beauties of Owen Feltham, 12mo. 1801.

2.

The will and understanding here unite
One mind to fix an image of it's God;
While man with caution checks each vain delight,
And treads the humble path his Saviour trod.

3.

Oh! may each thought that fills my teeming brain
The bias take that virtue can improve,
Each cause of reason and of right maintain,
And crown each action with benignant love.

Eternal objects keep the soul serene,
While MADNESS DOATS UPON LIFE'S TRANSCIENT SCENE.

We perceive a variety of opinions; one considering a trunk of nerves as a solid chord, capable of being divided into an infinite number of filaments, by means of which the impressions of feeling are conveyed to the sensorium commune; another supposes it to be a canal which separates into more minute channels; or as being an assemblage of very small distinct tubes, connected and forming a cylindrical cord. They who contend for their being solid bodies, are of opinion that feeling is occasioned by vibration; so that, by pricking a finger, a vibration would be occasioned in the nerve, which being extended to the sensorium, would be an excital of pain. But the inelasticity, softness, connection, and

and situation of the nerves, are proofs against the system of vibration.

But an hypothesis more probable is, that in the brain and spinal marrow, a very subtle fluid is secreted, and from thence conveyed through the imperceptible tubes, which they consider as existing in the nerves; to this fluid the name of *animal spirits* has been given. Mr. Cheselden says "I think the nerves may be tubes, and that a fluid whose cohesion is very little, and *whose parts perhaps are finer than light*, may move freely in them.

" The soul which imagines it can penetrate into every thing without it, and that nothing can set bounds to its knowledge, is nevertheless utterly at a loss to describe its own habitation, and is no where more to seek than at home," (Steno.) " The influence of the nerves on the vital organs, and of the latter on the nerves, is reciprocal. Grief or excessive application of mind, alters digestion, and diminishes the secretion of the gastric and other fluids. On the other hand an overloaded stomach, blunts sensibility and induces sleep.—Remedies calculated to restore the powers of the mind, give also new energy and vigour to the vital organs. The diseases which most enfeeble the powers of perception and understanding, also reduce the body to an inert state, which is speedily followed by dissolution. In general the mind possesses no influence over the organs of circulation, and the will cannot stop their motion, but when lively images heighten the excitement of the nervous system, the mental influence extends to those muscular fibres which produce circulation; thus the hope of a much desired event causes the heart to palpitate. Anger or shame impel the blood to the skin of the face, from whence it is driven back by the reaction of the vessels; producing alternate blushing and paleness. The sight of a good meal occasions a great secretion of saliva, in a hungry man, and even mentioning victuals, is sufficient, as the common phrase is, to make his mouth water. Excessive joy or sorrow increases the tears so considerably, that they cannot flow through the lachrymal * ducts, but drop on the cheek.

A few only of the various opinions held on the subject of the nervous system are stated; it is a subject involved yet in a considerable degree of obscurity, and on which much is still to be discovered. Lately new light has been derived, by

* Cuviers Lectures ut supra. Trans. by Mr. Ross.

the discovery of *galvanism* or animal electricity. And the influence of the brain and nerves upon the muscles appears to be of an *electric* nature. This Dr. Priestly mentions as among the most important discoveries of the day *.

Dr. A. Monro, from experiments concludes, that as *animal electricity*, did not affect the nerves of the hind legs of frogs, unless applied lower than the 5th vertebræ that these nerves are not derived solely or chiefly from the brain or cerebellum. The effects of opium seem from these experiments, to be conveyed by sympathy to distant nerves—a sympathy obvious when the head is separated, and consequently not owing to the connection of the nerves, within the encephalon. After the head is separated the animal is susceptible of pain and performs voluntary motions; from this fact our author concludes that nerves do not receive their energy wholly from the head and spinal marrow, but from every part of the nerve in it's course. But on this the reviewers † very judiciously remark, " that the necessity of a common sensorium, or a connection between the different nerves, *is different in the different classes of animals.* The mere ani-

* Lectures, 8vo. 1794. † Critic. Review, June, 1795.

mal functions of the body do not require it; and in the polypus, each part is a whole. The intermediate classes require a general receptacle of the nervous influence in different degrees: the frog may be considered as one of the intermediate beings, equally remote from each extremity, The conclusion therefore cannot be implicitly admitted or indiscriminately applied. The various plexus and ganglia probably supply in part the office of a common sensorium." This sketch may probably excite farther curiosity in the reader, to investigate more fully this complicated part of the animal œconomy, by which we move and feel, originating from the brain and spinal marrow, and from thence distributed to the utmost parts of the body, visibly coming out in 40 pairs, which branching and rebranching, send out twigs of that extreme minuteness to exceed our comprehension, so that the point of the smallest needle touching them produces great pain; in some parts, as the gums, where the nerves are not so plentifully spread, we find greater insensibility, which were it otherwise would subject us to many inconveniencies: if the nerve of the elbow is pressed on, or struck in a certain way, a very painful sensation reaches to the fingers.

Were it possible for the eye to view through the skin, the mechanism of our own body, the sight *would overwhelm us.* Durst we make a single movement, if we saw our blood circulating, the nerves operating, the lungs blowing, the humours filtrating, and all the incomprehensible assemblage of fibres, tubes, pumps, currents, pivots, which sustain an existence at once so frail and so presumptuous?

Thou moving mystery, that canst or move,
Or stop at pleasure—curious mechanism
Whose spring is spirit, and whose action will!
Warm conscious wax, on which all passing things,
Series of seals, successive impress make,
Of pleasure or of pain! imperial mark,
By which the frame Almighty fingers formed
Is known from moving systems made by man!
Eminent work! which all the sons of skill
From every clime convened, could ne'er with all
Their hands collected cunning, emulate!
Invention all divine! FAWCETT.

It may not be useless to remark the injury which the nervous system is liable to, from the prevailing practice of taking *laudanum* which if persisted in, will materially affect the brain and nerves, and diminish their influence on the vital organs of the body. Its immediate action, however, is supposed to be on the *muscular* fibres through the medium of the blood *.

* Dr. Thornton.

Fontana

Fontana employed more than 4000 animals in experiments relative to the action of the poison of the viper; and the conclusion he draws is, that this poison does not act on the *nerves*, but on the *irritable principle*, in the moving fibres, through the medium of the blood. Hence in those animals that recover, the parts bitten are usually *paralytic*, but not *insensible*. For a farther illustration of this wonderful branch of our system, we refer the reader to the works of *Meckel* and *Monro*; and to *Walter*, *Duverney* and *Scarpa*, for the nerves of the thorax and abdomen. For the influence of pneumatic medicine on the nerves and system in general to the writings of Drs. Thornton, Beddoes, &c. M. Fourcroy has also published a memoir on the application of pneumatic chemistry to the art of healing, wherein he displays, his usual eloquence vivacity, and energy. See also *Henry's* general view of the nature and objects of Chemistry, and of its application to the arts and manufactures.

On the *brain* consult Soemerring—

For the *muscles*, Cowper, Albinus, Winslow, and Dumas.

The *bones*, Cheselden, Albinus, Sue, and Trew,

The *Vessels* Haller. The *pregnant uterus*—Albinus, Hunter and Jenty—the *joints* and Fresh Bones,

Bones, Weitbretch and Leber—the *eye*, Zinn, Petit.

The *Ear*, Cohennius, Mekel.

The *Bursæ-Mucosa*, Monro.

The *Absorbents*, Sheldon and Cruikshanks *.

The *Skin*, Dr. Willan.

As an elementary book, Dr. Simmonds's Anatomy will be desirable. These will naturally lead to a knowledge of others not specified here—Though we cannot omit the works of John and Charles Bell, from their superior information and accurate execution; Mr. Fyfe's Works †; Rowley's Scholia Medicinæ; Sabatier's Anatomy, imported by De Boffe, 3 vols. 12mo; Chambon on the Diseases of Women and Children, Paris, 10 vols. 8vo; Townsend's Physician's Vade Mecum, &c.; Parkinson's Chemical Pocket Book; Motherby's Dictionary; Dr. Hooper's Anatomist's Vade Mecum, and other Works;

---

* Mr. Sheldon's Work contains likewise the history of Chylography, and the method of injecting the lacteals: both are illustrated with fine plates.

A publication on *Medical* works, on the plan of the Biblio. The. Angli. would probably be highly useful to students.

† Fyfe's Anatomy, with 160 plates, 3 vols. 4to. 1800, 5l. 5s. his Views of the Bones, &c. 1 vol. with 23 folio plates; and his Compendium, 2 vols. 12mo. 10s. 6d.

Dr.

Dr. Cogan on the Passions; Dr. Baillie on Morbid Anatomy; Cuvier on Comparative Anatomy. All these have been sanctioned by the approbation of the public; but in the mention of these we wish not to exclude enquiry after others, equally entitled to notice, many of which are quoted in other parts of this volume.

But it would prove tedious to enumerate all the classical publications on these subjects, many of which are not to be found but in large medical libraries; and it is to be regretted that those which exist in London are particularly inaccessible.

Men of extensive genius and indefatigable industry are daily employed in Anatomical and Medical researches, and are adding to the knowledge of their predecessors, the results of their labours.

In London and Edinburgh, the present æra exhibits, in the respective Lecturers on these topics, a constellation of brilliant knowledge which exceeds any former period, and adds a lustre to sciences, at once profound, elegant, and eminently useful.

Still,

Still, however, the human fabric is so complex, that in various shapes and properties it eludes our acutest investigation; and the more we discover, the more we find yet to learn in this divine and energetic composition.

One of the most singular incidents to which the human frame is liable, is that of *combustion*, from the abuse of spirituous liquors; a subject which has given rise to a 12mo vol. lately published at Paris, by P. A. Lair.

It is an astonishing, though little known fact, that the bodies of living persons have been known to catch fire from the flame of other bodies, and continue to burn almost to ashes. From consulting the journals of various nations, on this subject, it appears that none but women have been consumed, and that these women were old. Spirits are known to dry the flesh, to soften the fat, and to fit both for combustion, producing an internal vapour, highly inflammable, ever ready to catch fire and consume the body. Men are less subject to this accident than women. This M. Lair attributes to the delicacy of the female fibres, and the less compactness of the parts of the body, which is natural to them, and their sedentary life, rendering both the flesh and

the

the fat more proper to absorb spirituous substances, and dispose them to inflammation.

Mr. Sandford of Worcester has published a work of a popular nature, on the "Medicinal Effects of Wine and Spirits, &c." designed as an impartial appeal to such as are uninformed in medicine, which if attended to will effectually prevent any ravages on the frame, or fear of human combustion.

From the time of Sir Kenelm Digby, who professed to cure disorders by means of a sympathetic powder, to the time of *Mesmer*, the professor of animal magnetism, an idea has prevailed of the existence of some natural cause or principle, interwoven with our natures, which is as yet unknown and inexplicable, but which a more advanced period of human knowledge may discover. Many eminent men have been anxious to trace out the hidden properties of bodies, while, generally speaking, this idea has been treated as visionary and weak.

The electric powers of the animal nerve, and the possibility of accumulating electricity in those bodies which were considered merely as conductors, remained unknown, until Dr. Galvani

discovered,

discovered, that two pieces of two different metals, such as zinc and silver, if in contact at two of their extremities with each other, and at the other two with the nerves of a living animal body, would communicate a sort of sensation, and produce a muscular contraction, like a faint shock of electricity. Mr. Volta, and others in England, after a minute investigation of this supposed new fluid, have ascertained, that what has been called Galvanism is entirely the same as electricity. Still, however, this new clue to the arcana of nature is pursued with eagerness, and advantages the most important to medicine, and to the arts, are earnestly expected to result from it.

"Having succeeded in our researches concerning the electrical fluid, and what is called *Galvanism*, it is not impossible but we may discover some other fluid, or material substance, which shall have its particular laws, relations, and affinities. In animal magnetism we meet with appearances which cannot be traced to the imagination as their cause, nor indeed to any cause known or stated by the enemies of this doctrine. The French Academicians themselves, in their report on animal magnetism, shew, perhaps, that they bestowed upon it neither the time, nor the candour and impartiality, which a subject so difficult, and so much entangled in the grossest prejudices, had a right to obtain from them. Upon the whole, we are still entirely in the dark as to this unknown cause, which, though we cannot as yet assign to it any name or determinate qualification, *is not on that account less possible* *."

---

* Acerbi's Travel's in Sweden, &c. 4to. Mawman, 1802.

For the influence which the nervous system of two different individuals may exercise on each other, see also Cuvier's Lect. vol. 2. p. 122. 8vo.

CHAP.

CHAP. VI.

ON THE BLOOD VESSELS.

The blood, the fountain whence the spirits flow,
The generous stream that waters every part,
And motion, vigour, and warm life conveys
To every particle that moves or lives;
This vital fluid through unnumber'd tubes,
Pour'd by the heart, and to the heart again
Refunded; scourg'd for ever round and round;
Enrag'd with heat and toil, at last forgets
Its balmy nature; virulent and thin
It grows; and now, but that a thousand gates
Are open at its flight, it would destroy
The parts it cherish'd and repair'd before.
Besides, the flexible and tender tubes
Melt in the mildest, most nectareous tide
That ripening nature rolls; as in the stream
Its crumbling banks; but what the vital force
Of plastic fluids hourly batters down,
That very force those plastic particles
Rebuild....so mutable the state of Man.
" For this the watchful appetite was given,
Daily with fresh materials to repair
This unavoidable expense of life,
This necessary waste of flesh and blood;
Hence the concoctive powers, with various art,
Subdue the ruder aliments to chyle;
The chyle to blood; the foamy purple tide
To liquors, which through finer arteries
To different parts their winding course pursue,
To try new changes, and new forms put on,
Or for the public, or some private use."

ARMSTRONG.

NATURE brings all her works to perfection by a gradual process. Man, the last and most perfect

perfect of her works below, arrives at his by a very slow process. In the early period of life, nature seems particularly solicitous to increase and invigorate the bodily powers *.

One of the principal instruments she uses for this purpose, is, that restless activity which makes a child delight to be in perpetual motion. The faculties of the mind disclose themselves in a certain regular succession. The powers of the imagination first begin to appear by an unbounded curiosity, a love of what is great, surprising, and marvellous, and in many cases of what is ridiculous. The perception of what is beautiful in nature does not come so early. The progress of the affections is slower: at first they are mostly of the selfish kind, but by degrees the heart dilates, and the social and public affections make their appearance. The progress of reason is extremely slow. In childhood, the mind can attend to nothing but what keeps its active powers in constant agitation, nor can it take in all the little discriminating circumstances which are necessary to the forming a true judgment either of persons or things. For this cause, it is very little capable of entering into abstract reasoning of any

* Dr. Gregory.

kind,

kind, till towards the age of manhood. It is even long after this period before any justness of taste can be acquired, because that requires the improved use of the affections, of the reasoning faculty, and of the powers of imagination.

The advantages which mankind possess above the rest of the animal creation, are principally derived from reason, from the social principle, from taste, and from religion. Nature has furnished us with a variety of internal senses and tastes, unknown to other animals. All these, if properly cultivated, are sources of pleasure; but without culture, most of them are so faint and languid, that they convey no gratification to the mind.

This culture is the peculiar province of reason.

Those who were skilled in anatomy among the ancients, concluded, from the outward and inward make of an human body, that it was the work of a being transcendently wise and powerful. As the world grew more enlightened in this art, their discoveries gave them fresh opportunities of admiring the conduct of Providence in the formation of an human body. Galen was converted by his dissections, and could not but own

a SUPREME

a SUPREME BEING, upon a survey of this his work. There were indeed many parts of which the old anatomists did not know the certain use; but as they saw that most of those which they examined were adapted with admirable art to their several functions, they did not question but those whose uses they could not determine were contrived with the same wisdom for their respective ends and purposes. Since the circulation of the blood has been found out, which was near 2000 years after Galen, and many other great discoveries have been made by modern anatomists, new wonders are obvious in the human frame; and several important uses are seen for those parts, which the ancients knew nothing of. In short, the body of man is such a subject as stands the utmost test of examination. Though it appears formed with the nicest wisdom upon the most superficial survey of it, it still mends upon the search, and produces surprise and amazement in proportion as we investigate it. What is here said of an human body, may be applied to the body of *every* animal.

That part of the human frame now to be discussed, is the blood-vessels; a most important branch of the living body, and on which all the rest depend for life and support.

As the heart is the fountain from which this vital fluid issues, it may be necessary to say, that the heart is a hollow involuntary muscle, of a conical shape. Its basis, from which the great vessels arise, is covered with fat, and it has two hollow and fleshy appendages called *auricles;* the heart includes two cavities, divided from each other by a fleshy septum; one of these is called the right, the other the left ventricle, though perhaps they might more properly be termed the anterior and posterior ventricles; from the contraction of one of these ventricles the blood is forced into vessels, which carry it into the remotest part of the system—these vessels are called *arteries* *; and it is brought back again by an-

* As the circulation near the heart is more warm, fresh, and vigorous, than at the extremities, so every man's affection for his native country ought to be more fervent and vivid, than that philanthropic heart which may interest him in the happiness of distant regions." (Dr. Parr's Sermon, 4to. p. 80. 1801.'"— Were the knowledge of the situation of the blood-vessels of the extremities, so far as is necessary for checking dangerous effusions of blood, and the use of the Tourniquet more general amongst society at large, it could not fail (says Dr. W. Blizard) of proving highly beneficial to mankind. See Dr. B.'s popular Treatise on the large Blood-Vessels, 8vo. 1798.

The Student will find Dr. Murray's description of the arteries, 8vo. 1801, translated by Mr. Macartney, a very desirable Vade Mecum.

other set of vessels called *veins*, to the heart, so that the same force which sends it forward, also brings it back again; the right ventricle is not quite so long, though somewhat larger than the left, but the latter has more substance than the former, and this seems to be, because it is intended to transmit the blood to the most distant parts of the body, whereas the right ventricle distributes it only to the lungs. The heart is usually described as of a pyramidal form, but one of its sides is rather flat, and this is placed downward, the right side is placed in front; but in brutes, the right ventricle is on the right side, and the left, on the left, from whence their names.

The auricles are situated at the basis of the heart, these muscular bags corresponding with the ventricles, are like them divided into right and left; from their externally appearing like ears, they derive their name of auricles. The heart in contracting throws the blood from its ventricles into the pulmonary artery, and the great artery termed *aorta*, it then relaxes and receives a fresh supply, from two large veins, which are the pulmonary veins, and the vena cava; the principal distribution of these are as follows:—

The

The pulmonary artery arises from the right ventricle by a large trunk, which soon divides into two considerable branches, which ramify through every part of the lungs, from whence the blood is returned by the veins; which, contrary to the course of the arteries, begin by very minute canals, and gradually becoming larger, form four large trunks, called pulmonary veins which terminate in the left auricle by one common opening; hence the blood passes into the left ventricle: from whence arises the aorta; here nearly an inch diameter: it soon sends off two branches called *coronaries*, which nourish *the heart itself*, and its auricles; it then, about the third vertebræ of the back, makes a considerable curvature, from which arise three arteries, one of which soon divides again. The first two are the left subclavian, and left carotid, and the third is a common trunk to the right subclavian, and right carotid; though sometimes both the carotids arise distinctly from the aorta.* The two carotids ascend within the subclavians, along the sides of the trachea; and when they have reached the larynx divide into two principal branches, the internal and external

* For a beautiful display of the arteries, see the volume of plates, published by Charles Bell, 1801. Dr. Thornton's large plates of the heart, &c.

carotid. The first of these runs a little way backward in a bending direction; and having reached the under part of the ear, passes through the canal in the os petrosum, and entering into the cavity of the cranium, is distributed to the brain and membranes which envelope it, and likewise to the eye. The external carotid divides into several branches, which go to the larynx, pharynx, and other parts of the neck; and to the jaws, lips, tongue, eyes, temples, and all the external parts of the head.

Near the corner of the mouth the artery is serpentine in its course, which is accounted for thus; that it may afford distention to the mouth, without the sides of the artery being compressed. By falls, or what are often thought slight incidents, the arteries of the brain are liable to burst, the consequence of which is mortal: hence, a trip of the feet by orange-peel, or vegetables, or the pulling the chair from a person about to sit down, (a trick which merits the most severe reprehension) may be productive of the most serious effects.

The superior scapular artery lies so across the neck, that it is liable to be cut, by a sabre; and in a big man it is of such a size, as to pour out a great a great quantity of blood. It is necessary for the surgeon to remember this, its long course over the shoulder, at what place it arises, within the chest, and how it may be compressed.

The right subclavian artery, is supposed larger than the left; and goes in a more direct course; the peculiar form or direction of this artery propably gives to the right arm a superior dexterity and strength. When horses are to be broken the chief difficulty consists in teaching them to move equally with both feet, for they prefer the right; when a dog trots, or when he digs the ground, he goes with his right side foremost, and digs chiefly with his right foot; and in these creatures we find the same arrangement of these arteries as in ourselves. But the question respecting the preference of one hand to the other, has not yet sufficiently engaged the attention of naturalists.

Each subclavian is divided into a great number of branches. It sends off the vertebral artery, the mammary, phrenic, intercostal, &c. when it reaches the axilla, however, it is still a considerable artery, where it drops its former name, and is called *the axillary* artery, alluding to its passage under the clavicle; from which a variety of branches are distributed to the muscles of the breast, scapula and arm.

But its main trunk named *brachialis*, runs inside the arm, and going under the *biceps* muscle, pursues nearly the direction of the seam of the coat sleeve. The artery in its whole course is so near the bone, that a slight compression will stop the flow of the blood, but in passing under the axilla, it is defended by such strong muscles, that persons may support themselves on crutches, without injuring its circulation, though indeed their arms generally become smaller: when it reaches the joint of the fore-arm, it then divides into the *radial* and *ulna* branches, this is sometimes higher, sometimes lower. When it happens to divide above the joint, it is fortunate in case of accident by bleeding; for if the artery were cut, and the blood could only be stopped by a ligature, one branch would remain unhurt, through which the blood would pass uninterrupted to the forehand and arm. One branch plunges down under the flexor muscles, along the side of the ulna; the other goes to the outer surface of the radius, and is easily felt at the wrist, where we commonly feel its pulsation, and where it is only covered with the common integuments.*

integuments.* Both these branches commonly unite in the palm of the hand and form an arterial arch which detaches branches to the fingers. In the hand these arteries have a variety of communications, and in general in proportion to the danger of obstruction from the action of the muscles, or their situation.

---

* Dr. Heberden has given some observations on the pulse (Lon. Med. Tran.) by which he proves in how few cases it can be depended upon.

The pulse of a child, under two years old, should be felt whilst it is asleep; and the following are the mean rates of the pulse.

On the day of birth, - - -	130 *to* 140
First year, - - - - - - -	110—120
Second year, - - - - - - -	90—100
3d. 4th. 5th. and 6th. - - -	90—108
Seventh year, - - - - - -	72—80
Twelfth year, - - - - - - -	70—and a few more.
Adults, a little below - - - -	60 *to* 80.

A full meal quickens it 10 or 12 pulsations; a variation of 10 indicates disease in the system; that number below the natural standard shews an affection of the brain. In any inflammatory fever, 120 is a dangerous pulse; *except* in an acute rheumatism, the pulse rises to 120; and to 150 before the appearance of a critical swelling, without danger.

Abstract of Lec. on Anatomy, &c.
By Mr. Baker, 8vo. Brett, 1784.

The muscles in their action have the effect of stopping not only the small branches, but even the large branches running betwixt them: as by acting strongly with the muscles of the humerus, the pulse may be stopped without any other pressure.

The aorta having thus at its curvature given off the carotids and subclavians, which convey the blood to all the upper parts of the body, descends upon the bodies of the vertebræ, a little to the left, as far as the os sacrum; where it drops its name by dividing into two branches; from its curvature to this point, it sends off several arteries, as the bronchial, arteriæ osophageæ, inferior intercostal, diaphragmatic, the cœliac, from whence comes the coronary, stomatic, splenic, and hepatic arteries; the superior mesenteric; the emulgents which go to the kidneys; those which go to the glandulæ renales; the spermatic; the inferior mesenteric; going to the lower portion of the mesentery, and large intestines, a branch of which goes to the rectum, and is called internal hemorrhoidal and the lumbar arteries, with a small branch called the *sacra*, which are distributed to the muscles of the loins, and abdomen, and to the os sacrum and medulla spinalis.

The

The trunk of the *aorta* when it has reached the last vertebræ lumborum, or the os sacrum, drops its name, and separates into the branches termed Iliacs, each of these soon divide again into the internal Iliac or hypogastric artery, which runs upon the contents of the pelvis, and the muscles on its outer side. One branch called pudenda communis, sends those called hæmouhoidales externa, and afterwards is farther distributed. The other branch, the external Iliac, after giving off the circumflex artery of the os ilium and epigastric, which goes to the recti muscles, passes out of the abdomen under pouparts ligament, and is now called the *crural* artery, which descends to the inner part of the thigh, close to the os femoris, sending off branches, and then sinking deeper in the hind part of the thigh reaches the ham, when the artery passes over the bone and the pulsation may be easily felt, and the artery compressed; here it takes the name of *popliteal*. After this it separates into two considerable branches, the first of which the tibialis antica, passes over the extremity of the tibia, where its stroke may be felt, and in this place we may try the experiment of the stroke of the artery, being at a different time, in the parts distant from the heart, than those near it. Another branch is the fibular, which passes nearer the bone than the

 tibial,

tibial, and hence often causes a difficulty in tying it. This artery and the tibialis postica have frequent communications with one another, and with the tibialis anticus all their course downwards. All these arteries communicating in the foot, form an arch, which is just the same as that in the hand, except that there are two arches in the hand, and but one in the foot. There are also numerous other communications running between the bones, which are lodged there for protection. From the description of these arteries in the legs, it is evident, that the operation for an areurism may be performed with certainty of success, any where below the knee, and it has been done successively.

The blood which is thus by the aorta distributed to all parts of the body, is brought back by the veins, which begin where the arteries end, and uniting as they approach the heart, form those large veins called *vena cava ascendens*, and *descendens*.

All the veins which bring back the blood from the upper extremities, and from the head and breast pass into the vena cava descendens; those which return it from the lower parts, open into which the cava ascendens; the two cavas uniting as they approach the heart, open by one common orifice into the *left auricle*. Every artery is accompanied by its vein; but in the extremities, and some of the deep-seated, and superficial ones, they take a course different from that of the arteries. In the arms are two sets of veins, one clearly accompanying the arteries, and more numerous, and another subcutaneous; the use of this is, that the valves of the veins are not sufficient in a strong continued action of the muscles to prevent the stoppage of the circulation. Now the subcutaneous veins, are not subject to the action of the muscles, and these two sets of veins communicate in many places; this explains the use of acting with the muscles of the hand in bleeding, as this prevents the course of the blood in the deep veins, and consequently increases it in the subcutaneous.

In the lower extremities are two sets of veins, but they are fewer than in the upper extremities; they perhaps accompany the *artery* closer here, that the motion of the blood upward may be assisted by its stroke: which is necessary, both from the gravity of the blood, and as the muscles of the lower extremities are more longitudinal, and there is less danger of compression of veins in the lower extremities than in the superior, from there being less variety in the action of the muscles. The veins throughout the body have the thickest coats where they run among muscles, and where they are most liable to compression; hence those in the *inferior extremities* have thicker coats than those in the superior, as they are subject to a greater degree of pressure from the weight of the column of the blood. Many instances occur of the effects of weight of column; thus, if a person is of a dropsical habit, the inferior extremities will become anasarcous sooner than the superior, because the pressure being greater, the liquor is more pressed out from the exhalent vessels: this difference of thickness in the coats is a sufficient proof of the force of the heart not being so great as some imagine; for otherwise the effect of weight of column would be so inconsiderable, in proportion, as not to occasion any difference of structure. Wounds and ulcers in the lower extremities are more difficult of cure than in other parts, which is probably owing to the same cause; and for this reason, rest and a reclined posture is necessary in these cases; though, under certain circumstances, exercise, by exciting the parts to a new action, has forwarded granulation and a cure.

From

From the veins at the back of the hand the largest branches run along the *radius,* and uniting, form the cephalic. Those of the ulna are less, and being connected, form the basilic. Those of the middle of the hand run up, and form the median, which below the joint divides, one branch going to the cephalic, the other to the basilic. Any visible vein may be opened, yet from their situation danger attends many, and therefore the median vein is considered as the most eligible, being also steady under the pressure of the finger *.

The veins which accompany the carotid arteries are termed jugular.

A vein termed *azygos*, in the thorax, is a pretty considerable one; it runs on the right side of the vertebræ of the back, and is chiefly destined to receive the blood from the intercostals, and to convey it into the cava descendens. In the abdomen there is a vein still more remarkable, and this is the vena portæ, which acts both as an

* A contrary practice prevails in Spain; few of the Spaniards, the women especially, are bled in the arm: this operation is generally performed in the hand or foot.

Bourgoanne's Travels, 8vo. 1789.

artery

artery and a vein. It is formed by a re-union of all the veins which come from the stomach, intestines, &c. so as to compose one great trunk, which goes to ramify through the liver, and after depositing the bile, its ramifications unite, and bring back into the venæ cava, not only the blood which the vena portæ had carried into the liver, but likewise the blood from the hepatic artery.

Every artery has its corresponding vein, but the trunks and branches of the veins are most numerous. For as the blood, in its course through the veins, is much farther removed from the source and cause of motion in the heart than in the arteries, so its course is consequently less rapid, and enough of it could not possibly be brought back to the heart in the moment of its dilatation, to equal the quantity which is driven into the arteries every contraction; and the equilibrium, which is so essential to the continuance of life, would be destroyed, if the capacity of the veins did not exceed that of the arteries in an adequate proportion.

A large artery ramifying through the body, and continued to the minute branches of veins, which gradually unite together to form a large trunk, may be compared to two trees united to each

each other at their tops; or rather, as having their ramifications so disposed, that the two trunks terminate in one common point; and if we farther suppose, that both these trunks and their branches are hollow, and that a fluid is incessantly circulating through them, by entering into one of the trunks, and returning through the other, we shall be enabled to conceive how the blood is circulated through the vessels of the human body.

Every trunk of an artery, before it divides, is nearly cylindrical, or of equal diameter through its whole length; and so all its branches are when examined separately. But every trunk seems to contain less blood than the branches into which it is separated; and each of these branches probably contains less blood than the ramification into which it is divided; and the same with the veins; the volume of their several ramifications being found to exceed that of the great trunk which they form by their union. The return of the blood to the heart is promoted by the action of the muscles, the pulsations of the arteries, and by the valves in the veins, which constitute one distinction between them and the arteries; these valves permit the blood to flow to the heart, but oppose its return. They are most

frequent

frequent in the smaller veins. As the column of blood increases, they seem to become less necessary; and in the ascending cava there is only one near its origin. The arteries have nervous, muscular, and cuticular coats; which the veins are supposed also to have *, but not being irritable, the muscular fibre is doubted. Both are nourished by still more minute arteries and veins, creeping over and ramifying their whole substance, called *vasa vasorum*; they have also minute branchings of nerves, and these minute branchings, vessels to nourish them.

The arteries are much stronger than the veins, and they seem to require this force, to be enabled to resist the impetus of the blood, and to impel it forwards.

The heart contracting, impels the blood into the arteries, and sensibly distends them; and these vessels again contract, as the heart becomes relaxed, to receive more blood from the auricles; so that the cause of the contraction and dilatation of the arteries seems easy to be understood, being owing in part to their own contractile power, and

* The coats of the blood-vessels are said by a late writer not to be furnished with any *nerves*.

in

in part to the action of the heart; but in the *veins*, the effects of this impulse not being so sensibly felt, and the vessels themselves having little or no contractile power, the blood seems to flow in a constant and equal stream; and this, together with its passing gradually from a small channel into a larger one, seems the reason why the *veins* have no pulsatory motion, except the large ones near the heart; and in these it seems to be occasioned by the motion of the diaphragm, and by the regurgitation of the blood in the *cavas*.

Now, although both the ventricles of the heart contract at the same time, yet the blood passes from one to the other. In the same moment, for instance, that the left ventricle drives the blood into the aorta, the right ventricle impels it into the pulmonary artery, which carries it to the lungs, from whence the pulmonary vein carries it into the left ventricle; at the same time, the blood is returned by the cavas, into the right ventricle, from all other parts of the body. The cause of the action of the heart seems to depend on the stimulus communicated by the blood, or other properties which are capable of first exciting that motion which is continued through life independent of the will. The heart possesses the principle

principle of irritability in a much greater degree than any other muscle of the body.

The pulse is quicker in young than in old subjects, because the former are more irritable than the latter; upon which principle it is, that the pulse is continually quicker in weak than in robust persons *. In a new-born infant the pulse is about 134 in a minute; in middle age from 60 to 80; in extreme old age from 50 to 24. In Greenland, the body is exposed, during long winters, to such cold, that the pulse is reduced to 40 or 50 strokes in a minute.

To the circulation of the blood, rightly and equally performed, we are indebted for life, health, and at last gradual decay. But if by any means the blood in its rotatory motion should be impeded or disturbed, it will become the fruitful cause of diseases and death. So long as the blood and humours of the body are in circulation, life

* The pulse is not affected by electricity, unless by the impulse of shocks, or the irritation of sparks; yet Cavallo and others have asserted to the contrary; but later and more accurate experiments have decided that the pulse is not in the least influenced either by negative or positive electricity. Mr. Wilkinson, from repeated trials, never observed any increase in the circulation, See Note to page 199. on this subject.

exists,

exists, and when it stops, death (generally speaking) succeeds. If the circulation should be performed freely, equably, moderately, and agreeably, so long we remain sound and healthy; but in diseases it is increased, decreased, immoderate, or unequal. Morbific causes are in a great measure productive of diseases, by disturbing and impeding the œconomy of the vital functions, and perverting the secretions and excretions.

The blood contains several saline substances, which appear not naturally constituent parts of it, but are probably introduced with food; for persons eating salt, or taking nitre, may have those salts separated from the blood; but the salt contained in the blood in most considerable quantity, is soda, or mineral alkali.

The whole blood passes through the lungs in the same time as through all the rest of the body; as it passes from the right side of the heart, through the pulmonary artery, into the lungs, before it can enter the aorta, and be sent to the rest of the body.

The quantity of blood passing being the same, the momentum will be less in the pulmonary artery than in the aorta, in proportion to the greater thickness

thickness of the left than right ventricle, though the velocity be the same.

This proposition being laid down, let us next consider the velocity with which the blood moves through the small branches of the pulmonary vessels.

The lungs weigh about a 30th part of the whole body; therefore supposing the number of branches to be the same in an equal portion of the rest of the body as in the lungs, the velocity in the lungs will be 30 times greater; but as great part of the body is composed of parts not having the same degree of circulation of blood; as the earth of bones, and the fat of cellular membrane, deduct half, and say the velocity is 15 times greater; then, though the momentum of the pulmonary artery is less than that of the aorta, yet as the space it is spent upon is much less, we may reckon the momentum also greater in the small branches of the lungs. The arteries of the lungs have a greater and more free communication with the veins than any other part of the body, injections being found to pass easier. The veins of the lungs are without valves, which however is common to those in all places where they are not subjected to the action of the muscles; they

are

are also not so large in proportion to the arteries as in other parts of the body, nay, they are actually smaller than the arteries; the common reason given for which is, that the blood undergoes some condensation in the lungs; but this will admit of another explanation: In the first place, the pulmonary veins are smaller in common with other parts of the left side of the heart, which is partly owing to the structure, and partly to the stoppage which the blood meets with on the right side from respiration, for which reason nature makes it larger, in order to give a diverticulum to the blood when respiration is impeded; and we see that animals which dive under water have a dilatation near the right auricle of the heart: 2dly, the veins being smaller, makes the motion of the blood more difficult, and by this means mixes the blood better, and increases animal heat, which is the chief purpose of the lungs: 3dly, the blood, by passing through small canals with greater velocity, perhaps, stimulates the left side of the heart to contract more strongly than if they had been larger. Dr. Monro informs us, that when he pushed injections with force from the pulmonary artery into the veins, the finer part readily transuded into the cells of the lungs, and a vapour was sent out continually from the lungs, which was found to be poisonous, and contained a great quantity of effete air, which is probably driven from the extremities of the pulmonary arteries: whence it may be concluded, there is a very curious structure in the termination of this artery, enabling it to secrete this fetid vapour: probably it is such a contrivance as in the air-bladders of fishes, which in many does not communicate with any other part of the body, but have a reddish glandular substance within them, by which, perhaps, the air within is separated from the blood.

A great number of small vessels, called bronchial, are found in the lungs, derived in an uncertain manner from contiguous arteries; and from these being never wanting, and the organ into which they pass having the whole blood of the body passing through it, we may conclude that these vessels serve a purpose of great importance.

Their importance seems still greater from considering that the heart itself is supplied with blood from vessels, always rising from the aorta, though they might have as conveniently arisen from the pulmonary artery, and as constantly have returned its blood by veins running into the right side of the heart, or right auricle. The liver also,

besides

besides the number of vessels from the chylopoetic viceræ, receives an artery from the aorta. From the whole it may be concluded that the blood is somehow rendered effete for certain purposes, perhaps for nourishment by a single circulation, and that probably according to ancient opinion, bronchial arteries serve to nourish the lungs.

The bronchial artery communicates with the pulmonary, as by injection may be traced, and in some subjects by dissection; and not with the pulmonary vein, as some suppose; which is improbable, as such a communication is not found between the arteries and veins that are visible; a branch of an artery here from the thinness of its coats, may be probably mistaken for a vein. On account of the frequent communication here, it seems also impossible to distinguish an inflammation of the bronchial from the pulmonary vessels, the bronchial veins terminate in the vena cava.

By the blood some understand not only the fluid in the veins and arteries, but likewise that in the lympheducts, nerves, or any other vessel in the body; because they are all parts of the blood separated from it by the force of the heart, and many of them by the animal mechanism re-

turn

turn to it again after performance of their destined task, and in this acceptation it is taken in the calculations of its quantity in the human body, and its velocities, which because it is requisite to understand a short account is introduced here.

The ventricles of the heart, can each receive one ounce of blood, or more, and being full at their dilation, they throw out that quantity each contraction. The heart contracts about 4000 times an hour, and passes therefore 4000 ounces or 250lb. weight of blood. The common opinion is, that the whole mass of blood does not exceed 25lb. which passes through the heart therefore ten times an hour; that is, about once every six minutes. If the heart contracts 80 times per minute, then 25lb. of blood passes through its ventricles once in 5 minutes or 12 times an hour.

By mathematical calculation 26 feet is the space through which the blood moves in a minute, supposing it were constantly going out of the heart with the same velocity; but because of the dilatation, which is at least half the time of pulsation, there go out 80 ounces in half a minute, and consequently the velocity of the blood is double, moving at the rate of 52 feet in a minute: the blood

blood, moves 5233 times slower in some of the capillary arteries, than it does in the aorta.

The blood is received from the arteries, into the veins, where it still moves slower as it re-turnes to the heart again: the arteries are to the veins, as 324 to 441, and consequently, the blood moves in the veins above 7116 times slower than it does in the aorta. The farther the blood removes from the heart, the slower it returns, and all the blood, which at the same time is thrown out of the heart, does not return at the same time to it again; but, the times are directly as the spaces the blood runs over before it returns to the heart again, and reciprocally as the velocities; and consequently some parts of the blood may be some thousand times longer in returning to the heart than others; and there is no time when all the blood, can be said to have only once circulated; but, if there were any such time, the quantity of blood must be first determined, which is very difficult to do, and not yet agreed upon.

Bleeding to death can never give the estimate of its true quantity: because no animal can bleed longer than while the great artery is full, which will be longer or shorter as the size of the wounded artery; and the aorta must always be the first vessel that empties. Dr. Keill upon a curious calculation of the proportion which the cavities of the vessels of the whole body bore to the thickness of their coats, found in the least of the proportions, that the liquor was one half the weight of the body; and if a calculation be made on the proportion of the blood in the arteries, to their coats, in a body weighing 160lb. there will be found 100lb. of blood.

From the blood all the organs are supplied with the peculiar juices they demand *. It is this humour which receives the product of digestion from the stomach, which it elaborates and animalizes. It is with reason considered as the focus of life. The difference of temperaments with regard to the passions, has been attributed to it, by philosophers. It is in vain that physicians (observes M. Chaptal) have changed their system; for the opinions of the people have been less versatile, and they have contrived to attribute all the shades of temperament to the modifications of the blood. It is likewise to the alterations of this humour that physicians have for a long time, ascribed the cause of almost every malady †.

* Chaptal.

† Blood drawn from a person labouring under inflammation, is soon covered with a white crust generally called its buffy coat, and which characterises it during inflammation.

The blood varies in the same individuals not only with regard to the state of health, but at the same instant; the blood which circulates through the veins, has not the same intensity of colour, nor the same consistence, as that of the arteries; that which flows through the organs of the breast, differs from that which passes languidly through the viscera of the lower belly.

The blood differs also, 1st. according to age—in infancy it is paler and less consistent, 2d. according to temperament—sanguine persons have the blood of a vermillion red; in the phlegmatic it is paler; and in the choleric it is more yellow. The temperature of the blood, is not the same in the several species of animals, some have the blood hotter, and some colder, than the medium in which they live. Animals with lungs have the blood redder, and hotter, than those which are without that organ, and the colour and heat are in proportion to the extent and perfection of the lungs.

Blood is a fluid of a rich and beautiful colour; it is vermillion coloured in the arteries, strong purple in the veins, and black, or almost so at the right side of the heart; it feels thick and unctuous betwixt the fingers, is of a slightly saline taste, and is various, in various parts of the body.

Seneca thought that the red globules of the blood, were of an oval form; Mr. Hewson supposed they were flat, easily sliding over each other! but Mr. Abernethy, after viewing them attentively with a solar microscope, is convinced that they are spherical.

Blood contains iron; * experiments prove that this metal is capable of entering into the blood by the first passages, since patients who are under a course of martial medicine void it by the way of urine. When the coagulated part of the blood has been washed, if that part which has retained the colouring matter, be burned, and the coal be lixiviated, the residue of this lixivium, is in the state of saffron of mars, of a fine color and usually obedient to the magnet. The colour of the blood has been attributed to iron, and it is very

* Of the Crocus of Iron, one grain can hardly be procured from 400 grains of the red particles of the blood.

According to *Menghini*, the blood of a healthy person contains above two ounces of Iron.

Cadet found the presence of Iron in *Bile;* although others have denied its existence therein.

true

true that the colour appears to be entirely formed of it, for there exists no vestige of this metal, in the washed and discoloured coagulum: but as on the other hand, the blood does not become coloured without the concourse of air, and as oxygene alone is absorbed in respiration, it appears that the colour is owing to *iron calcined by pure air*, and reduced to the state of red oxide.

From this manner of conceiving the phenomena, we may perceive why animal substances are so advantageous in assisting and facilitating the red dye, and why these substances take colours more easily.

The blood in passing through the lungs is *black*, without receiving the influence of the air; and therefore supposed to want the stimulus necessary to excite the left cavity of the heart. *Hook* and *Lower* long since noticed the difference of colour in arterial and venal blood; and it has been since proved, by numerous experiments, that the fine vermillion colour of the former, is produced solely by *vital air*, which it is capable of acquiring even through bladders, the coats of blood-vessels, &c. And lately Mr. Hassenfratz, seems to have proved (vid. Ann. de Chymie, tom ix.) that as this fine red colour is gained by a dis-

 solution

solution of *oxygene* in the arterial blood, so it is lost, and the dark colour of the venal blood restored, by a separation of the oxygene, in consequence of its forming a new combination with the hydrogene, and carbone thereof *.

There is perhaps no bowel of the body of its weight, that receives so much blood, except the Lungs, as the Kidnies, hence we may easily conceive that a great quantity of urine may sometimes be secreted in a short time. A very great proportion of blood passes through the Kidnies; indeed we have every reason to conclude that the whole of the blood passes through them very frequently. The kidnies are absolutely necessary for the continuance of the life of the animal; for it dies very speedily when they become, by disease, unfit to perform their functions; therefore the change which they produce in the blood, is a change necessary for qualifying it to answer the purposes for which it is intended †. In some diseases blood enters into vessels of the animal body, which do not receive it in a *natural state*.

The arteries and nerves of the tongue, compared with other parts are remarkably large; the

* Bancroft's Experim. Research. 8vo. 1794. Vol. 1st.

† Thompson's System of Chemis. Vol. iv.

reason

reason of which may be, that the tongue is, in the first place an organ of secretion, and in the next place, an organ of sensation; 2d. an organ of motion; there is hardly any muscle of the body, except the heart, *and muscles of the eyes*, * that we can use so long without being tired, and the blood-vessels are necessary to this in a secondary way. The vessels hereabout are so situated that while the action of the muscles presses out the liquor of the glands, they also by squeezing the artery, promote secretion.

The veins in the cranium, do not pass through the holes with the arteries, as they do in other places of the body, because on any sudden commotion of the blood, the swelling of the arteries would press the veins against the bony sides of the holes, and cause an extravasation and stagnation of the blood in the brain, which would destroy the machine—the veins in the brain do neither accompany the arteries; but rise from the extremities of the arteries in the cineritious substance of the brain, and go strait to discharge themselves into the sinuses of the dura mater.

* What a pressure is laid upon this tender, exquisite organ, with glass-blowers, printers, watch-makers, &c. &c. and but seldom with fatal effects.

Among the numerous experiments tried with blood, perhaps the most curious, is that of conveying it, out of one body into another. The transfusion of blood, was first hinted by Dr. C. Wren, in 1658, at Oxford; who proposed a method of transfusing LIQUOR into the veins of living animals. In 1666 this hint was improved by Dr. R. Lower, who invented the method of TRANSFUSING BLOOD out of one animal into another. This practice was much tried, and with avowed success—until after two unfortunate experiments, it was prohibited in France, and Rome; and thereby fell into disuse. Professor Harwood has lately made some trials of it on animals at Cambridge, to whom it seemed to impart additional vivacity *.

The name of blood, as before said, has been used in a more or less extended sense by different writers †. Some confine it to the red fluid, which circulates through the veins and arteries of the animal body; others have with propriety, extended it to that fluid, which whether coloured or colourless, is the most abundant in the animal body, and upon the circulation of which the life

* Dr. Harwood published a Treatise on Comparative Anatomy 4to. 1796.

† Cavallo.

of

of the animal principally depends; hence the red colour is not an absolute characteristic of blood; and in fact the blood of certain animals has not the least tint of red: the name of blood has also been given to the fluid which circulates in the vessels of plants.

Our bodies are a congeries of vessels, with their contained fluids; the vascular system is extended to a prodigious subtlety, and as there is not the smallest point of our machine, but what is liable to have some part of it worn away, and unless repaired, would waste, we must be persuaded that there are vessels, which convey nourishment to repair every such part, and that therefore the whole is vascular.

"In vain however will the air expand the lungs, and the heart propel the blood to the extremities of the body, if their efforts are not seconded by exercise for the preservation of life and health. That man was intended for action is from nothing more evident, than from a consideration of the necessity of exercise or labour to guard him against weakness and disease, such is the nature of the human constitution, that without the assistance of these powerful agents, the solid parts must be deprived of their due elasticity, and the fluids become too thick for circulating through the various orders of vessels of which the body is composed *."

Can we view the indefinite number of fibres and fine vessels, the formation of larger vessels, and the several members out of them, and their apt disposition; the mode of reception and distribution, of our nutriment; the effect this has in extending the vessels, and bringing on a full growth and expansion, continuing the motion of the several fluids, repairing decays, and preserving life. Can we view the several faculties of animal existence; the uses of plants to animals; of animals to one another, particularly to men; the care taken of their species, &c.—without looking up with wonder, and reverence, to a gracious author of these things, and a grateful sense of the distinguishing part *we hold in this sublunary state of existence.*

* Dr. A. Thompson's Family Physician, 12mo. 1801; a work of considerable merit and utility as a family book.

CHAP.

CHAP. VII.

ON THE INTERNAL PARTS OF THE BODY.

When I with curious eyes survey,
My complicated frame ;
I read in every part inscrib'd,
My great Creator's name :
With nicest art in secret, God
Did every member write,
And when the model was complete,
My eyes beheld the light.
He bade the purple flood of life,
In circling streams to flow,
And sent the genial heat around ;
Through every part to glow.
My heaving lungs while they have Power,
To fan the vital frame,
Shall sing thy praises, O my God,
Thy wond'rous skill proclaim.

HOW great is the disparity between mankind, and all other animals ! Brutes are wholly guided by their appetites and instincts ; they are not endued with a principle of reason, which is able to curb or controul their natural inclinations. As far as we have been able to judge hitherto, they can make but a small progress, and soon attain all the perfection to which they can ever arrive. They give no signs that they have any ideas of the beauty or grandeur of the universe. They are far from being able to form any notions of God, of religion, or of morality. They have no ideas of an eternal existence, nor any anxiety about a future state. Their hopes and their fears, their passions and their desires, and all things in their internal, as well as external structure, seem wholly adapted to the exigencies of a short and uncertain life. As they neither have any knowledge of another life, nor any anxiety about it, nor longing after it, providence may well be justified, though it has not prepared any higher mansions for their reception; but having raised them up for the greater fulness of the creation, and having supported them as long as was originally intended, leaves them to that final dissolution, which is suitable to their nature, and which is necessary for carrying on the higher designs of the divine wisdom.

The body of an animal is an object adequate to our senses. It is a particular system of providence, that lies in a narrow compass. The eye is able to command it, and by successive enquiries, to search into all its parts. Could the

body

body of the earth, or the whole universe, be thus submitted to our examination, were it not too big for the management of the eye and hand, there is no doubt but it would appear as curious, well-contrived frame, as that of a human body.* We should see (says Addison) the same concatenation and subserviency, the same necessity and usefulness, the same beauty and harmony in all and every of its parts, as what we discover in the body of every single animal,

" All discord, Harmony, rightly understood."

The more extended our reason is, and the more able to grapple with immense objects, the greater still are those discoveries which it makes of wisdom and providence, in the sublime mystery of creation.

A Sir Isaac Newton can look through a whole planetary system, and consider it in its weight,

* In an ingenious work (4to, Crutwell, 1802) by my friend, Mr. *Smith*, Land Surveyor, of Bath, the order and regularity of the various strata of the EARTH is first laid down, in the most satisfactory manner, and will thus prove of the greatest use to various classes of men, as well as convince, that the globe is not a jumble of unconnected parts, but a regular and harmonizing whole.

 number,

number, and measure; and draw from it as many demonstrations of infinite power and wisdom, as a more confined understanding is able to deduce from the system of the human body. Let us consider the texture of bodies, in one view, which shews, the hand of a thinking and all-wise Being in their formation with the strongest evidence of demonstration.

It may be laid down, as an incontestible principle, that chance never acts in a perpetual uniformity and consistency with itself. If we should always fling the same number with 10,000 dice, or see every throw just five times less or five times more, who would not imagine, that some invisible power directed the cast? This is the proceeding which we find in the operations of nature. Every kind of animals, is diversified by different magnitudes, each of which give rise to a different species. In the dog or lion-kind, we may notice, how many of the works of nature, are published in a variety of editions. Among reptiles and aqueous animals are the same repetitions among several species, that differ very little from one another but in size and bulk: The same creature that is drawn at large, is copied out in several proportions, and ends in miniature. It would be tedious to produce

duce instances of this regular conduct of providence, and superfluous to those versed in natural history. The magnificent harmony of the universe is such, that we may observe innumerable divisions running upon the same ground.

This speculation may be extended to the dead parts of nature also, in which matter is disposed into many similar systems, as well in our survey of stars and planets, as of stones, vegetables, and other sublunary parts of the creation. In a word, Providence has shewn the richness of its goodness and wisdom, not only in the production of many original species, but on the multiplicity of descants, which it has made on every species in particular. To pursue this thought still farther, every living creature considered in itself, has many very complicated parts, that are exact copies of some other parts which it possesses, and which are complicated in the same manner. One eye would have been sufficient for the subsistence and preservation of an animal, but to better his condition another is placed with mathematical exactness, to correspond in every particular. Is it possible for chance to be thus delicate and uniform in her operations? Should a million of dice turn up twice together the same number, the number would be nothing

in

in comparison with this. But when we see this similitude in the *arm*, *hand*, and *fingers*, when we see one *half of the body*, entirely correspond *with the other*, in all these minute strokes, without which a man might have very well subsisted; nay, when we often see a single part repeated an hundred times in the same body, notwithstanding it consists of the most intricate weaving of numberless fibres, and these parts differing still in magnitude, as the convenience of their particular situation requires—a man must have a strange understanding, who does not discover the finger of God in so wonderful a work. These duplicates in those parts of the body without which a man might have subsisted, though not so well as with them, are a plain demonstration of an all-wise contriver; as those more numerous copyings which are found among the vessels of the same body, are evident demonstrations that they could not be the work of *chance*. This argument receives additional strength if applied to every animal and insect within our knowledge, as well as those numberless living creatures that are objects too minute for the human eye, and if we consider how the several species in this whole world of life resemble one another, in many particulars, so far as is convenient for their respective states of existence, it is much more probable that one hundred million of dice should be casually thrown one hundred million of times in the same number, than that the body of any single animal should be produced by the fortuitous concourse of matter; and that the like chance should arise in innumerable instances, requires a degree of credulity that is not under the direction of common sense. We may carry this consideration yet farther, if we reflect on the two sexes, in every living species, with their resemblance to each other, and those particular distinctions that were necessary for the keeping up of this great world of life.

Many other demonstrations of a Supreme Being, and of his transcendent wisdom, power, and goodness, in the formation of living bodies, might be adduced—but it is time to attend to the more immediate province of this chapter, which is to treat cursorily on the internal parts of the human body.

The body presents three internal cavities: 1st, the head; 2d, the thorax; 3d, the abdomen, or belly.

1st, The cranium has been described, as inclosing and defending the brain, but that is not

its

its only protection, as this mass is every where surrounded by two membranes, termed the dura and pia mater: the first lines the interior surface of the skull, is perfectly smooth and inelastic, and its inner surface has a fine fluid, which separates it from the pia mater. It sends off several processes, dividing the brain to prevent compressions; one of which is termed the falx. The arterial blood is returned by veins, which all pass on to channels behind these processes. The pia mater is softer, and a finer membrane than the dura mater, being exceedingly delicate, transparent, and vascular. It invests every part of the brain, and sends off an infinite number of elongations, which insinuate themselves between the convolutions, and even into the substance of the brain. There are several parts included under the title of brain, the principal of which only we shall notice, avoiding a tedious and obscure description of their attendant processes, protuberances, sinuses, ventricles, grooves, &c. which would convey but little idea of them.

The greatest part of the cavity of the cranium is filled with the *cerebrum*, or Brain *, properly

---

* Brain is composed of a peculiar matter, differing in many particulars from all other animal substances. It has been com-

so called, of the softest consistence. Another portion, in the inferior and posterior part of the head, is called the *cerebellum*; and a third, derived from these, is the *medulla oblongata*.

The cerebrum is a medullary mass of a moderate consistence, filling up exactly all the upper part of the cavity of the cranium, and divided into two hemispheres by the falx of the dura mater. Each of these is distinguished by the anterior and posterior lobes of the brain. The cerebrum appears composed of two distinct substances. Of these, the exterior one, greyish or ash colour, is called the *cortex*, and is somewhat softer than the other, which is very white, and is called medulla. In a central situation, a small body, about the size of a pea, is called the pineal gland: Des Cartes supposed this the seat of the soul; some moderns have supposed another part, with as little reason, to be its residence, namely, the part called corpus callosum. The pineal gland rests on four remarkable eminences; these tubercles have ridiculous names, as most of the

pared to a soap; but it is plain the resemblance is very faint, as scarcely any oily matter could be extricated from it by Fourcroy.

Thomson's Sys. of Chemis.

inferior

inferior parts of the contents of the cranium have.

The cerebellum is divided into two lobes, and is supposed of a firmer texture than the *cerebrum;* but there seldom appears any sensible difference. It has more of the cortical than the medullary substance.

The medulla oblongata is situated in the middle, lower, and posterior part of the skull, and may be considered as the production or continuation of the whole medullary substance of the cerebrum and cerebellum, being formed by the union of two considerable medullary processes of the cerebrum, and two smaller from the cerebellum *.

The medulla spinalis, or spinal marrow, is that medullary cord which is extended down the vertebral canal, from the head to the last lumbar vertebræ, and is a continuation of the medulla oblongata. Like the brain, it is nicely invested

* Mr. Charles Bell has just published a series of engravings, illustrating the contents of the cavity of the head, and which, from their correct and elegant execution, give a very clear idea of the subject.

by

by delicate membranes, termed dura and pia mater, which support the spinal marrow, that it may not affect the oblongata by its weight. The spinal marrow is externally white, but internally darker, resembling the cortex of the brain. The marrow at the first lumbar vertebræ becomes very narrow, and at length terminates in an oblong protuberance, from the extremity of which the pia mater sends off a prolongation or ligament, resembling a nerve, that perforates the dura mater, and is fixed to the bone called coccygis. The medulla spinalis gives rise to 30 or 31 pair of nerves, but they are not all of the same size, nor do they all run in the same direction. The upper ones are thinner than the rest, and are placed almost transversely; as we descend they run more and more obliquely downwards, till at length their course is almost perpendicular; so that the lowermost nerves are called cauda equina, from its resemblance to a horse's tail.

2dly, The cavity of the *thorax*, or chest, is that cavity which extends from the lower part of the neck to the diaphragm, and includes those vital organs—the heart, lungs, trachea or windpipe, and œsophagus or gullet. It is formed by the ribs and vertebræ of the back, covered with muscles and the common integuments, and be-

fore

fore by the glandular bodies called breasts. The muscular fibres between the ribs are called *inter-costal* muscles, from their situation. The breasts are two large conglomerate glands, mixed with adipose membrane, that is made up of many small distinct glands, in which the milk is secreted from the ends of the arteries. The excretory ducts of these glands uniting as they approach the nipple, form about a dozen milky tubes, which open at its top; they are capable of distension or contraction, but are moderately corrugated, to prevent an involuntary flow of milk, unless the distending force from accumulation be too great. The operation of suction depends on the principles of the air-pump, and the flow of milk through the lactiferous tubes is facilitated from their being stretched out. Milk is composed of oil, mucilage, and water, and a considerable quantity of sugar.

The thorax is every where lined with a membrane of a firm texture, called the pleura, composed of two distinct portions or bags, which joining literally, form a septum called mediastinum, which divides the cavity into two parts, and is attached *behind* to the vertebræ, and *before* to the sternum. The laminæ which form this septum are separated at the lower part to accommodate the heart, and at the upper part, to receive between them the thymus. The *pleura*, like all membranes lining cavities, is supplied with moisture, which prevents adhesions, which when in too great quantity, or not properly carried off, accumulates, and produces the *hydrops pectoris*.

The mediastinum, by dividing the breast, prevents the compress of the lungs when we lie on one side, and consequently contributes to free respiration, when any pressure invades. If a sword passes the ribs into the cavity of the thorax, the lungs on that side cease to act, because the air admitted by the wound prevents the dilatation of that lobe, while the other lobe, which the mediastinum separates, remains unhurt, and performs its usual functions.

The thymus is a glandular substance, whose use is not perfectly known, not having an excretory duct. It is oblong, larger in the fœtus, and children, than in adults, and is nearly effaced in some old subjects. Its situation is the upper part of the thorax.

A fleshy and membranous septum, called the diaphragm or midriff, parts the cavity of the *thorax*

thorax from the cavity of the *belly*. This midriff is, like the heart, in constant action, but its motion is about one fourth less. It is a muscle both of voluntary and involuntary action. Being composed mostly of muscular fibres, it may class with the muscles. Its middle part is tendinous, and it is covered by the pleura above, and by the peritoneum below. It may be easily seen in the animal as suspended in a butcher's shop, running then *horizontally* across the cavity of the body, and commonly called the skirt. It is a chief agent in respiration; when its fibres contract, its convex side towards the thorax becomes flat, and by thus increasing the cavity, allows a complete dilatation of the lungs, by the air filling them in respiration. The fibres of the diaphragm then relax, and the cavity being diminished, the air is driven out, and this is termed expiration. The diaphragm acts in assisting various efforts of nature; and coughing, sneezing, speaking, gaping, and sighing, could not take place without its assistance.

The trachea, or windpipe, is that cartilaginous and membranous canal through which the air is conveyed to the lungs. Five cartilages form its upper part, which is called the larynx; the first of these is placed over the glottis or mouth of the larynx, and is called epiglottis, which closes the

passage

passage to the lungs when we swallow. The fore-part of the larynx is formed by two cartilages, called thyroid or scutiform, and cricoid or annular; both may be felt under the skin at the fore-part of the throat; the convexity of the thyroid forms a visible eminence, called *Pomum Adami*, larger in males than in females. These cartilages, with the assistance of several muscles, dilate and contract the larynx, and perform that variety of motion, which point it out as the principal organ of the voice; for when the air passes through a wound in the trachea it produces no sound.

From the larynx, the canal begins to take the name of trachea, and extends from thence as far as the third or fourth vertebræ of the back, where it divides into two branches, the right and left bronchial tubes, which ramify through their respective lobes of the lungs.

The lungs fill the greater part of the cavity of the breast, are of a soft and spongy texture, and divide into two lobes, separated by the mediastinum, and externally covered by the pleura. Each is divided into lesser lobes, commonly three on the right, and two on the left. The ramifications of the bronchi, becoming more and more minute, at length end in the cellular spaces which form the greater part of the lungs, and readily communicate with each other.

Two series of arteries carry blood to the lungs, which possess but little sensibility. The bronchial arteries nourish them, and the bronchial vein returns the blood to the vena azygos. It is singular, but the pulmonary artery and vein are not intended to nourish the lungs, but the blood passing them, undergoes such changes, and acquires from the atmospheric air such principles, as are of the utmost importance to animal life. On this subject the reader may refer to the works of Dr. Beddoes, Thornton, &c. in which are displayed the most important results, from the recent discovery of the function of the lungs, as to their contact with the air *.

The pulmonary artery has the blood from the right ventricle of the heart, and dividing in two, accompany the bronchi every where by its ramifications

* The blood, as it passes through the lungs, absorbs a portion of air, and carries it along with it through the blood-vessels. During the circulation, this air is gradually decomposed by the blood, its oxigene and part of its azote entering into new combinations, while at the same time a portion of azote, of carbonic acid

fications through the lungs; the blood returns by the pulmonary vein, which gradually forming a considerable trunk, goes to the left ventricle of the heart; so that the quantity of blood sent to the lungs, exceeds that sent to any other part in the same time.

In the cavity of the thorax are also the pericardium and the heart. The two membranous bags of the pleura, which form the mediastinum, recede one from the other, so as to afford a lodgment to a firm membranous sac, in which the heart is securely placed, called the pericardium, composed of two tunics, united by cellular membrane.

This bag adheres to the diaphragm, and contains a liquor which lubricates the heart. It is usually large enough to contain the heart loosely. As its cavity does not extend to the sternum, the

---

acid, and water, is evolved. When the blood returns to the lungs, it absorbs a new dose of air, and at the same time lets go the azotic gas, carbonic acid gas, and watery vapour, which had been formed during the circulation. The same changes are again repeated, and the same substances emitted, every time the blood goes to the lungs.

System of Chemistry, by Thomas Thomson, vol. iv. p. 497.

lungs cover it in inspiration; and as it every where invests the heart, it secures it from being injured by any fluid extravasated into the cavities of the thorax.

The heart is a hollow involuntary muscle, of a conical shape, situated transversely between the laminæ of the mediastinum, at the lower part of the thorax; its *basis* to the *right*, its *point* or *apex* towards the left side. Its basis, from which the great vessels originate, is covered with fat, and it has two hollow and fleshy appendages, called *auricles*. The heart includes two cavities, termed the right and left ventricles, separated by a fleshy septum:—of the uses of these particular parts we have before spoken *. The heart is the strongest muscle in the body; in all creatures it survives for a long while the death of the body: for when the creature has died, and the breathing and pulse have long ceased, and the body is cold; when the other muscles of the body are rigid; when the stomach has ceased to feel; when the bowels, which preserve their contractile power the longest, have ceased to roll, and they also feel stimuli no more—still the heart preserves its irritability; it preserves it

* See Chapter VI. on the blood-vessels.

when torn from the body and laid out upon the table; heat, caustics, sharp points, excite it to move again.

The heart is supposed, in popular language, (says Dr. Johnson), to be the seat sometimes of courage, sometimes of affection, sometimes of honesty, or baseness.

The following Sonnet, on the HEART, *was presented by a Gentleman of considerable poetic and literary talents.*

ON THE HEART.

A SONNET.

BY MR. W. H. I———

1.

In every mortal form resides
   The panting source of breath;
'Tis thence the purple current glides;
   There centers life and death.

2.

This flutt'ring pris'ner can impart
   To man extatic joy;
'Tis the sensations of the heart
   Yield bliss, or bliss destroy.

3.

Thence flows the agony of grief,
For kindred, parent, friend;
'Tis this alone can yield relief,
And pitying comfort lend.

4.

But, ah! more potent far than this
Is what we all must prove,
When we experience the soft bliss
Which flows from tenderest love.

5.

'Tis there the urchin's arrows fly
Which raise the warm desire;
From thence bursts forth the fev'rish sigh,
When rapture fans the fire.

6.

Thus kindles in the heart each glow
That warms our senseless clod;
From thence the gen'rous feelings flow
Which stamp us Sons of God.

May, 1802.

The heart, though somewhat confined by the pericardium, rolls about in the thorax: we turn to our left side in bed, and it beats there; we turn over to our right side, and the heart falls back into the chest, so that its pulsation is no where to be perceived; we incline to our left side again, and it beats quick and strong.

The

The stimulus of aliment upon the stomach, and of blood upon the heart and arteries, probably cease to be felt only from the influence of habit. The exercise of walking, which was originally the result of a deliberate act of the will, is performed from habit without the least degree of consciousness.

The next cavity is the *Abdomen* or belly, which begins at the pit of the stomach, and extends to the lower part of the trunk. The upper part is termed the epigastric region, the middle the umbilical, and the lower the hypogastric regions. The centre of the first is called epigastrium, its sides hypochondria; the centre of the middle region is from the navel called umbilicus; its sides the flanks, or iliac regions. The centre of the lower division retains the name of hypogastric, and its sides the inguina or groins. The back part of the abdomen is termed the lumbar region. The belly contains many of the principal parts of the human body.

A membrane, called the peritonæum, envelopes all the viscera of the belly. On opening this, the omentum or cawl is seen floating upon the intestines, which are loose and moist, and make a great number of circumvolutions. The

 stomach

stomach is placed in the epigastrium, and under it is the pancreas. The liver fills the right hypochondrium, and the spleen is in the left. The kidnies are about the middle of the lumbar region, and the bladder and pudenda in the lower division.

The peritoneum is a strong simple membrane, capable of considerable extension; it is kept smooth and moist by a vapour exhaling from its inner surface, and which is returned again into the system by the re-absorbents. When this fluid is too abundant, or not re-absorbed, it produces a dropsy in the belly. It is not very vascular, and seems to possess little or no feeling. It prevents the attrition of the viscera upon each other, and envelopes almost the whole.

The omentum or cawl is a double membrane, produced from the peritoneum; it is interlarded with fat, and adheres to the stomach, spleen, and those intestines called the duodenum and colon; from thence hanging down loose, and floating on the surface of the intestines; its softness may prevent adhesions of the viscera, and serve other uses which cannot at present be satisfactorily stated. The fat is distributed very unequally in the omentum, being in some places

very

very thin and transparent, in other parts an inch thick. The cawl in calves will give a beautiful representation of this fact; it may be noticed in butchers shops stuck on certain joints.

The stomach is a membranous and muscular bag, shaped not unlike a bagpipe, lying across the upper part of the abdomen, inclining rather more to the right than the left side. It has two orifices; the left, or upper one, called *cardia*, which receives the food from the gullet; and the right and inferior one, called the *pylorus*; both these are more elevated than the body of the stomach; the last commences the intestines. The tomach has four coats; membranous, muscular, nervous, and within these the villous, forming the inside; this is always moistened by a mucus, called gastric juice. The whole alimentary canal likewise is composed of four coats. The human stomach, and still more remarkably, the organs of digestion in certain animals, have the power of counteracting a *septic* (putrid) tendency; but this power (in our stomachs at least) is very limited. Besides the more obvious mechanical uses of the stomach, it possesses most important functions in other respects. It will convey actions to the most remote part of the system for its benefit, and will be also affected by sensations induced on different parts distant from itself; so close is its union with other parts, and its sympathy with the well-being of the frame *.

The œsophagus, or gullet, is a membranous and muscular canal, extending from the bottom of the mouth to the stomach; its upper part, where the aliment is received, is shaped somewhat like a funnel, and is called the pharynx. It passes close to the bodies of the vertebræ, as far as the diaphragm, through which it passes, and terminates in the stomach, about the twelfth vertebræ of the back.

The intestines form a canal, usually six times longer than the body to which it belongs. Though but one long circumvoluted canal, the upper portion is called the small intestines, and the lower portion the large intestines.

The first are divided into the *duodenum*, *jejunum*; *ilium*: the other into *cæcum*, *colon*, and *rectum*.

The duodenum is so called, from being twelve finger-breadths long; jejunum from being com-

* See this illustrated more at length, in Dr. Wallis's Treatise on Diseases, 8vo. 1796.

monly

monly found empty; ilium, from being supported in part by the bones called ilia. They are supplied with mucus from clusters of glands, termed *Peyer's*, from their discoverer. By a peculiarly salutary contrivance, the contents of the stomach, when it passes the ilium to the cœcum, and becomes putrid, are prevented effectually from returning, and thereby tainting the chyle in the small intestines, or throwing up offensive matter into the mouth, which might otherwise happen. The intestines are not left to move at random in the cavity of the abdomen, but are artfully tied down by a membranous web which prevents their entangling; at the same time allowing them a gentle but limited motion. That part connected with the small intestines is called *mesentery*; the other part, fastened to the colon, *mesocolon*. The rectum has a particular membrane allotted to itself for fixing it *.

The

* The intestines of animals, when manufactured and prepared, form an article of export. In London (1802) about ten manufactories exist of this kind; about 50 ton is probably annually exported from London, and 25 from Ireland. Ox gut is sent to Italy, to stuff their high-dried meats, called German sausages. Sheeps gut is used in England for clock-lines, bow-strings for hat-makers, door-pullies, laths, &c.; and lambs gut for the finer sort of work for whips, having a finer colour when finished. We import fiddle-strings from Italy, as

 our

The middle and fore parts of the belly are filled with the small intestines, while the larger ones fill the sides, and the upper and lower parts. The duodenum is the first, beginning at the pylorus and ending at the jejunum, where the canal is more empty than in other parts. The ilium is longer, than both the former, and takes its name from its circumvolutions which cover the first large intestine ; named cœcum ; the cœcum seems properly to belong to the next, the colon, being a kind of pouch, about four fingers wide and long, with a small exterior appendix. It is situated in the cavity of the os ilium on the right side, and ends in the colon, the largest intestine of all *.—This ascends by the right kidney to which it is attached, passes under the hollow part of the liver, and bottom of the stomach to the spleen; to which, and to the left kidney it is secured, and passing down to the os sacrum from its straight course takes the name of rectum. The inner coats of the intestines being more extensive than their outer coats,. form internal plaits, which retard their contents and afford a

our sheeps gut is too fat for the purpose ; the leaner the gut the stronger they are supposed to be. In Wales and Scotland no use of this kind is made of the intestines of animals.

* The colon of an Elephant extends to the great size of 15 or 20 feet in length, and two or three in diameter !

greater

greater surface for the absorption of the chyle, and prevent the return of the aliment upwards.

A valve larger than the rest is found where the ilium joins the colon, which permits the food to descend, but opposes also its return, and by this clysters are prevented from passing into the small intestines. The use of the appendix of the cœcum, has not been discovered. Birds have two of them. The intestines are guarded from any irritation from the aliment, by a constant supply of mucus, which when it takes plače in a certain degree is called the colic, from its chiefly being in the colon. The intestines are likewise frequently distended with air, (particularly the *colon* in the *tympany*) this sometimes occasions pain, and constitutes the flatulent colic. From examining the structure of the human organs, it is clear nature has designed men for a mixed aliment, and that neither vegetable, nor animal food alone, is his proper nourishment. His teeth, stomach, and intestines, give evidence of this, for by the first he appears equally a carnivorous, and graminiverous animal; by the second he approaches to the carnivorous, and by the third he shows an union of both.

It is most probable that our first food was of the vegetable class, in the selection of which man was directed by experience, led to it from the smell and taste, and the support and increase of strength from thence consequently would confirm their use. But beasts being troublesome to the cultivators of the earth, and vegetable diet not being proper to support sufficiently those who were employed in such labour, the flesh of animals made a necessary addition, of which we find, a great variety are appropriated at present as common food, and the catalogue of which luxury hath, in no small degree augmented *.

* Nor is man less capable of subsisting on a great variety of *aliments*, than he is able to endure a great difference of *climate*; the former of which circumstances as well as the latter, is properly adduced, by naturalists, as a great presumption, that he was intended by nature to inhabit every part of the world.

Animal diet, by the firmness and tone of fibre, and the constant steadiness and resolution which it conveys, is perhaps better adapted to the common business of life, than a diet which produces a greater degree of sensibility. Man is formed more for action than for contemplation; for bodily exertion more than mere mental researches; and the firm and tense fibre, which is adapted to the former, is inconsistent with the delicacy of sensation necessary for the latter. The most valuable state of mind is somewhat of a medium between the two.

Falconer on Climate, 4to. 1781.

The

The mesentery is a fat membrane placed in the middle of the abdomen, and which keeps the intestines from entangling; it is almost *circular*, with a narrower production which attaches the colon and rectum. It is about four fingers and a half breath, in diameter; its circumference being full of plaits and foldings, is about three ells in length. The intestines which are tied like a border on this circumference, are about 8 or 9 ells long; so that to every inch of the circumference of the mesentary, there are three inches of the intestines fastened. The mesentery itself is strongly tied to the three first vertebræ of the loins. Through this a variety of arteries and veins pass directly to the intestines, where they are spread in extremely fine branches on its coats *.

The lacteal and lymphatic vessels likewise run on the mesentery, which here also pass several conglobate glands, in their way to the thoracic duct.

On dissection, the lymphatic vessels will be found immediately under the true skin. They are more superficial than even the veins and

* As may be seen in preparations, where these vessels are observed so exquisitely small, as to excite our astonishment!

nerves,

nerves, running in strait lines, only partially seen, or frequently broken by interrupting pellicles of fat. When injected they take a very peculiar appearance; for they swell only betwixt their valves, which makes them appear like beads irregularly joined. Their fluids are accelerated by the actions of the muscles.

In infancy the arteries are numerous and large in respect to the veins, and the lymphatic glands are larger than at any other time of life; whereas in old age, the capacity of the venous system, exceeds that of the arteries, and the lymphatic system almost entirely disappears. Lymphatic vessels are difficult to demonstrate, therefore less known than the sanguiferous system: they are supposed to possess a muscular power, although muscular fibres are not discovered in them, for otherwise we cannot account for the *motion of fluids in them*: for in the *veins* the blood *is propelled by the power of the arteries.* An Italian philosopher has lately made some discoveries in the absorbent system, and found a new method of injecting of them *.

* The curious investigator of the animal œconomy, will be highly gratified by the perusal of the works of Mr. Sheldon, and Mr. Cruickshanks, on this subject.

The pancreas is a conglomerate gland placed behind the bottom of the stomach, towards the first vertebræ of the loins; shaped like a dog's tongue; with one point stretched to the spleen, the other towards the duodenum. It is about 8 fingers breadth, long, three wide, and one in thickness. This viscus is of a yellowish colour, somewhat inclined to red. The many little glands of which this is composed, sending out a duct each, at length form its common excretory duct, in the middle, which opens into the duodenum, sometimes by the same orifice as the biliary duct, and sometimes by a distinct opening. Its liquor is mild and insipid, somewhat like saliva, and serves to dilute the alimentary pulp, and to incorporate it more easily with the bile.

The *liver*, is a viscus of considerable size, of a reddish colour, convex before, where it is placed under the ribs and diaphragm, and of unequal surface behind. It is chiefly in the right hypochondrium, and under the false ribs; extending also into the epigastric region, where it borders upon the stomach. It is covered by a production of the peritoneum, which attaches it to the false ribs. The antients thought the liver was destined to prepare and perfect the blood, but it

is

is now evinced to be a glandular substance formed for the secretion of the bile.

The liver is supplied with blood by the hepatic artery and vena portæ. The vena portæ as it is ramified through the liver does the office of a vein and artery; for like the former it returns the blood from the arteries, while as the latter it prepares it for secretion. Two drachms of bile, and no more, in the opinion of Keill, are hourly separated from the liver.

The bile is conveyed from the liver by small ducts, which at length form a large one, called ductus hepaticus. The gall bladder is a little membranous bag, shaped like a pear, and attached to the hind and almost lower part of the liver. The neck of the gall bladder is continued in a canal called ductus cysticus, which soon unites with the ductus hepaticus, through which the cystic and hepatic bile enter the duodenum.

The bile is a natural liquid soap, somewhat unctuous and bitter, yellowish, mixing easily with water, oil, and vinous spirits, and capable of dissolving resinous substances. It blends the alimentary mass, by dividing and attenuating it; corrects the disposition to acescency, and by its acrimony

acrimony tends to excite the peristaltic motion of the intestines. The two kinds of bile from the gall-bladder and hepatic duct, do not much differ; for the hepatic bile is milder and more liquid than the cystic, which is thicker and yellower, and by being bitterer, seems to possess greater activity. In obstructions of the cystic duct, the gall-bladder has been found shrivelled and empty: so that we may consider the gall-bladder as a reservoir of hepatic bile, and that the bile in the gall-bladder is derived from the liver; that it passes from the hepatic, to the cystic duct, and from that to the gall-bladder; the difference in the bile being the effect of stagnation and absorption. When the stomach is distended with aliment, this reservoir undergoes a certain degree of compression, and the bile passes out into the intestinal canal, and in the efforts to vomit also pours out its contents. The bile besides its uses in the intestinal canal, conveys certain superabundant principles out of the blood.

The *spleen* is a soft spungy viscus of a bluish colour, about 6 fingers breadth long, and 3 wide, situated in the left hypochondrium, between the stomach and false ribs, towards which it is convex, to the stomach, concave. Its use has been till lately unknown: Dr. Haighton first discovered

vered its true office to be that of assisting the Pancreas in its duty: * the stomach being distended with food, presses on the spleen, and thereby occasions a greater quantity of blood to pass into the pancreas, and consequently a greater increase of the secretion from that viscus.

The spleen has no excretory duct.

The *glandulæ renales*, are two irregular flat bodies, one on each side between the kidney, and the aorta. In the fœtus they are as large as the kidnies, but do not increase in proportion, and adults are generally shrivelled, their use is not perfectly known.

The kidnies are two, one on each side the lumbar region, between the last false rib, and the os ilium, resembling a kidney bean. Their concave part is towards the aorta and ascending cava. They are surrounded by a great deal of fat, as we may readily observe when we buy a loin of

* Dr. Yeats in his Claims of the Moderns, quotes the writings of Dr. Mayow (a cotemporary with Boyle) and Dr. Stukely who published a volume on the subject in 1723, to shew *that they* considered the use of the spleen to be, as an auxiliary to digestion, &c.

mutton, and receive a coat from the peritoneum, when this is removed a very fine membrane is found investing their substance. The water is conveyed from the hollow part of the kidney by canals called *ureters* into the bladder; these are each the size of a common goose quill. They are curved in their course to the bladder, which they enter obliquely, which promotes the discharge while its return is prevented.

The bladder is a membranous and muscular bag of an oblong shape, situated in the pelvis, between the pubis and rectum in men, and the pubis and *uterus* in women. The upper and widest part is called the bottom, and the narrow part the neck. The bladder continually receives from those glandular bodies the kidnies, that saline fluid we call urine, when a small quantity is collected in the bladder it excites no uneasiness, but when a larger quantity distends it, it brings on a voluntary disposition to contract itself, and to discharge its contents. It having been observed that after drinking light wine, or *spa-water*, that it very soon passed off, some have supposed that it was not altogether conveyed to the bladder by the ordinary means, but that it must have some shorter course of circulation; but this is an erroneous supposition. It is sufficiently proved that all that passes is secreted from the *emulgent arteries* by the kidnies, and from thence is conveyed, through the ureters, to the bladder. It is true that wine, gin, and other liquors, promote a speedy evacuation of urine, but the discharge is merely the effect of the stimulus they occasion, by which the parts are solicited to a more copious discharge of what was before in the body, and not immediately that which was last drank; and this increased discharge, if the supply is kept up, will continue; nor is this wonderful, if we consider the great capacity of the vessels that go to the kidnies; the constant supply of fresh blood that is essential to health, and the rapidity with which it is incessantly circulated through the heart to all parts of the body, as has been before explained.

The various parts thus familiarized to your attention, differ very materially in size, situation, use, and texture; yet they are only different modifications of those parts of the system before spoken of; being all made up of muscular flesh, nervous fluid, arteries, veins, membranous and oleaginous matter, variously combined, in greater or less proportions, as best answers the purpose.

pose*. No one part can be altered, or made any way different, more simple, or more compound, so as to produce every effect they do at present; and it is beyond the limits of the greatest human faculties to demonstrate or to have any idea of a terrestrial being, that, with more or less degrees of animal powers, could possess equal or superior harmony and happiness, than we with our present system enjoy.

Of all the different systems in the human fabric, the use and necessity are not more apparent, than the wisdom and contrivance which has been exerted in putting them all into the most compact and convenient form; in disposing them so, that they shall mutually receive and give help to one another; and that all, or many of the parts, shall not only answer their principal end, but operate successfully and usefully in a variety of secondary ways. If we consider the whole animal machine in this light, and compare it with any machine in which human art has exerted its utmost, we

* All the animal functions appear to reduce themselves to the transformation of the *fluids*. In the manner in which these transformations are produced, the real secret of the admirable œconomy of animals consists, as health depends upon their perfection and regularity.

shall be convinced, beyond the possibility of a doubt, of an intelligence and power far surpassing what humanity can boast of. One superiority in the natural machine is peculiarly striking:—in machines of human contrivance or art there is no internal power, no principle in the machine itself, by which it can alter and accommodate itself to any injury which it may suffer, or make up any injury which admits of repair; but in the natural machine, the animal body, this is most wonderfully provided for, by internal powers in the machine itself; many of which are not more certain and obvious in their effects, than they are above our comprehension as to the manner and means of their operation. Thus, a wound heals up of itself; a broken bone is made firm again by a callus; a dead part is separated and thrown off; noxious humours are driven out; a plethora is removed by spontaneous bleeding; a bleeding naturally stops of itself; and a great loss of blood is in some measure compensated by the contracting power of the vascular system, which accommodates them to the quantity contained. The stomach gives information when the supplies have been expended, represents with great exactness the quantity and quality of what is wanted in the present state of the machine; and, in proportion as she meets with neglect,

glect, rises in her demand, urges her petition in a louder tone, and with more forcible arguments.

For its protection, an animal body resists heat and cold in a very wonderful manner, aud preserves an equal temperature in a burning and a freezing atmosphere. A farther superiority in the natural machine, more beyond all human comprehension, than what we have been speaking of, is, that besides those internal powers of self-preservation in each individual, that they are endued with powers of making other animals like themselves, which again are possessed of the same powers of producing others, and so of multiplying their species without end.

> " If, Epicurus, this whole artful frame
> Does not a wise Creator's hand proclaim,
> To view the intellectual world advance;
> Is this the creature too of fate or chance?
> Turn on thyself thy godlike reason's ray,
> Thy mind contemplate, and its power survey.
> What high perfections grace the human mind,
> In flesh imprison'd, and to earth confin'd!
> What vigour has she! what a piercing sight!
> Strong as the winds, and sprightly as the light!
> She moves unwearied as the active fire,
> And, like the flame, her flights to heaven aspire."

All living creatures (observes Lavater) as well as MAN, have a set of features, and organization, forming so many pages in that *Great Book of Nature* which it is our duty to learn; and the perusal of which is so much the more easy, as it is a delightful task to gratify that innate passion, the strong curiosity to KNOW OURSELVES.*

---

* The attentive reader may possibly observe a repetition of similar ideas, or subjects mentioned in this volume; but it will generally be found, that where such do occur, that the language is not only varied, but some additional matter introduced, to illustrate the argument; which sometimes rather recurred from necessity, than choice.

CHAP

CHAP. VIII.

ON THE EXTERNAL DIVISIONS OF THE BODY, &c. &c.

By thee ! my growing parts were fram'd,
And to their proper functions nam'd ;
The eye, the ear, the lungs, the heart,
Constructed with unerring art,
At last to shew the *Maker's name*,
God stampt his image on my frame,
And in some unknown moment join'd,
The finished members to the *Mind*.

HYMN TO THE DEITY.

ANATOMY may be considered both as a useful, and a delightful study—there is no condition in life but may be improved by it; to many of the liberal sciences it is an assistant, to others absolutely necessary.—" Masters of academies, are not in general understood nor do they pretend (says Dr. Beddoes) to have any accurate knowledge of the HUMAN FRAME, though that be the qualification most essential in a superintendant of youth. It would be desirable and easy to establish in every considerable town, popular lectures for a mixed audience, on select subjects of anatomy."* In the words of the doctor, therefore, "it is no barren course, but with a prize at the goal, which we are exhorting the public to traverse. At every distance will be found some recompence for exertion, which will increase in value as further advances are made."

It is proposed in this chapter to speak of the external divisions of the body, and to include a few particulars which have not before been discussed.

The effects of the external force of man indicate a being, far more elevated than the inanimate creation. He performs actions which excite and deserve universal admiration; but the operations

* At Horniton, in Devonshire, Mess. Feltham, White, Chappel, and Smith, established a weekly lecture, on anatomical, medical, botanical, and philosophical subjects, for admission to which tickets were delivered *gratis* to ladies and gentlemen. To the Rev. Dr. Honeywood, *Rector,* and those who honoured their efforts by attending, their thanks will ever be due, as it has gratified them, and fostered liberal science in their minds. Mr. Brooks in London, and Mess. Bowles and Smith in Bristol, have also succeeded, in giving popular lectures and conversations on these subjects.

and productions of his mind, give demonstrations of his affinity with the father of spirits, and prove him to be in the highest sense the Son of God.*

It may not be amiss to detain the reader with a few observations relative to the external beauty of the human figure.

Personal elegance or grace, is a fugitive lustre, that never settles in any part of the body—we see it glance and disappear in the features and motions of an elegant person—it strikes the view, but the moment you follow it, the wandering flame vanishes.

Let us trace the history of the short life of beauty. In youth that borders on infancy, the passions are in a state of vegetation, they only appear in full bloom in maturity; for which reason the beauty of youth, is no more than the dawn and promise of future beauty. The features as we grow in years, gradually form along with the mind; different sensibilities gather into the countenance, and become beauty there, as colours mount in a tulip and en-

* Philosop. Estim.—Northcote's Anat—Clio—

enrich it. How beautiful the female form in the fulness of youth and health; observe that round and voluptuous swell of the limbs; that graceful ease in motion; that balmy warmth; those cheeks tinged with the roses of health; those eyes beaming with love, or sparkling with intelligence; that countenance enlivened by wit, or animated by feeling; every thing combined to form an object of fascination.

Yet an instant shall dispel the charm; often without apparent cause, sensation and motion cease at once; the body loses its warmth; the muscles become flacid, and disclose the prominent angles of the bones; the eyes loses their lustre; the lips and cheeks become livid. These are but the preludes to changes more hideous.

When the eloquent force, and delicacy of sentiment, has continued some little time, age begins to stiffen the features, and destroy the engaging variety and vivacity of the countenance; the eye gradually loses its fire, and is no longer the mirror of the agreeable passions. Finally, old age furrows the face with wrinkles, as a barbarous conqueror overturns the city from its foundations.

The

The general sense of *beauty*, as well as of grandeur, seems peculiar to man in the creation: the herd in common with him, enjoy the gentle breath of spring; they lie down to repose on the flowery bank, and hear the peaceful humming of the bee; they enjoy the green fields and pastures: but we have reason to think that it is man only who sees the image of beauty over the happy prospect, and rejoices at it; that it is hid from the brute creation, and depends not upon sense, but on the intelligent mind.

In different nations, how opposite are the sentiments concerning the beauty of the human shape and countenance.*

Upon the coast of Guinea, a fair complexion is considered as a shocking deformity; while thick lips and a flat nose are esteemed beautiful. In some nations long ears that hang on the shoulders are the objects of general admiration. In China, if a lady's foot is so large as to be fit to walk upon, she is regarded as a monster of

* Smith's Theory of M: Sentiments: See also what is said before.—p. 129. 155.

ugliness.* Some of the savage nations in North America, tie four boards round the heads of their children, and thus squeeze it while the bones are tender and gristly, into a form that is almost perfectly square. To be fat is one of the rules of beauty among the Moorish women; and they take the same care to fatten young women, as in Europe to fatten fowls. The reason of this, may be found in the nature of the climate, and the quality of the aliments, which make the people naturally meagre.† Our slen-

* The women of the middling and lower class, ape the unnatural custom of their superiors, who consider a small foot, as a mark of beau'y, and suffer much pain and inconvenience by having their feet maimed or distorted. The great toe is the only one left to act with freedom; the rest are doubled down under the feet in their tenderest infancy, and retained by cm presses, and tight bandages, till they unite with and are buried in the sole. This gives them an awkward hobbling gait, causing them to walk upon their heels, and to totter as they pass. The same pressure is aplied by some to the ancle.

Emb. to China, 1797, 8vo.

† Chenier's History of Morocco, 8vo. 1788.—

The female reader, who wishes for an introductory work to facilitate the drawing of the human form, will be gratified with Mr. Wells's work on the proportions of the human figure, adapted to the art of designing, painting, and sculpture, with plates, written principally for ladies, 4to, Hookham, 1796.

der

der waists, and fine turned ancles, would be imperfections in this part of Africa, and perhaps over all that quarter of the globe; so great is the contrast of taste, and so various the prejudices of nations.

Europeans are astonished at these absurd practices, without reflecting that our fashions often deviate as egregiously from nature.

Nature is always grand in her designs, but frugal in the execution of them, sublimity and simplicity are the striking characteristics of her workmanship. From a few simple principles she produces the most astonishing effects, and charms us no less by the infinite diversity of her operations, than by the skill and contrivance manifested in the performance of them. Although the human shape is externally more delicate than any other animal, yet perhaps, it is stronger for its size, than that of the *strongest* animals.

With regard to the rosy glow of health that blooms in the face, it is suggested by a late writer, (Dr. A. Fothergill) that the principle of *vital air*, which reddens the blood, and tinges the cheek of beauty, is probably the same which diffuses elegant shades of the same colour over a considerable part of the vegetable creation—which blooms in the rose—the tulip—and the carnation; which glows in the western sky; and which even adds colour to the calces of metals; as in red lead, cinnabar of antimony, vermillion, &c.

It will be requisite to offer, in this chapter, a concise view of the technical divisions of the body, and the terms used by anatomists for the parts; which, as it will occupy but a page or two, may be passed over, if the reader be so inclied.

1st. *The Head.*

It is considered as an erroneous idea, that the *face*, alone contains expressive striking features; for in the estimation of many, besides physiognomists, all parts of the body are stamped with such marks as equally denote a man's character, his inclinations, and sensations.

The principal part of the body is the head, the hair of which is termed in technical language *capillus;* the part covered with hair the *scalp.* The crown of the head, *vertex:* and the hinder part, *occiput.* The fore-part, *sinciput.* The

space

space between the hair and eye-brows, the *fore-head.* The sides, the *temples.* The eye-brows, *supercilia:* and the space between them, *gabella.* The eye-lids, *palpebræ*, *superior*, and *inferior*. Their cartilaginous edges, *cilia*. The eye, *oculus*, which consists of proper tunicles and humours. The hollow of the eye, *cavum oculi.* The inner angles, *canthus major.* The outer corner, *canthus minor.*

The nostrils, are termed *nares:* the ridge of the nose, *spina nasi:* the partition between, *septum nasi*; the sides, *alæ;* the hair, *vibrisæ.* It has internally, the mamillary, sphenoidal, and frontal sinuses.

The external ear, has many eminences and cavities which have proper terms annexed to them: as the upper part, called *pinna:* the lower part, *lobus:* the outer circle, *helix:* the inner circle, *antihelix:* the space between both, *scapa:* the lower end of the antihelix, makes a little prominence called *antitragus*, and the one just opposite, *tragus.* The cavity leading to the internal ear, is named *meatus auditorius.*

The jaws are termed *maxilla*, superior and inferior; the prominent part of the cheek *mala;*

the cheeks stretched out as in blowing, *bucca*. The chin, *mentum*, &c. The roof of the mouth is termed the *palate*; and the fleshy appendage suspended for modulating the voice, &c. *uvula*.

2d. *Of the Neck, &c.*

The neck is generally divided into the anterior part, or throat; and the posterior part, or nape; the throat begins by an eminence, and terminates by a *fossula*; which as it descends is gradually lost. The neck consists of seven small bones, termed vertebræ; a number of muscles which serve to move the head, neck, larynx, pharynx and the hyoides; a number of very large arteries, as the internal and external *carotids*; and the *vertebral* ones; with similar veins, called the jugulars, and vertebral ones—large nerves of those termed *par vagum*, *intercostals*, recurrent, &c. A part of the spinal marrow; part of the trachea and gullet: the thyroid, and some other small glands.

3d. *The Thorax, &c.*

Is that large part of the body situated between the abdomen and the neck, and answers to the extent of the *sternum*, ribs and vertebræ of the back.

back. The anterior part is called the *breast*, the posterior part the *back*. The breast includes the channel bones, (technically the *claviculæ*,) and the sternum, or breast-bone, which is in the middle; and terminates in a cartilaginous point. The cavity is lined by the membrane called *pleura* and is divided into lateral cavities, by the *mediastinum*; for which see the last chapter.

The mammæ or breasts, are two round tumours, which ornament the fore part of the chest, under which are situated part of the ribs, the pleura, and lungs as already described. The *papilla*, or nipple, is encompassed by a reddish circle, named *areola*. The hollow below the breasts, is termed *scrobiculus cordis*. The back is composed of 12 vertebræ, and two shoulder blades, named *scapulæ*. The lateral parts of the *thorax*, are called *peristerna*. The cavity of the thorax, is divided from the abdomen, by the diaphragm. The sternum, ribs, and all the chest stand so much exposed, that did we not naturally guard them with the hands, fractures must be very frequent; but when they are broken and beaten in, they hurt the heart or lungs, and not unfrequently the most dreadful consequences ensue. The root of the neck, just over the clavicle, forms the most deadly aim of the assassin;

for

for his knife passes at once into the breast, and pierces the great vessels near the heart *.

4th. *Of the Abdomen.*

The abdomen begins immediately under the thorax, and terminates at the bottom of the pelvis of the ossa innominata. Of its divisions and contents we have already spoken, in the preceding part of this work. A blow on the pit of the stomach, or on the *mark* as it is called (in the language of boxing) is productive of very dangerous effects, and generally causes a vomiting of blood. A blow cannot be planted in any part of the system, with more probability of disabling a man, than in this point, which therefore ought to be sedulously guarded from brutal attack.

5th. *Of the Arm.*

The arm comprehends the whole limb or member from the top of the shoulder to the fingers ends. It is divided into the shoulder, including the scapula and clavicle; the arms, properly so called; and the fore-arm and hand, including the fingers. The upper part is termed the *humerus*,

* Charles Bell, on Dissections, folio, vol 1. p. 30

which extends to the elbow, or back of the bend of the arm, called *olecranon*: then follows the *radius* and *ulna*, curiously articulated, terminated by the *carpus* or wrist; metacarpal bones, and bones of the fingers. A surgeon before he is capable of exercising his profession should have a perfect knowledge of each distinct muscle covering the bones, with its use and office. Mr. Andravi, an eminent anatomist in Paris, has discovered the method of amputating the *humerus*, at its articulation, by which he saves that large portion of flesh, the *deltoid* muscle, and the parts are healed in a few days. An improvement which Dr. Thornton remarks, is very little known, but which in England would render him immortal.

6th. *Of the ower Extremities.*

These comprise the thigh, leg and foot; from the hip to the knee, it is named the femur, or thigh; the fold between the belly and the thigh, is termed the *inguin*, or *groin*; the top of the knee, *patella* or knee-pan; the hinder part, the ham. From the knee to the instep, is properly called the *tibia* or leg; the fore-part, crea or skin; behind sura, or calf: the ancles, *maleolus*

external

external or internal. The foot, comprises the tarsus, metatarsus, and toes. Behind is *calcaneous* or the heel; and before tarsus, the instep, from thence to the toes, forms the metatarsus. The top of the foot is termed *dorsum pedis;* the under part, or sole, *planta pedis;* and the toes, *digiti pedis.*

The impropriety of cramping and distorting, so beautiful a form as the foot and toes, by wearing tight shoes, and the various ill consequences of such a practice, is explicitly pointed out by *Dr. Willich* in his *lectures* on diet, where he advises a particular shoe for each foot, by keeping *separate double lasts;* for, (says the Dr.) is it not injudicious and absurd, to have both shoes made of the same size and form, when nature has not formed both feet alike, or at least not in the same direction? a convenient shoe, therefore ought to be somewhat round at the toes, as is at present the fashion, sufficiently long, with thick soles, and the upper leather soft and pliable; otherwise the skin will be rendered callous; the necessary perspiration stopped; warts and corns will appear, with various other inconveniencies.

The wearing of French high-heel shoes must have been very inconvenient to women, and therefore

therefore gave way to the Italian heels; and now the more rational practice of wearing low heels, like the men, is admitted to be the most comfortable. High heels made women walk with their knees more or less bent, so that the extensor muscles never attained the last degree of contraction, nor the flexors the last degree of extension. Ladies therefore, on the sudden adoption of low heels, complained of a pain, occasioned by the new action of stretching the last-mentioned muscles, which obliged them to lift their feet quicker from the ground than before. The first form of a shoe was doubtless a sandal, a mere sole without an upper-leather; which fashion has since almost reversed—as we sometimes find an upper-leather nearly without a sole. Under the Plantagenets it shot out to an enormous length from the toe, and the extremity was fastened to the knee by a silver chain, silk-lace, or packthread. In 1465 an order of council prohibited this length of the shoe-toe, confining it to 2 inches, or to be subject to a fine of 20s. and the displeasure of the priest. In the reign of the Tudors, the shoe was fastened by a full-blown silk rose *.

* History of Birmingham, 8vo.

The

The shape as now worn was adopted about 1633, and in the reign of the Stuarts the shoe-string appeared, which, with King William, gave way to a minute buckle: square-toed shoes followed, which has been succeeded by the pointed form, and present broad-toed shoes. Fashion having sported with the buckle till it became an irksome appendage, the shoe-string has superseded it, and will probably hold its empire from its ease and cheapness.

The hind part of the foot, according as we raise it, is contracted to such a degree, as only to touch the ground with the toes, while the soles are suspended. For this reason, those living creatures who lay down the whole foot, are slow; such as man, and the bear; those are swifter who use only their toes; and the swiftest run on tip-toes; as dogs, deer, and horses.

A few parts shall now be noticed, not so particularly described in the foregoing pages; and which, while they are necessary to complete our plan, will not, it is hoped, be deemed uninteresting.

The Scarf Skin,

Sometimes also called Epidermis and Cuticula, is that fine, transparent, and insensible pellicle, destitute of nerves and blood-vessels, which invests the body, and every where covers the true skin *. Though seemingly very simple, yet under the microscope it appears composed of several *laminæ* or scales, which are increased by pressure, as may be observed in the hands and feet, where it is frequently much thickened, and becomes perfectly callous. It seems to adhere to the *cutis*, or true skin, by a number of very minute filaments, but may be easily separated from it by heat, or by maceration in water. It is pierced with an infinite number of pores, or

* The cuticle having neither nerves nor blood-vessels, there is little or no reason to believe that it possesses organization. It is therefore, in strictness, less a part of the living body. than a kind of tight shirt, or close setting tunic, drawn over the whole surface of the body. The foulness of this natural shirt is a frequent occurrence, producing, if not washed, pimples, tetters, &c. To a correct mind, a *dirty cuticle* will appear to be a dirty shirt. (Dr. Mitchell on Perspirable Fluids.)

Dr. Willan has published a work on the Eruptions of the Skin, with plates, 4to. a subject certainly of great importance, and which had not been before sufficiently investigated. The works with plates representing morbid anatomy are few, but certainly may be of considerable utility.

little

little holes, which afford a passage to the hairs, sweat, and insensible perspiration, and likewise to warm water, mercury, and whatever else is capable of being taken in by the absorbents of the skin; the lines on it belong to the true skin; the cuticle adjusts itself to them, but does not form them: if the surface of the skin be held between the eye and the light, a *fine polish* will be observable.

The mucous substance between both skins is a double membrane, called *rete muscosum*, which gives colour to the body, and on which, therefore, the complexion entirely depends; the scarf skin is itself colourless, and the true skin is always white, whatever may be the complexion of persons. The colour of the mucus is *black* in Negroes; *copper* colour in the Mulatto; *brown* in the Egyptian; *white* in the Albino, and in the people of cold climates. *In blacks*, therefore, *the true skin is of the ordinary colour*; yet in what cruelty has the outward distinction of a sable hue involved a great portion of human beings!

> Man finds his fellow *guilty* of a *skin*
> Not colour'd like his own; and having power
> T'inforce the wrong, for such a *worthy cause*,
> Dooms and devotes him as his lawful prey.
>
> COWPER.'

In

In all climates children are born fair, or at least red, and grow darker or black as they advance in life.

——————O sacred Truth!
Tell the proud Lords of Traffic, that the breast,
Thrice ebon tinted, bears a *crimson tide*
As pure, as clear as EUROPE'S *sons can boast* *.

MRS. ROBINSON.

The blisters which rise on burns or scalds are supposed to be a rarefaction of mucus beneath the skin; but are more probably occasioned by the increased action of the vessels, pouring forth the thinner parts of the blood. We take the liberty here to recommend, in case of accident, the part to be instantly dipped in brandy, or other spirit, wine, cold water, or, what perhaps is preferable, and generally at hand, into *common ink*; or apply cloths, wet with either, which will wonderfully relieve the pain and ill consequences attendant on such occasions. Dr. Underwood

* On this subject, consult Professor Blumenbach on the Bodily Conformation and Mental Capacity of Negroes. The investigation is highly to the honour of our sable brethren.

The inhabitants of the Southern climates are considered as indebted to the action of heat on the surface of the skin for that exquisite sensibility which is superior to theirs who live in the Northern regions. Itard's Account of the Wild Boy, 12mo. 1802, Philips; and consult also Dr. Falconer on the Influence of Climate on the Body, 4to.

desires

desires olive oil to be avoided. The application of oil of turpentine by a feather has also had the best effects.

The Skin.

The cutis, or true skin, is composed of fibres closely compacted, as we may notice in *leather*, which is the prepared skin. It has through its whole surface innumerable papillæ, which look like minute granulations, which seem to be calculated for receiving the impressions of the touch, being most easily observed where feeling is the most delicate, as in the palms of the hands and fingers. The great sensibility of these papillæ proves them extremely nervous. The cuticle serves to defend them from the air, which would dry and make them less sensible, and form rough and hard bodies, which would make a painful impression on the true skin, if unprotected.

When we are frightened (or expose the arm to sudden cold) the skin immediately cockles up into what we term *goose-skin;* this is owing to the contraction of the exhaling vessels of the skin. Both the exhaling and inhaling vessels of the skin are capable of contraction and relaxation, as appears by the effects of the passions on them.

them. *Joy* increases the circulation, and relaxes the exhalent vessels, so that then they yield easier to the impulse of the blood: and a redness, moisture, and turgescence of the skin follows. On the contrary, those passions which are *sorrowful* are known to retard the circulation, and thereby contract the exhaling vessels, and produce that dryness and corrugation called goose-skin.

The sense of touch, of smell, and of taste, have been considered as merely different modifications of the organ of the skin; whilst those of the ear and the eye, being less exposed to external impressions, and enveloped with a covering much more complicated, are subject to other laws of amelioration, and ought on that account to be considered as constituting a class perfectly distinct *.

Of Insensible Perspiration.

The matter of insensible perspiration is not secreted by any particular glands, but seems derived wholly from the extremities of the minute arteries, every where dispersed through the skin.

* Account of the Savage of Aveyron, by Itard, 12mo. 1802.

These

These exhaling vessels are demonstrated in the dead subject, by throwing water into the arteries, when small drops exude from all parts of the skin, and raise up the cuticle, the pores of which are closed by death; and in the living subject, a looking-glass placed against the skin is soon obscured by the vapour. This perspiration is not confined to the skin only; a great part is thrown off from the lungs: the quantity of vapour from both is supposed nearly 5-8ths of the aliment taken in. In the warm climate of Italy, if a person eats and drinks 8lb. in a day, 5lb. of it will pass off by insensible perspiration. In colder places the matter thrown off is less; and in some northern climates does not equal what is discharged by urine. It varies, from age, constitution, diet, &c. (See page 67.)

Excessive perspiration is always *morbid*, and is the effect of violent stimulus; and can never be continued long, without producing sensible debility of the body.

A proper proportion of perspiration is essentially necessary to health, it may be *deficient* for some time without producing any bad effects, but it is generally the cause of diseases.

The insensible perspiration can only be discerned by a lens, being of so volatile and subtle a quality, that it passes through our garments with the utmost ease, particularly if woollen: and it even ascends through the bed-cloaths like a mist, in the greatest abundance, when we sleep, and the animal functions are at rest. In this manner nature endeavours to relieve herself from all casual obstructions; and so long as diseases are recent, and of a mild tendency, they are usually carried off by this means. When by disease the circulating mass becomes foul and viscous, yet in this state the vital heat and activity of the blood strives to purify itself, by determining these morbid particles to the skin *, where it forms eruptions; or else, falling inwardly on the lungs and other viscera, fatal consequences ensue.

Although Pathology be not the province of this work, it may be remarked, that health very materially (in our opinion) depends on keeping the

* Of all the human excretions, none is more highly animalized, or more susceptible of becoming putrid, than the *perspiration*, or vapour issuing from the surface of the body and lungs. Hence contagious fevers are generated from a number of persons being confined in a close place.

Dr. J. C. Smyth on Nitrous Fumigation, 8vo. 1799.

pores of the skin clean and free from obstruction; and that we should have no excuse for omitting this essential duty, nature has profusely given us an element, easily attainable, adapted to our comfort with regard to personal cleanliness: yet the utility of ablution and bathing seems not so much attended to, in an individual or national view, as it merits *.

Of the Nails, and Hair.

The *Human Nails* appear on the third month after conception; they are of a compact texture, hard and transparent like horn. They possess many properties of the cuticle; like it, they are neither vascular nor sensible, and when the cuticle is separated from the skin by maceration or otherwise, the nails come away with it. They

* The reader will find some interesting remarks on the benefits of public and domestic baths, in Willan on the Diseases of London, 12mo. 1801; and of its operation in fevers, in Dr. A. Fergusson's Medical Researches, Aberdeen, 1801.

For the comfort of those who cannot very readily bathe, Dr. Mitchell remarks, that clean shirts, drawers, and stockings are substitutes for clean water, and that they who change their linen *very frequently*, deterge the surface of the body almost as much as by bathing, and perhaps for the purpose of health *quite* as much.

appear

appear composed of different layers, of unequal size, applied one over the other. Each layer seems to be formed of longitudinal fibres; they increase from their *roots*, and not from their *upper* extremity, and renew themselves every two months. Their chief use appears to be to cover the ends of the NERVES, and to defend them from injury; and thereby conduce essentially to our comfort. Their colour depends upon that of the *rete muscosum*.

The Hair (supposed to be renewed twice every year) arises from distinct capsules, seated in the cellular membrane under the skin. Some of these bulbs inclose several hairs, and may be observed at the roots of the whiskers of a cat: like the *nails*, they grow only from below. The soft hair that covers the body in general is different from that of particular parts, as the head, chin, axilla, &c

It is highly ornamental to the person, and no doubt useful in other ways, perhaps not apparent to us; but in the eye-brows and lids it has evident utility. It is subject occasionally to *tenants*, not very pleasing, but which *cleanliness* will always obviate.

Dr. Smith, in his ingenious Essay upon the variety of colour and figure in the human species, has derived it from four causes, viz. climate, diet, state of society, and diseases: yet the woolly heads of negroes (says Dr. Rush) cannot be accounted for from these causes; for all those circumstances combined have not produced it in the natives of Asia or America, who inhabit similar latitudes. Wool is peculiar to the negro.

Of the Cellular Membrane.

The presence of this membrane is so universal, that Haller asserts that far the greater part of the body is composed of it. It invests the minutest fibres, and is the connecting medium of every part. It is composed of an infinite number of minute cells, communicating with one another. Two diseases which it is subject to, prove this—in the *emphysema*, all its cells are filled with *air*; in the *anasarca*, with *water*. It is this membrane which the *butcher* inflates, to make the meat look well, by plumping up its pores with air. Its cells serve as reservoirs for fat, which is *re-absorbed*, and carried again into the system by the lymphatics. Its waste in a consumption proves such a resorption to take place. The fulness and size of the body are in a great mea-

sure

sure proportioned to the quantity of fat contained in its cells. Adipose membrane, is this cellular, rendered impervious by the distension of its contents. The chief uses of the fat seem to be to afford moisture to every part, to facilitate the action of the muscles, and to add to the beauty of the body, by making it smooth and equal.

Of Digestion, and Parts assisting.

Digestion is that process that changes our food into chyle; this is done by the mouth, stomach, and small intestines. The lips and cheeks are made up of fat and muscles, covered by the cuticle, which is continued over the inside of the mouth, like a fine and delicate membrane: besides this, the mouth has a spongy and vascular substance, the gums, which fasten the teeth. The roof of the mouth has a similar substance, called *velum pendulum palati*, which terminates in a soft small body called *uvula*, which is seen suspended in the middle of the arch over the basis of the tongue. The tongue is composed of several muscles, by which it performs a variety of motions, for the articulation of the voice, mastication, and conveying the aliment into the pharynx. The papillæ, on its upper surface, (which are easily seen) constitute the organ of taste; it is covered with the same membrane as the inside of the mouth, which terminates under in a part called *frænum*. Under the velum palati is the pharynx, which is the top of the gullet, resembling the top of a funnel, through which the aliment passes into the stomach. The pharynx is moistened by glands called *tonsil*, on each side of the velum palati. The saliva comes from the parotid glands; one runs over each cheek, and opens into the mouth by an orifice big enough to admit a bristle; the sublingual glands at the root of the tongue, in the palate, &c. contribute to pour out this liquor.

The uses of the saliva are, to moisten the mouth and to facilitate deglutition, as well as to assist the gastric juice, which every where lines the inner part of the stomach, to prepare the food for the intestines. When the stomach is empty, this juice accumulating, irritates the stomach, and produces hunger. The saliva becomes so acrid by long fasting, as to excoriate the gums, and the breath acquires not only a fœtor, but a pungency so active, as to draw tears from the eyes of persons who are exposed to it*. A spitting, or an increased discharge of saliva, is

* Dr. Rush.

not

not common to any disease but small-pox, chiefly of the confluent kind. In this disease it is considered as a favourable sign, and also when it occurs in fever *.

The wind-pipe is placed before the gullet; its upper part has a thin cartilage attached to its fore part only, to prevent the food while swallowing from falling into it; when the food passes this, it presses it down, and covers the opening while the velum palati is drawn backwards, and closes the openings to the nose and *eustachian tubes.*

It is necessary that the nostrils and lungs should communicate with the mouth for speech and respiration; but if the most minute part of our food happens to fall into the wind-pipe, it produces a violent cough, and the most alarming symptoms. This is what is termed passing the wrong way.

After food has been one or two hours in the stomach, it becomes a greyish pulp, having no resemblance to the food when first swallowed. This pap has been called *chyme*, and it is formed

* Dr. A. Fergusson, ut supra, vol. i.

by the action of the *gastric* juice on the aliment, which now passes gradually into the intestines, where it undergoes farther changes; it soon meets the bile and pancreatic juices, which flow into the duodenum, and these, with the mucus of the intestines, are all incorporated into the alimentary mass, which then seem to possess new properties. It is now termed *chyle*, being a mild, sweet, whitish fluid, resembling milk.

This is absorbed by the lacteal veins, which convey it into the circulation, where, by being assimilated into blood, it affords that supply of nutrition which the waste of the body requires. The grosser and more solid parts pass off through the intestines, and are termed fœces.

The coats of the alimentary canal act *mechanically* upon the food by their power of muscular contraction, and *chemically* by the liquors which they secrete.

If the intestinal canal was shorter than it is, if instead of its present circumvolutions it passed in a direct course from the stomach, and if its inner surface had not valves, the aliment would pass through with great rapidity, and time would be wanting to assimilate the chyle, and for its ab-

sorption

sorption into the lacteals, so that the body would be deprived of that nutrition which is so essential to life and health; but the length and circumvolutions of the intestines, the inequality of their internal surface, and the course of the aliment through them, all concur to perfect the separation of the chyle from the fœces, and to afford the necessary nourishment to the body. The period when digestion takes place varies with different substances. Milk passes into the bowels in a very short space of time; recent vegetables are next in their progress; bread is digested in four hours; fish of different kinds in five, and meat in six or seven.

It is not here necessary to enter on the various hypotheses of the nature of the hidden process of digestion.

Some animals are almost incapable of digesting animal food, as others have been not capable of digesting vegetable food; but under some circumstances animals may be brought to feed on either, which were naturally accustomed to one only.

Digestion is influenced under circumstances of the *Passions* of the *Mind*, and under the circumstances of *Disease*, want of exercise, a stooping posture, to which some persons in business are obliged, as coblers, literary men, &c.

Mr. Hunter mentions cows having been brought to feed on animal food a considerable time, and digested it.

An infinite number of very minute vessels, called the lacteal veins, arise like net-work from the inner surface of the intestines (but principally from the jejunum and ilium) which imbibe the chyle. These were first discovered in brutes by Asselius, of Cremona, in 1622, and soon afterwards in men. They pass obliquely through the coats of the intestines, and run into the mesentery and its glands, when they get larger, and proceed to the thoracic duct, which conveys the chyle to the blood.

By frequent inebriety (says Dr. Darwin) the lacteal system is affected with paralysis, from whence arises a total abhorrence of flesh, and general emaciation. In some the lymphatic system is affected with paralysis, and dropsy ensues.

The thoracic duct begins at the lower part of the first vertebræ lumborum, passes up between the aorta and vena azygos, close to the vertebræ, being

being covered by the pleura; empties itself into the left subclarian vein, from whence it flows into the cava, and so on to the right auricle of the heart. Its lower part being largest, is generally called receptaculum chyli, or Pecquet's receptacle, who first discovered it in 1651.

These lacteals compose only a part of a system of vessels which perform the office of absorption; the lymphatic veins are minute pellucid tubes, which, like the lacteals, direct their course to the centre of the body, where they pour a colourless fluid into the thoracic duct. They are dispersed through the body, and enter this duct from the lower parts by three or four large trunks. The lymphatics from the upper parts meet the duct in different parts in its passage upwards; on the right side they terminate in the right subclavian vein. The lymphatics are nourished after the same manner as the other parts of the body; for even the most minute of these vessels have probably still more minute arteries and veins. Both the lacteals, lymphatics, and thoracic duct, are furnished with valves, which in these are more common than in the red veins. These promote the chyle and lymph in going forward, but prevent its return. The lymphatic vessels begin from surfaces and cavities in all parts of the body as *absorbents.*

The lymph is a transparent liquid like water, capable of coagulating in a certain degree of heat. In the progressive motion of the chyle to the heart, it derives no benefit from the action of the heart, nor does it receive any assistance from the contraction of the arteries, as it has no communication with them; therefore there must be some moving quality or power in the chyle to carry it to the heart. The absorbent vessels of the skin convey whatever they imbibe into the habit, in the same way that the lymphatics convey the chyle from the stomach to the heart, which is by some inherent moving quality, which appears to act independently of the action of the heart.

Of the Glands.

The several humours of the body, which are a great many, are all separated from the blood by different glands. These glands are of two sorts, conglobate and conglomerate. A conglobate gland is a little smooth body, wrapped up in a fine smooth skin, by which it is separated from all the

the other parts, only admitting an artery and a nerve to pass in, and a vein and excretory canal to come out.

A conglomerate gland is composed of many little conglobate glands, all tied together, and wrapped up in one common tunicle or membrane. Of this kind is the pancreas or sweet-bread.

The glands secern from the blood near *thirty* different humours; but these are probably only combinations of a few simple principles; for we find urine, sweat, tears, milk, and spittle are compound liquors, and that in each of them there are parts common to all of them.

In different parts of the body, we meet, within the substance of the skin, certain glands which discharge a fat and oily humour, which lubricates the skin. When it inspisates, it is somewhat like suet. They are particularly remarkable in the nose, but are found in the nipple, axilla, &c. &c. and are termed *sebaceous*. A little attention to diet will prevent their accumulation, and wiping the skin daily with a dry napkin will resist their accumulation, and contribute to the fairness of the complexion.

Of Respiration.

Respiration is one of those functions termed *vital*, as being essential to life, for to live and breathe are in fact the same.* It consists in dilating and contracting the thorax, by first inspiring air into the lungs, and then expelling it. What induces the first inspiration is not easy to say. The blood acquires every inspiration some material beneficial change, from some principle it imbibes from the air, and from some noxious qualities it parts with in return. Respiration is very important in forming the voice and speech. The organ of speech has been compared to a musical instrument. The wind-pipe may be supposed the pipe of an organ, the lungs dilating, like bellows during the time of inspiration; and

* In an attempt to hold one's breath, the blood soon begins to distend the veins, which are unable to empty their contents into the heart; and we are able only, during a very little time, to resist the stimulus to inspiration. In drowning, the circulation seems to be stopped upon this principle; and, in hanging, the pressure made on the jugular veins, may co-operate with the stoppage of respiration in bringing on death. (Dr. Simmonds.)

Modern experiments have shewn, that one of the principal uses of respiration, is to re-animate the muscular power, by recruiting the exhausted irritability of the muscular fibre.

as the air is driven out from them by expiration, it finds its passage straightened by the cartilages of the larynx against which it strikes. These occasion a vibration in the air and constitute sound. The variation of which depends on the state of the glotis; when straightened it produces an acute tone, and when dilated a grave tone. But the manner in which the voice is formed has not been yet satisfactorily accounted for; we may observe however that the sound produced by the glottis is not articulated. To effect this it is required to pass through the mouth, where it is differently modified by the action of the tongue, which is either pushed against the teeth, or upwards towards the palate: detaining it in its passage, or permitting it to flow freely, by contracting or dilating the mouth.

The learned Dr. Arbuthnot is of opinion, "that the air, or rather the temperature, has some influence in forming the nature of language. The serrated close way of speaking of the Northern nations, may be owing to their reluctance to open their mouths wide in cold air, which must make their language abound in consonants. Whereas from a contrary cause, the inhabitants of warmer climates opening their mouths wider, must form a softer language abounding in vowels."

As

As we have spoken of the subject of the voice in page 81; we shall now close the subject with the following lines, presented by the Rev. Mr. G——, a gentleman whose abilities are eminently displayed in his pulpit-eloquence, and in his literary labours.*

ON THE HUMAN VOICE.

The Human Voice melodious, sweet, and clear,
Pours matchless music on the raptured ear;
No feathered minstrels from their vocal spray,
Can emulate its heaven-instructed lay,—
No magic sounds of instrument combined,
Can wake like these the raptures of the mind!
The force of rage subdue with soft controul,
Or fill with tenderest extacy the soul—
O sacred sense! by verbal accents taught,
To wake to tuneful life, unbodied thought,
Thy pow'rs that now their peerless charms bestow,
No lasting pause, no final change shall know!
Those sounds which art inspires must disappear,
And hush'd to silence die upon the ear!
Whilst thou the pow'r of death itself shall brave,
And rise a matchless phœnix from the grave,
To heav'n's high mansions take thy destin'd flight,
And form the chorus of the saints in light!

Kingsland Road, July, 1802.

---

* Author of Sig. Rom. 4to. being an explanation of the Roman abreviations, dedicated by permission to the King—

Poems,

*Of the Senses.**

We are endowed with five external senses,—seeing: hearing; tasting; smelling; and feeling.—

The imagination; memory; and the passions of the mind, are termed the internal senses.

By *sight*, man's enjoyments are diffused into a wide circle—that of *hearing* though less widely diffused, nevertheless extends his powers; the sense of *smelling* is more contracted still—and the *taste*, and *touch*, are the most confined of all. Thus *man*, enjoys *very distant objects* with *one sense* only; more nearly, he brings *two senses* at once, to bear upon them; while the

Poems, &c.—for the latter see *Pearch's* Collection, vol. iv. latter part.

* We have many internal sensations of the most agreable kind, hardly referable to any of the five senses. Some physiologists have held, that all secretion is pleasurable; and that the complacency which in health, without any external, assignable, object to excite it, we derive from life itself, is the effect of our secretions going on well within us.

sense

sense of *smelling* assists the other *two;* and at its own distance.*

The sense of touch may be defined, the faculty of distinguishing certain properties of bodies by feeling. The organ of touch, that is, the nervous papillæ of the true skin, like all other senses, is not equally delicate in every part, or in every body: being in some much more exquisite than in others. Some parts also, that in a healthy state as in the bones, possess little or no sensibility, yet in an inflamed state, are susceptible of the most painful sensations. Different parts are more or less sensible, as they have a greater or smaller quantity of nerves distributed to them.

Chemists have evinced, that *heat*, so essential to the animal œconomy, is a *fluid* element; the excess of which, or its deficiency, alike give us pain, and induce us to avoid the circumstances that occasion them. And in this (observes Dr. Thornton†) the perception of heat essentially *differs* from the perceptions of the sense of *touch*,

* For some curious observations on the odours exhaled from living animals. See Med. and Physical Journal. Oct. 1801.

† Philos. of Med. 8vo. vol. 2. 4to. edit. 1799.

as

as we receive pain from too much pressure of solid bodies, but none from the absence of it.

It is hence conjectured that our CREATOR has provided us with the *nerve of touch*, as distinct in itself as the optic, or any other nerve of sense, and a *set of nerves* for the reception of *this fluid*, which anatomists have not yet attended to. And from the teeth, the perceptions of heat and cold, appear not to belong to the organ of touch; since they are the least adapted for the perceptions of solidity and figure, and are the most sensible to heat and cold; whence we are forewarned of swallowing those materials, whose degree of coldness or of heat, would injure our stomachs. Dr. Darwin also corroborates this opinion, and cites an experiment to shew, that the sensation of *heat*, and of *touch*, depend on different sets of nerves. All sensation is performed by the immediate action of the finer and more fluid parts of bodies upon the organs of sense; the impulse communicated by these subtle parts of bodies upon the organs fitly disposed, is by them transmitted to the nerves peculiarly adapted to it, and from thence to the brain. Thus in vision, the light reflected from the surfaces of bodies is transmitted through the humours of the eye, and congregated upon the retina, in the same manner

ner it was reflected from the body ; and thereby an impulse of a peculiar kind affects the filaments of the optic nerves, which convey this impulse to the brain.

In *hearing*, the sound, after divers modifications, through the meatus auditorius, strikes on the tympanum, which moving the bones of the barrel, and those, the inclosed air of the labyrinth, the auditory nerves are there moved after the same manner they would have been had the common air acted upon them, with the advantage of a better qualified and gentler impulse than they could otherwise have had. In SMELLING *, tasting, and touching, the effluvia and more subtle part of bodies act immediately upon the nerves themselves, and they communicate this action upon the brain : so that in some manner all sensation is nothing but touching, several ways diversified.

---

* Odours have a sensible effect in promoting animal life. The greater healthiness of the country, than cities, is derived in part from the effluvia of odoriferous plants which float in the atmosphere in the spring and summer months, acting upon the system, through the medium of the sense of smelling. The effects of odours upon animal life appear still more obvious in the sudden revival of it which they produce in fainting,

DR. RUSH.

The

The poet Blackstone; thus beautifully directs our attention to the *senses*.

Mark how the spirits, watchful in the *ear*,
Seize undulating sounds, and catch the vocal air.
Observe how others that the *tongue* possess,
Which salts of various shape and size impress,
From their affected fibres upward dart,
And different tastes by different strokes impa
Remark how those which in the nostril dwell,
That artful organ destined for the smell,
By vapours mov'd, their passage upward take
Aud scents unpleasant or delightful make.
If in the TONGUE, the NOSTRIL, and the EAR *
No skill, no wisdom, no design appear;
Lucretians next, regard the curious eye;
Can you no art, no prudence there descry?
By your mechanic principles, in vain,
The sense of sight you labour to explain.

Repinings, and secret murmurs of heart, give imperceptible strokes to those delicate fibres of which we are composed, and wear us out insensibly; not to mention the injury they do to the blood, and those irregular disturbed motions which they raise in the vital functions.

---

* See Mr. Home's Essay on the Structure and Uses of the Drum of the Ear, in Philos. Trans. part 1st. 1800, or London Med Review, vol. iv, 1800. The nicety or correctness of a musical ear, being the result of muscular action, renders it, in part, an acquirement.

Cheerfulness

Cheerfulness therefore, will be found an essential promoter of health.

It is difficult to determine the nature of animal life. It is manifest that it cannot exist without certain organized parts, and that it possesses greater degrees of vigour, in proportion as this organization is complete; by an attentive examination of animal substances, we perceive that they do not consist of a confused mass of materials heaped together without choice and without distinction, but that they form throughout their whole extent, an assemblage of parts exquisitely finished, and wonderfully combined so as to form one complete whole, subdivided into solids and fluids.

The solids comprehend the nerves, arteries, veins, muscles, tendons, cartilages, glands, intestines or in a word, more clearly expressed perhaps, by the flesh and bones.

Among the fluids are the chyle, blood, lymph, bile, animal spirits, and a variety of other humours, contained in the substance of the glands. These different parts in animated bodies, are each dest ed to some particular use. They possess the precise configuration, size, weight flexibility, in short all the qualities requisite for their destination. None of them exist independent of the rest, but they have all an intimate connection with each other, and preserve themselves in perpetual motion by maintaining their due balance, and reciprocal action.

The solids, continually contracting and dilating promote the circulation of the blood through all the parts of the body. The fluids after they have passed through their fermentation, and been filtrated through the glands of the brain, are returned by means of the nerves to the solids, and communicate to them their proper powers of motion.

The close harmony that subsists between the life and organization of bodies, has induced some philosophers to imagine, that life is no other than a certain combination of organs, which are kept in a perpetual motion by mutually acting upon each other. It is not here intended to enter into any disquisition, as to what vitality consists in; Moses asserts, that in the *blood* of an animal is the *life* thereof; and John Hunter follows him; while on the other hand, it has been ably contended by Mr. Thelival and others, that the blood is only the medium or agent of vitality; Mr. Saumariez has published a disquisition on the principle of life to which however we can only refer *.

Life consists according to the *brunonian* system, in a principle of excitability, or a power of being excited and put into motion by external objects. When this faculty is abundant, we are said to be in a state of accumulated excitability; when deficient, the excitability is said to be exhausted. The bodies exciting are heat, air, food †.

* For a correct idea of the essential attributes of life, and a comprehensive view of the relations that subsist between the different functions of the animal œconomy; the reader will be gratified in the perusal of Cuvier's Introduction to the study of the animal œconomy, translated by Mr. Allen, 8vo. Longman, 1801, comprising 1. organic functions, 2. structure of animal organs, 3. Differences of organs, 4. relations subsisting between organs, and 5th. classification of animals from their internal structure.—On Vitality, also consult Mr. Thelwall's Essay, 4to. 1793, for which the author had the *thanks* of the Physical Society of *Guy's Hospital.*

† Dr. Garnet on Health, 12mo. 1800. This amiable physician, whose exertions were directed to the general diffusion of knowledge, the improvement of useful arts, and to the promotion of social happiness, lately fell a victim to a fever caught in the gratuitous exercise of his profefsion The managers of the *Royal Institution*, have therefore encouraged a subscription to print his "*Lectures on the laws of animal life*," for the benefit of his two infant orphan daughters. The patrons of science, and the friends of humanity will therefore be zealous, on such an urgent call.—Subscriptions are received at Mess. Coutts's, &c. &c.

Abstract these bodies, or keep them from us for a certain time, and we should all die, vegetables, as well as animals.

We shall take the liberty to close this chapter, with relating the following singular circumstance, which happened in an anatomical theatre, in the last century; *Peter Peutman* of Rotterdam, was requested to paint an emblematical picture of mortality representing human skulls and bones, surrounded with rich gems, and musical instruments, to express the vanity of this world's pleasures: that he might imitate nature with exactness, he went into a room, where several skeletons hung by wires, and bones and skulls lay scattered about, and immediately prepared to make his designs.

While he was thus employed, he insensibly fell asleep, but was suddenly roused by an earthquake. The moment he awoke he observed the skeletons move about, and the loose skulls roll from one side of the room to the other; and being totally ignorant of the cause, he was struck with such horror that he threw himself down stairs and tumbled into the street half dead. His friends took all possible pains to efface the impression made on his mind by that unlucky event, and

 acquainted

acquainted him with the real cause of the agitation of the skeletons ; yet the transaction still affected his spirits in so violent a manner, that it shortly brought on his death.

CHAP.

CHAP. IX.

ON THE STRUCTURE OF THE HUMAN FORM, MALE AND FEMALE.

> " Why was my body form'd erect,
> While brutes bow down to earth?
> But that my soul should learn *to know*
> And *claim*, it's nobler birth."

THE beginning of human nature is a mystery, and also its state of subsistence, before it breathes the atmosphere of the world. We know not how the bones grow: yet we are certain that they are a state of growth, from an atom of matter, to the stature of a child; from the lowest degree of life, to a condition of sense and perception. Such also is the state of man, after he breaks from the prison of his nativity, and becomes a free agent in the world. His body by daily nourishment, increases from smallness and weakness, to stature and strength; his mind in proportion also, improves from mere sensation to reasoning, from ignorance to knowledge, from acting by appetite and natural instigation, to act by reason and moral rules.

In one state, that which was a *speck of entity*; becomes a well formed creature; in the other, he who could not move himself, becomes an active being, and he who was almost weaker than the meanest creature, acquires that strength of limbs, and sagacity of mind, which gives him a right to a lordship over his kindred animals *.

From the time of conception till birth †, the growth of the body proceeds in an accelerated or increased proportion, that is, the growth in the sixth month for instance, is greater in proportion than in the fifth; from birth till manhood it is gradually less and less, in other words the growth of the second year is less *in proportion*, than that of the preceding, and so of all the succeeding years. As the body advances in growth its disproportions are gradually lost; the head increases more slowly, and the lower extremities with more rapidity. The head indeed ceases to grow, much sooner than the other parts; for these, and particularly the thorax, seem to gain size and strength for several years after the head is arrived at its utmost dimensions.

---

* Barton's Analogy. † Dr. Gregory.

At

At the age of 15 or 16 years sooner in females than in males, and sooner in warm countries than in cold, the signs of puberty begin to manifest themselves, and the system consequently experiences a change. When the body has attained to full growth and strength, it does not immediately decline, but remains in a state of nearly equal vigour, till between 40 and 50 years of age: at this time it begins sensibly to lose its agility, and the approaches towards old age, which had hitherto been insensibly going on, begin to manifest themselves. But though the body has now lost considerably of its agility, yet in persons of good constitutions, and who have not been remarkably intemperate, its strength remains pretty entire, After 50, decline becomes more apparent; from 60 to 70 the health is frequently pretty good, but the strength evidently fails.

In the whole progress of life the body is continually becoming *less vascular*. The vivid bloom of youth, which is owing to the ramifications of minute arteries in the skin of the cheeks, subsides into the moderate hue of middle life, and this into the wrinkled and shrunk appearance of old age. Similar changes are taking place in other parts of the body, and the coats of the arteries, gradually becoming thicker and stronger with respect to the veins; these latter, become more distended, and the livid hue of venous plethora, succeeds to the livid tint of the arterious. A disposition to solidity invades the body in the progress of life, and that which in the child was pliant cartilage, becomes in the old man brittle bone.

The proportions which are admired in one animal body, are altogether different from those which are esteemed in another. Every class of things has its own peculiar conformation, which is approved of, and has a beauty of its own distinct from that of every other species. It is upon this account that a learned jesuit (Buffier) has determined that the beauty of every object consists in that form and colour which is most usual among things of that particular sort to which it belongs. Thus in the human form, the beauty of each feature lies in a certain middle, equally removed from a variety of other forms that are ugly. A beautiful nose for example, is one that is neither very long, nor very short, neither very streight, nor very crooked, but a sort of middle, between these extremes, and less different from any one of them, than all of them are from one another *.

* Adam Smith.

The

The women in every country have particular charms by which they are characterised. In England by the elegance of their shape, and modesty of their carriage. In France; by that amiable gaiety which animates all their features, and in Germany by the freshness of their complexions. But the charm felt on approaching a Spanish lady, (most writers agree) is of too exquisite a nature to be described.

Deformity is peculiar to the civilized part of mankind, and is almost always the work of our own hands. The Turkish and Asiatic women, who are distinguished for the elegance of their form, and the gracefulness of their carriage, are accustomed from their infancy to wear no dress, but what is perfectly loose.

Climate operates with decisive influence on the condition and character of man. In the extremes of heat and cold, this influence is conspicuous *.

Whether we consider man merely as an animal, or as a being, endowed with rational powers, which fit him for activity and speculation,

* See page 254 on this subject.

he has uniformly attained the greatest perfection of which his nature is capable, in the *temperate regions*. There his constitution is most vigorous, his organs most acute, and his form most beautiful. There too, he possesses a superior extent of capacity, greater fertility of imagination, more enterprising courage, and a sensibility of heart, which gives birth to passions not only ardent, but persevering. In this favourite situation, he has displayed, the utmost effects of his genius, in literature, policy, commerce; and in all the arts which improve and embellish life.

The time of day also, brings with it its peculiar influence: in the morning life is *languid*. It acquires vigour by the gradual and successive application of stimuli in the forenoon. It is in its most perfect state about mid-day, and remains stationary for some hours. From the diminution of the sensibility, and contractility of the system to the action of impressions, it lessens in the evening, and becomes again languid at bed-time.

The height and breadth of the body is different, at different times of the day; being commonly an inch more in the morning than at night. The body ceases to grow in height, when the bones are arrived at a degree of firmness and rigidity

dity which will not allow of farther extension by the effort of the heart, and motion of the blood *.

It is necessary to the health of the body, that the passions, as well as our reason, should be exercised, as much as possible. We shall walk, run, dance, swim, fence, sail, and ride, to little purpose, unless we make choice of an agreeable friend to accompany us. Solitude is the bane of man, insomuch that it is difficult to tell which suffers most, the soul in its qualities, or the body in its temperament, from being alone. Too great a concourse of people, breeds diseases. Too much company is destructive to cheerfulness. For the sake of both body and mind, therefore, we should move in a little circle, and let heaven circumscribe it for us. Let our wives and children be always around us, or if we are not blessed with these, let a few cheerful friends be our constant companions.

Among other influences on animal life, we must not omit *talking*, which has its benefits; but perhaps is more necessary in the *female* constitution, than in the *male*; for it has been ob-

* Philos. Trans. ab. Vol. 7.

served that women who are very taciturn, are generally unhealthy.

Life is continued in a less imperfect state, in old age, in women than in men. The former sew, and knit, and spin, after they lose the use of their ears and eyes; whereas the latter, after losing the use of those senses, frequently pass the evening of their lives in a torpid state in a chimney corner. It is from the influence of moderate and gently stimulating employments upon the female constitution, that more women live to be old than men, and that they rarely survive their usefulness in domestic life.

Young people stand in less need of exercise than old; women less than men. The natural vigour of their constitutions is such, that they suffer least from the want of it. This will explain the meaning, and shew the propriety of an opinion of Rousseau's—that women only should follow those mechanical arts which require a sedentary life.

Knowledge is no less proper for women than for men; learning and science give a solidity to the mind, a turn for reflection which must be highly favourable to the best feelings of huma-

nity

nity, and consequently to the most amiable of all the affections, *the parental* *.

In every nation, illustrious females have shone in the paths of science and virtue, fully establishing their intellectual faculties to be equal to those of men, when duly cultivated and permitted to expand †.

It cannot be attempted here to discuss the subject of the supposed superiority of one sex to the other; nor to enquire why females labour under so many physical degradations on the one hand, or why power, profit, and honours are *monopolized exclusively* by men. The Marquis of Beccaria remarks, that nations, by excluding women, unjustly confine political liberty to one half only of their subjects. So contracted have

* Appeal in behalf of Women, 8vo 1798. Strictures on Female Education, 8vo.

† *Andrienne Liquiere*, of Paris, defended (in Dec. 1800) a public thesis on child-birth, for which she had a prize medal. Queen Caroline was fond of the study of anatomy, and often conversed with Cheselden on the subject. Miss Hays, a lady of considerable abilities, has lately published the Memoirs of Illustrious Women of all ages, in 6 vols. 12mo. 1802.

hitherto been the views of all legislators, that the natural and political rights of women, as rational creatures, seem never to have been in any degree objects of their contemplation.

Among other circumstances of painful degradation attached to the sex, is that of polygamy, which is permitted over a large portion of the world, and must be considered as baneful to domestic virtue. By the latest accounts, in the greatest part of Europe, the proportion of females born, in general, is as 105 to 100 males; inequality of births, therefore, cannot be an adequate plea to support the practice. Unless affection be reciprocal and equal, there can be no proper society in the matrimonial state; no cordiality, nor due care of offspring. But such affection is inconsistent with polygamy.

The female constitution, in warm countries, sooner arrives at puberty, and sooner declines. This has been also urged as a reason why polygamy has been generally adopted in such climates. Women there sooner loose the charms of youth, while men still preserve their passions, and the powers of nature. In hot climates puberty begins with women at 9 years old, in Lapland

land not till the age of 20, and in this country between 14 and 16 years of age.

Jesus Christ placed the female character in a respectable point of view. Women frequently composed a great part of his audience; but to them no particular precepts were addressed, no sexual virtues recommended; his morality was addressed to the judgment, without distinction of sex.

In a religious sect, which peculiarly elevates the female character, by admitting women to exercise their talents in the most distinguished offices, independent of the ministry of the church, they hold separate meetings of discipline, they visit their own sex, attend to and relieve their peculiar wants; and thus acquire the means of seeing, and the power of succouring distress *.

---

* It is calculated that no less than 3000 different sects exist in the world in regard to religion, and each individual of these sects probably differ in one point or more of their common faith; so that it may be asserted that no two persons in the world think precisely alike, and consequently that it would be as difficult to find two minds alike as two bodies. religious persecution therefore must be immoral.—Dr. Lettsom.

Each sex (in the opinion of a late amiable writer) in every situation of life has peculiar duties assigned to it by that good providence which governs all things and delights in order. The heart, regulated by the precepts of the gospel, will not murmur at its lot; and the single female, regulating her conduct by the virtues there recommended, will never consider her situation as abject and forlorn; nor will she who is the mother of a family consider its humblest duties as mean or void of dignity and importance *. Thus women will sustain their part with dignity and complacency, while the man who is influenced by the same principles will behave to her with that affection and respect due to a joint heir of immortality; nor ever form a wish of degrading the partner of his bosom to the condition of a slave.—And yet where shall we find in early history any adequate traces of their estimation. The greatest lawgivers have scarcely made one single decree in favour of this sex, excepting with some view to political advantage.

* See Memoirs of Modern Philosophers, a Novel, 1801, by Miss Hamilton. Another author observes, that there seems to be an error or absurdity in drawing the sexes into a comparison, as they were providentially formed as counterparts of one another. See Strict. on Female Education.

It does not occur to us that there is any great degree of distinction in the bodily *strength* and *vigour* of the sexes formed by nature; for where art and attention have had no influence, as in women of lower stations, they are equally strong, robust, and as capable of hardships as the generality of men, and in some countries perform the most laborious business. Their organization is more sensible than in men, and their texture more irritable; but it has been observed that men are more under the influence of their passions than women, and their appetites are more depraved by indulgence.

From this difference of constitution, &c. the sexes will be liable, each exclusively, to peculiar kinds of disorders*. Yet in sexual diseases,

* Females, particularly to cancer in the breast; Dolor faciei of Fothergill, &c. See on this latter, *Siebold* and others. Women are as often affected with gout, as men, though commonly under feeble forms of morbid action, and not so often attacking their feet and limbs. *L'affecteur's* Essay on the Physical and moral Diseases of Women, (Paris, 8vo.) includes the usual maladies incident to females, as well as the political evils to which the sex are subject in society. In this work he ably comments on the influence of the passions over the physical constitution of women, and forcibly inculcates the necessity of regulating the former for the benefit of the latter.

Med. and Phy. Journal. vol. 1. p. 310.

we may (says Dr. Nesbit) observe a considerable fluctuation; for the gout formerly confined to the men, is now a frequent visitant of the female sex, while in the same way, hysterics a peculiar female disease, is now found to attack the male.

A late eminent traveller, observed among the tribes of Indian women, that they were particularly affected with pains in the head, and in the muscles of the neck; but rather considers it more a mechanical effect, resulting from the manner in which they carry their burthens, than as otherwise peculiar to them.—In women diseases are in general milder than with men; some disorders depend on climate.

The attention of women to dress has been deemed a sexual propensity; but this is as natural to man; in barbarous states both sexes are equally fond of dress. Where the degrees of knowledge in both are alike, the sexes appear on a par. But if females by education and the habits of society are depressed in the scale of rational existence, their minds not open to adequate objects, will rise no higher than painting the body, and adorning it with sedulous care:

The

The present fashionable arrangement of dress, which exhibits so lucid a view of the female figure, reminds us of four lines of Anthony Pasquin's, which are here quoted for the benefit of our fair *Nudes*.

> " Pray let not a vulgar demeanour obtrude
> To debase your neat form by a habit that's rude,
> For e'en *Venus* offends, though the child of a *Deus*,
> As she takes up her vest to survey the *Glutæus*."*

Perhaps till lately, in this country, women have had their minds too much diverted from rational objects, to enable them to think with precision enough to form *principles;* or to act with that energy and dignity, becoming intelligent and accountable agents. It has been suggested, in favour of the superior energy of the mind of man, that the sex have never produced a *Locke*,

* Mr. I. King, who unites the talents of a skilful artist, and of an accurate anatomist, and who has considered the origin and effect of fashions with much minuteness, has undertaken a set of drawings, (for Dr. Beddoes) exhibiting various dresses, as they act upon various parts—Dr. Camper began ably with shoes, and Dr. Soemmerring with *stays*, but this work is not translated.—See also what we have said in chap. 3. &c.

a *Montesquieu*,

a *Montesquieu*, an *Euclid*, or a *Newton*; but the same writer, allows the inference unfair, till women have enjoyed equal advantages, and been called forth, by similar encouragements, into literary greatness.

But to proceed to the bodily structure; where a difference is evidently visible.

In viewing the structure of a man, in general, with respect to a female, the features will be observed stronger or more masculine, the neck not so round; the shoulders in a man are broader, and the chest is likewise more broad and prominent; the belly is more compressed; the haunches are narrower, and the limbs more brawny and muscular, though not so round, nor altogether so thick. These are the distinguishing properties of the male figure.

In the female figure, the features are softer, the neck more round and smooth; the *pomum adami*, less protuberant, the shoulders narrower, the chest likewise narrower and more compressed, the belly more prominent—the haunches a great deal broader—the thighs more thick and rounded: the arms, hands, legs and feet, more delicate and plump, and not so large.

The constitution of the general state of the solids in women is more lax than in men, for nature has designed them for bearing children, and giving suck; and a greater vigour of circulation being kept up in men, they perspire insensibly in a general way, more than women.

After women have passed a certain age, they live much longer, than men who have arrived at the same age; the reason of this is supposed to be, that in women, the bones, cartilages, muscles, and every part, are softer and less solid, than in men; consequently that they require more time in hardening to that degree which brings on death. The temperance also of women, must certainly longer protect them from the ravages of time.

The female skeleton has also some distinguishing marks:* from being subject to the lodgement

---

* Professor Sömmering, of Frankfort, has lately published one of the most perfect engravings of a *female skeleton,* purposely designed as a counterpart, to Albinus's male skeleton, which wanted the female; and by the addition of which, that collection is now rendered one of the most splendid and complete anatomical works we possess.

The

ment of the fœtus, it is of a make different from the robust male. M. Fischer has published an essay on the difference of bones, as they relate to sex, and particularly to nations.

The bones of women are smaller in proportion to their length, than those of men; because the force of their muscles is not so great, nor is there such strong external force applied to them, to prevent their stretching out in length. The surfaces of their bones are not so marked as men's, for their muscles are not so thick, strong, nor so much employed, as to make such strong prints on their bones.

The bone of their forehead is more frequently divided. Their clavicles are less crooked, because their arms are less forcibly pulled forward. Their sternum is more raised by long cartilages below, that the thorax might be there widened, in some proportion to what it is shortened by the pressure pregnancy occasions upon the diaphragm.

A less forcible power of ossification also, renders some defects visible in the bones, but the

The reader may apply to Dr. S's classical volumes "*De corporis humani fabrica*" in which reference is made to the most accurate figures.

superior

superior cartilages of the ribs are sooner ossified to support the weight of the breasts. Weak women, who have had many children when young, often have the vertebræ of the back bended forwards, and their *sternum* depressed, or become round shouldered and flat breasted, by the pressure and weight of the impregnated *uterus*, and by the strong action of the abdominal muscles. The os sacrum is broader, and turned much more backwards for enlarging the cavity of the pelvis. The coccysis is more moveable and less bent forwards.

The ossa ilium are more hollow, and more reflected outwards, consequently the lower part of the abdomen is wider, and they thus better support the fœtus. In short, the whole disposition of those bones which form what is termed the bason, or pelvis, are such as will best facilitate the growth, and birth of the child: The marrow contained in the bones, seems more solid and yellow in the male, than in the female sex, the latter possessing likewise a less proportion of it.

The articulation of the thigh bones, being wider, probably occasions that shuffling from side to side, observed in women when they run, to preserve an equilibrium, and prevent their falling.

It

It has been said, that the *sternum* of women is flatter than in men, to make allowance for the superior size of their breasts; but if compared, the female *sternum* connected by it cartilages is more round than the male: hence the capacity of the thorax is more enlarged, and they breathe with more freedom than they would otherwise do in the latter months of pregnancy; the principal difference is in the pelvis; the os ilium being more upright in the male, than in the female, who have it, as said above, reflected outwards; men being generally one third broader in their shoulders; and women, one third, in their haunches.

The male *ilium* is frequently thinnest, and the female *sacrum* most strait—these peculiarities require to be carefully attended to by young artists and painters, who can rise in their profession only by the most faithful copies of nature.—It is a false notion that a man has a rib less than a woman, or more ribs on one side than on the other: In women it has been remarked, that the descending trunk of the aorta is larger than with men.

Lavater draws many peculiar traits of characteristic distinction between the sexes; and concludes thus, "Man singly, is but half man; a king without a kingdom. Woman who feels properly what she is, whether still or in motion, rests upon the man; nor is man what he may and ought to be, but in conjunction with woman. It was an argument of great excellency in man, that all creatures were created for him; but the highest honour of man was the woman, who was created in the same nature, and in the same image, and to the same GLORY with himself. The attachment between the sexes is a natural principle, which forms in an eminent degree the happiness of human life in every part of the world. To give it any force or permanency we must connect it with sentiment and esteem. But it is not in our power to do this, if we treat women as we do children. If we impress their minds with a belief that they were only made to be domestic drudges, and the slaves of our pleasures, we debase their minds and destroy all generous emulation to excel; whereas, if we use them in a more liberal and generous manner, a decent pride, a conscious dignity, and a sense of their own worth, will naturally induce them to exert themselves to be, what they would wish to be thought, and are entitled to be, our companions and friends."

Till Hymen brought his love delighted hour,
There dwelt no joy in Eden's rosy bower!
In vain the viewless seraph ling'ring there,
At starry midnight, charm'd the silent air;
In vain the wild-bird carol'd on the steep,
To hail the sun, slow-wheeling from the deep;
In vain to sooth the solitary shade,
Aërial notes in mingling measure play'd;
The summer wind that shook the spangled tree,
The whispering wave, the murmur of the bee;
Still slowly pass'd the melancholy day,
And still the stranger wist not were to stray;
The world was sad! the garden was a wild!
And man the hermit sigh'd—till Woman smil'd!

PLEASURES OF HOPE.

The custom of keeping the sexes apart, (never intended by nature) in the opinion of eminent physicians, is often productive of ill effects to the female constitution; on the other hand, moral consequences must be attended to in regulations of this kind. It is remarked, that more single people die among those who are come to manhood, than married, and physicians agree, that single men and women, compose by far the greatest number of their *chronic patients* among adults. Family cares are unavoidable, but are necessary; stagnant waters are never sweet. Thus the cares attendant on a connubial state, by keeping the tenderer passions always agitated, prevent

prevent that uniformity in life, which is so foreign and disagreeable both to the body and mind.

> " Can he be bless'd, who has no friend or wife,
> No dear companion of the heart to share,
> His pleasures and his pains ? rather to-day
> Might vows of never-ending love, of faith
> In fortune's good or ill, be interchang'd
> 'Tween me, and some fair virgin, mutual in
> Affection, passion, sentiment, and soul."
>
> GOETHE.

We believe that no difference has been ever discerned in the *brain* of either sex.

The question of the rights of women, has been recently agitated in a variety of publications.

The arguments of those, who are of opinion with Plato " that women as well as men, ought to be intrusted with the government of states, and the conduct of military operations"—and of those who contend for contrary doctrines—cannot be detailed here—and we confess ourselves incompetent to decide, how far the happiness of society is involved in such disquisitions.

Having presented, though slightly, the characteristic distinctions of man and woman, we will proceed to consider what constitutes one chief purpose in studying the anatomy of the human body, besides understanding its functions, which is, to compare it with other creatures, till we at last arrive at some distant conception of the whole, of the various structures, of animals and vegetables, and of the various functions which in each of these classes support life, and through it the principle of life.*

But the peculiarities in the structure and formation of the vegetable and animal world from men, and from each other, are so extended, that the notice of each, will necessarily be confined, and miscellaneous, rather than systematic.

* Anat: by John Bell, 8vo. 1797, vol. 2.

CHAP

CHAP. X.

TRAITS OF THE VARIOUS ORGANIZATION OBSERVABLE IN NATURE, COMPARED WITH MAN—MISCELLANEOUS REMARKS ON THE SUPERIORITY OF MAN TO ANIMALS.

Quid mentem traxisse polo, quid profuit altum
Erexisse caput? *pecudum* si more pererrant.

THE comparative anatomy of brute animals has been the source of the most useful discoveries *.

Instinct is a principle common to us, and the whole animal world; to animals, as far as it extends, it is an infallible guide. In man, reason is often a weak and unsafe guide, when compared to

* "The importance of Comparative Anatomy has been at all times acknowledged. The abuse which prevailed towards the end of the 17th century, of so often describing the human body from the dissection of animals, was the cause of this branch of science being so much neglected during the early part of the present

to instinct. For instance, in the bringing forth and nursing of their young, the advantages of brute instinct over the customs which have been taken up by rational beings, may be observed. Numbers of mothers, as well as infants, die by the preposterous management of art, and by mothers omitting the duty of nursing; a natural duty and obligation, which contributes no less to the safety, health, and beauty of mothers, than it does to preserve the lives and health of their offspring.

"But she who to her babe her breast denies,
The sentient mind, the living man destroys;
Arrests kind Nature's liberal hand too soon,
And robs her helpless young of half the boon.
——'Tis his, not her's—the colour only chang'd,
'Ere while through all the throbbing veins it rang'd;

---

present century. But the study has been resumed with ardour, and a number of eminent men have for some time past made it the object of their peculiar attention. It is due to the National Museum of Natural History, at Paris, to observe, that the learned men connected with that establishment have constantly contributed to promote and encourage this study. The names of *Duverney*, *Ferrein*, and *Petit*, are celebrated in the annals of science. Buffon gave a new attraction to comparative anatomy, by displaying its importance as the foundation of characters in natural history; and the vast labours of his worthy assistant, *Daubenton*, render it henceforth the fixed basis of Zoology."

Cuvier's Lect. vol. i.

Pour'd

Pour'd through each artery its redundant tide,
And with rich stream incipient life supply'd;
And when full time releas'd th' imprison'd young,
Up to the breasts a living river sprung."

THE NURSE, A POEM, 1800.

Various tribes of irrational animals act in a thousand instances more prudent than we do, and being uniformly guided by instinct, are led implicitly and safely through all their operations. Many quadrupeds, fish, and even reptiles, seem to know what is proper for them as soon as they come into existence, and have strength sufficient to reach after it. In other instances they are guided by the parent, who seems to join some degree of knowledge, acquired by experience, to the instinct with which it is naturally endowed. The provision which brutes make for their young, previous to their bringing forth, is an instance, not of previous knowledge, but of instinct. A bird makes a nest, not from parental instruction, or any reasoning principle, but purely from instinct. Breed a bird up by hand, shutting out all communication with others, unassisted by the male, and by no effect of imitation, she will make a nest peculiar to her own class, and of the common materials. A cat accustomed to lie on stone, will, in spite of every-thing, secure a downy retreat for her young. Something of this kind attends the human mother, where her mind is ever so diverted or corrupted, yet she cannot avoid some preparation for her offspring.

Man, designed to be the pupil of observation, has scarce any innate discernment, and consequently his infant race pass through a long period utterly helpless, alike divested of ideas to guide, and of strength to manage for themselves. But to the parent is imparted both, whose province it is to judge for them, and actually to put into their hands or mouths whatever they may stand in need of. When the parent, therefore, forsakes the paths of simplicity, and lays down arbitrary rules, the result of false science, instead of patient experience, or mistakes the clamour of fashion for the voice of nature, confusion and disease must be the unavoidable consequence *.

The distinguishing excellence of man is REASON; of beasts, *instinct;* and of vegetables, *use;* which evidently administer to man in two respects: 1st, to his body, either as food or medicine; and, 2dly, to his mind, as means of pleasure and recreation, or lessons of instruction, and helps to thought; and in both may subserve the

* Dr. Underwood on Dis. of Children.

purposes

purposes of excitement to duty, and mementos of obligation *.

Those who are best acquainted with comparative anatomy (observes Mr. Bell) will best know how natural it is to illustrate the functions of our bodies, by comparing it with various animals. How pleasant and useful these analogies are, must be felt by every student. Persons are apt to shrink from science, because it is seldom presented in a form to allure; but these difficulties are gradually disappearing. In the Museum at Paris (1802) the arrangement is such as to render the study of *comparative anatomy* almost an amusement.

It seems evident that animals, as well as men, learn many things from experience, and infer that many events will follow from the same causes. By this principle they become acquainted with the more obvious properties of external objects, and gradually from their birth treasure up a knowledge of the nature of fire, water, earth, stones, height, depths, &c. and of the effects which result from their operation. The ignorance and inexperience of the young are here plainly distin-

* Sanders.

guishable from the cunning and sagacity of the old, who have learned by long observation to avoid what hurts them, and to pursue what gives them ease and pleasure. A horse accustomed to the field will not attempt what exceeds his force or ability; an old greyhound will trust the more fatiguing part of the chase to the younger, and will place himself so as to meet the hare in her doubles: this sagacity is founded on observation an experience.

This is still farther evident from the effects of discipline and education on animals, who, by the proper application of rewards and punishments, may be taught any mode of action most contrary to their instincts and propensities. Is it not experience which renders a dog apprehensive of pain when you menace him, or lift up the whip to beat him? Is it not experience which makes him answer to his name? It is custom alone which engages animals, from every object which strikes their senses, to infer its usual attendant, and carries their imagination from the appearances of one to expect the other.

But though animals learn much of their knowledge from observation, they derive also much from the original hand of nature, which greatly

exceeds

exceeds their share of capacity on ordinary occasions, and in which they improve little or nothing, by the longest practice and experience, these we call instincts, or half reasoning.

On this subject the following anecdote of the Elephant occurs, and is given on the authority of Thevenot.

An Elephant that had been very often fed and kindly treated by an herb-woman, belonging to the market of Delly, the capital of Indostan, passed once through the market when proud. This animal, at such a time, is observed to be quite outrageous, and to spare nothing that comes in its way; it accordingly drove on with the utmost fury, throwing down and trampling upon all those it met, till the daughter of the herb-woman, a little child, that could scarce crawl along, happened to come in its way; its rage immediately subsided; it took up the child gently upon its proboscis, and laying it upon a shed hard by, where it might be out of harm's way, proceeded with the same fury as before. A human creature could hardly discover stronger symptoms of gratitude and understanding. The circumstance of its knowing the child again to be that of its benefactress, and preserving it with tenderness and care,

care, in return for benefits received, shews that this animal is possessed of a high degree of intelligence and thought.

The following are sketches, of peculiar organization in birds, insects, and animals; the great variety observable in their frames, display the power of the Deity; a power, which has no limits, combined with a goodness incomprehensible to our finite capacities.

Bulk for bulk, man seems to possess a middle state when viewed merely as an animal, and when placed in the order of brutes: for although he is greatly superior in size to the tadpole, he is very inferior to the Elephant.

What man is there, whose eye is equal to that of the Hawk, or the Cat? whose arm is so strong, as that of a Lion; or whose olfactory organs, are so acute, as those of some dogs? *

Birds

* Saumarez on the Universe, 1795. We cannot distinguish by our smell the effluvia of the human body, or even, if we perceive it, we cannot discern one man from another. But the dog will distinguish all men by their smell. What a great distance will he follow his master without seeing him; and where various paths meet his scent, will find out the effluvia which ari-

ses

Birds are supposed to breathe like man, but have in fact no diaphragm to divide their body, which is all chest and no belly; they have vesicles or air bags extending through the whole body, and connected with the true lungs: their sternum and ribs expand over the whole, and by their motion move the air vesicles, which blow the air through the true lungs; while the true lungs, far from having any thing to do with a diaphragm never move. Mr. Hunter's assertion of a diaphragm, is ably refuted by Mr. J. Bell (Anat. Vol. 2. 8vo.) The muscles of respiration in frogs, are not the muscles of the belly; but the muscles of the jaws, which accounts for the uncouth broadness of the jaws in frogs, serpents, turtles, &c.

Quadrupeds have some resemblance in their internal structure with man; but that of birds is intirely dissimilar; these animals seem wholly formed to inhabit the apparent empty regions of

---

ses from his master, and he will follow him, though others have crossed the same road. He will even pick up a stone thrown by his master's hand, amidst many others thrown at the same time by different persons. That short touch of the flesh being sufficient to mark it from all the rest. This is sufficient to prove the difference of constitutions, as without it there could not be such a variety in the effluvia.

air, in order that no part of nature may be left untenanted. Every part of their mechanism, seems adapted for the improvement of their flight; their bones are extremely light and thin, and their muscles feeble, except the large pectoral muscle, by means of which they move their wings with such ease and rapidity. This very strong muscle fills up all that space, on each side of the breast bone, which though small in quadrupeds, is in these, large, broad, and externally of a very great surface; by means of this a bird can move its wings with a degree of strength which when compared to the animal's size is almost incredible. The ears of birds are devoid of wax, being sufficiently protected by their covering.

No bird or animal that approaches man in any of his faculties has a flat shull—flatness contains less and resists less—thus the goose has a flat skull, and a flat bill, and its stupidity is proverbial. But an ostrich which has the flattest skull, and flattest bill, is the most stupid *.

The migration of birds has been justly considered as one of the most wonderful instincts of

* Consult White's Gradation of Man, on this topic, 4to. where some curious observations, are illustrated with various representations of the forms of skulls.

nature;

nature; Milton styles birds, thus divinely taught "intelligent of seasons;" and the venerable prophet Jeremiah, adduces the instance of the stork's observation of their appointed times, as a circumstance of reproach to the chosen people of God, who although taught by reason and religion, "knew not the judgement of the Lord."

From the providential care so evidently manifested in the preservation of the feathered tribes; the divine teacher of our holy religion, has drawn an argument to prevent our sinking into anxiety and despondence, and to induce us to rely with filial confidence and piety on the goodness of our heavenly parent *. Behold the fowls, &c.

The ages of birds are various, and do not seem to bear the same proportion to the time of acquiring their growth, as has been remarked with regard to quadrupeds. Most birds acquire their full dimensions in a few months, and are capable of propagation the first summer after they are hatched. In proportion to the size of their bodies birds are much more vivacious, and live longer than either man or quadrupeds. The language of birds, by which they act in concert, and their

* Contemplative Philosopher, 1801, 12mo.

celerity of wing, gives them a decided superiority over every species of quadrupeds, and affords them means of safety, from attacks their weakness would otherwise subject them to.

If a bird flies only half a mile in a minute, for the space of twenty-four hours, it will have gone over, in that time, an extent of more than 700 miles, which is sufficient to account for almost the longest migration; but if aided by a favorable current of air, there is reason to suppose that the same journey, may be performed in a much smaller space of time *.

An ingenious physiologist supposes a certain language to exist among birds, which is traditional. For example, an old turkey teaches its young, a particular sound, denoting the presence of a kite. A few years since an Italian published a volume on the languages of singing

* Dr. Latham has published an Essay on the wind-pipe of birds, with plates, which contains a valuable addition to the knowledge of comparative anatomy. In birds, the glottis where the sound is formed is placed at the bottom of the trachea or air tube, where it divides into two principal branches, one for each of the lungs. In quadrupeds and reptiles, the glottis is situated at the top of the trachea, and, at the root of the tongue.

birds. In the small order of birds which winter with us, from a snipe downwards, let the external colour of the feathers be what it will, their creator has universally given them a bed of *black* down next to their bodies. Black, we know, is the warmest colour: and the purpose here is, to *keep in* the heat, arising from the heart and circulation of the blood.

In some animals, the tongue, besides being subservient to the purposes of sound, answers the purpose of a hand, to bring the food to the mouth, as in the wood-pecker; ant-bear, camelion and some shell fish.

Connected with the tongue are the fauces; which in many animals has peculiarities. In the electric eel, they have a very curious carunculated irregular appearance; but thay are yet more extraordinary in the camel, which has an apparatus to moisten the parts so as to prevent the painful sensation of thirst, thus adapting the animal to the sandy deserts it inhabits; this apparatus consists of a lárge bag hanging down several inches in the fauces, and attached to the palate, which the animal can at pleasure move up and down, and lubricate the fauces.

The roots of plants, are the simplest absorbents, which are analogous to the lymphatic and lacteal vessels of animals. These in the human subject, and elephant are small, and in the turtle large and more numerous; but in the spermaceti, whale where they are employed for conveying the spermaceti, of a size infinitely beyond what is met with in any other animal.

The most simple state of the brain, is found in the leech, consisting of a simple nerve with ramifications. In the snail the brain forms a circular nerve, through the middle of which passes the gullet, from which circle there are branches going to every part of the skin of the animal—in the insect, the brain has a more compact form, is larger in fish, but still more so in birds, gradually increasing in size, as the animal is endued with a greater degree of sagacity, till at last it becomes, the large complex organ, found in the elephant, and in the human subject.

In the *diptera* order of insects, which has two wings, there is under each the rudiment of another, which terminates in a little button or small solid head. These parts are called *balancers*, because they seem to maintain the equilibrium of the insect's body during the rapid motion of its wings: this much at least is known, every time the insect strikes the air with its wings, a very quick motion is perceived in the balancers. Between the balancer and the wing, is placed a hollow membranous scale resembling a spoon without a handle. When the balancer moves, it strikes against this part, and appears in that manner to produce the well-known buzzing sound made by flies when they are on the wing.

The nose properly so called, nor any organ appropriated to smell, is found in animals that have no vertebræ; yet they afford striking proofs that they possess this sense: which is therefore supposed to reside within the *trachea*, in flies, bees, &c.

The heart in a caterpillar is only a simple canal or artery, running along the middle of the back of the animal, admitting of undulation of the blood; from this simple structure it becomes in different animals, by small additions more and more complex, till it arrives at the degree of perfection, which is displayed in the organization of the human heart *. The silk worm also has only a large

* Cuvier has ascertained that the dorsal vessel of insects is not a heart, and that it possesses no branch which can serve for the purpose of circulation. He asserts, that insects are provided with

a large artery, which performs the office of a heart.

The heart in an oyster is perhaps situated more in the center of the body, than in any creature, the gills or lungs lie out on the side of the oyster, and bear a large proportion to its body; this part is commonly known under the appellation of its beard.

Many animals possess evident marks of understanding and passion. The elephant, fox, and ant, exhibit strong proofs of thought; and where is the school-boy that cannot testify to the anger of the bee, and the wasp *.

It has been remarked, that brutes are intelligent in proportion to their accuracy of feeling, or as their extremities approach in resemblance to the human hand. The horse and the bull, whose feet are covered with callous hoofs, are less intelligent than the dog: and the dog is inferior in acuteness to the ape who possesses a rude kind of hand. It has been conjectured from the great

with no other vessels than the trachea, that the nutritive juice passes only through the intestinal canal, and that all the parts derive their aliment from simple suction.

† Dr Rush Philad.

pains

pains which Hippocrates takes to describe the difference between the flesh of a dog, a fox, a horse, and an ass; that at that period, (which was 400 years before the birth of Christ,) they were used for victuals, at least by the common people.

Animals in cold climates have long hair to defend them from cold; in hot climates, thick skins to defend them from heat. Those that come nearest to man inhabit the torrid zone.

In the human species, and in the monkey tribe; the eye-lids are moveable, in most other animals only the upper eye-lid is capable of movement. It is remarkable that the simia have no lips, being unnecessary to animals destitute of speech *. It may be farther remarked: that 1st. All the feet of animals terminate either in horn, as those of the ox and deer; or in nails, as those of the dog and the wolf; or in claws, as those of the lion and cat. Now this different organization of the feet of animals from that of our hands, deprives them not only of all claim to the sense of the touch, but also of the dexterity requisite in hand-

* White's Gradation of Man, 4to. Dilly, 1799.

ling an instrument, in order to make any of the discoveries, which suppose the use of hands *.

2d. The life of animals in general, being of shorter duration than that of man, neither permits them to make so many observations, nor consequently to acquire so many ideas.

3d. Animals being better armed and better cloathed by nature, than the human species, have fewer wants, and consequently ought to have less invention. If the voracious animals are more cunning than others, it is because hunger, ever inventive, inspires them with the art of forming stratagems to surprize their prey.

4th. Animals compose only a society that flies from man; who by the assistance of weapons made by himself, is become formidable to the strongest among them. Besides, man is the most fruitful animal upon earth: he is born and lives

* A canine, or eye tooth, adapted to tear flesh, is never found in the same animal along with a hoof, fit for supporting the weight of the body, but totally unqualified for laying hold of prey. Hence the rule that every hoofed animal is herbivorous. For a description of the teeth of the Kangaroo, which are singular, and other parts of this animal: See White's Journal, 4to.

in every climate; while many of the other animals, as the lion, the elephant, and the rhinoceros, are found only in a certain latitude; and the more a species of animals capable of making observations is multiplied, the more ideas and genius it possesses—But some may ask, why monkeys, whose paws are nearly as dextrous as our hands, do not make a progress equal to that of man? because they are inferior to him in several respects; because men are more multiplied on the earth; because among the different species of monkeys, there are but few whose strength can be compared to that of man; because monkeys being frugivorous, have fewer wants, and therefore less invention than man; their life is shorter, and they form only a fugitive society with regard to man, and such animals as the tyger, the lion, &c. and finally, because the organical disposition of their body, keeps them, like children, in perpetual motion, even after their desires are satisfied.

Monkeys are not susceptible of lassitude; which ought to be considered as one of the principles of the perfection of the human mind; apes have a greater number of muscles than the human species; and in general, resemble quadrupeds in their muscular organization, much more than they resemble man.

By combining all these differences, between the nature of man and beast, we may understand why sensibility and memory, though faculties common to man and other animals, are in the latter only sterile faculties. If nature instead of hands and flexible fingers had terminated our wrist with the foot of a horse, mankind would doubtless have been totally destitute of art, habitation, and defence against other animals. Wholly employed in the care of procuring food, and avoiding the beasts of prey, they would still have continued wandering in the forests like fugitive flocks. It is therefore evident, that according to this hypothesis, the police would never have been carried in any society to that degree of perfection to which it is now arrived.

There is not a nation now existing, but with regard to the action of the mind, must have continued very inferior to certain savage nations, who have not 200 different ideas, nor 200 words to express those ideas; and whose language must consequently be reduced, like that of animals, to five or six different sounds or cries, if we take from it the words bow, arrow, nets, &c. which suppose the use of hands; from whence Helvetius is led to conclude, that, without certain ex-

terior

terior organization, sensibility and memory in us would prove sterile faculties.

Those animals that have *only* the *canine* teeth, as the lion, &c. have a gastric juice that does not dissolve vegetables; and, on the contrary, those that have only the incisors and grinders, as the horse, &c. have a gastric juice that only dissolves vegetable substances. The *uvula*, which prevents the food from passing into the nose, is wanting in prone animals, which not being subject to this inconvenience, need not this defence. Dogs, who do not sweat, and sheep, whose cloathing is so unfavourable to the carrying off an unusual quantity of heat, always open their mouths very wide, that the whole surface of the fauces may be exposed; and move the tongue remarkably quick, to agitate the air in contact with it. An horse, in a cold stable, eats more than in a warm one, and thus counteracts the debility which would otherwise be induced upon his system by the abstraction of the stimulus of warm air *.

Horses have proportionally less marrow than men, their cylindrical bones being much narrower and more solid.

§ Rush's Lectures, 8vo. 1799.

The

The foot of a horse is an object peculiarly curious, and has lately been illustrated in several elegant publications; on a large scale, by Mr. Freeman, Coleman, &c. and on a smaller plan by Mr. White*, whose Compendium of the Veterinary Art forms a desirable addition to this science.

Lavater applies his rules to all animated nature, extending them not only to brutes, but even to insects. That the temper of a horse may be discovered by his countenance, may be more obvious than that any quality can be inferred from the physiognomy of a bee, an ant, or a cockchafer †.

Animals, when afflicted with illness, fly instinctively to some silent and dark retreat, where, unaided by art, they quickly recover. Man, left to the guidance of reason only, often falls short in this respect of the brute creation; for when weakened by disease, he gets still more exhausted by an imprudent admission of company and *light*.

* White on the Anat. and *Physiolog.* of the Horse's Foot, &c. with plates, 12mo. 1801.

White's Comp. of the Vet. Art. 12mo. 1802.

† Coxe's Travels, 4to.

These

These stimuli act very prejudicially frequently at at the first onset of disease *.

Among other curious circumstances relating to the animal œconomy, is the reproduction of bones. An account of the regeneration of a whole thigh-bone is recorded †. Though the human fabric has a considerable power in this respect, yet we find in animals still more singular properties. Crabs and lobsters cast their shells, both from their bodies, legs, and claws, and even cast their stomach, generally every year, all which are immediately regenerated. The shell is renewed by a fluid which they eject, and it invests their whole body, growing hard and dry in a short time, and becoming as strong a shell as they had before.

But, what is more extraordinary, they frequently lose a leg or a claw in their combats, which are very frequent and furious: the lost part will be regenerated in about three weeks,

* Philos. of Medicine, 8vo.—See also Dr. A. Fergusson ut supra.

† See an account, in 1794, by Mr. Russel, of this case.—When the thigh-bone is broken, it re-unites in about 60 days.

and be almost of its natural size. The violet crab, in seizing its food, catches such a hold, that the animal loses its limb sooner than its grasp; the claw continuing its retentive power for above a minute, whilst the crab is moving off. In the polypus, not only young ones will grow out like warts from different parts, and drop off, and live, but you may cut them into various pieces, and they will still live and do well. This is accounted for by its whole body being composed of stomach and parts of generation; the latter not being peculiar organs, but merely particles of the stomach, which are its body, each part of which has the power of producing the like. Its food is converted into chyle in the stomach; absorbents, opening into the heart, take up the chyle; and these, at some distance, become arteries. If the animal-flower be cut through, both parts will live; and if torn from the rock or shell to which they generally adhere, and a shred is left behind, it will become a perfect animal. The earth and sea-worm will live after being cut in two; and the red-headed earth-worm, if cut in the middle, both extremities will shoot out the parts wanting. The lizard and viper cast their skin—the sea-slug is said to cast its head—the buck its horns; all which are regenerated.

These few remarkable specimens of animal œconomy are worthy of reflection and observation; for we may ultimately gain a clue to the operations of nature which may lead to consequences of great moment.

That man was designed for a social state, may be inferred from hence, that to all other animals nature has given appropriate weapons of offence. The inborn violence of the bull is seconded by weapons of pointed horn *; the rage of the lion with claws; on the wild-boar are fixed terrible tusks. The elephant, in addition to the roughness of his hide and his enormous size, is defended with a proboscis. The crocodile is covered with scales as with a coat of mail. Fins serve the dolphin for arms, quills the porcupine, prickles the thornback; and the gallant chanticleer, in the farm-yard, crows defiance, conscious of his spur.

Some are furnished with shells, some with hides, and others with external teguments, resembling in strength and thickness the rind of a tree. Nature has consulted the safety of some of her creatures, as of the dove, by velocity of

* Antipolemus, trans. by Dr. Knox, 8vo. 1795.

motion. To others she has given venom as a substitute for a weapon; and added a hideous shape, eyes that beam terror, and a hissing noise. She has also given them antipathies and discordant dispositions, corresponding with this exterior, that they might wage an offensive and defensive war with animals of a different species. But Man she brought into the world naked, weak, tender, unarmed; his flesh of the softest texture, his skin smooth and delicate, susceptible of the slightest injury. There is nothing observable in his limbs adapted to fighting or to violence. Other animals, as before observed, when born, are qualified to support the life they have received; but man alone, for a long period, depends upon extraneous assistance; unable either to speak, walk, or help himself to food, he can only implore relief by tears and wailing. From this alone may be collected, that man is born for that love and friendship which is formed and cemented by a mutual interchange of benevolent offices. Nature evidently intended that man should consider himself indebted for the boon of life, not so much to herself as the kindness of his fellow-man; so that he might perceive himself designed for social affections. She gave him a countenance, not frightful and forbidding, but mild and placid, intimating by external signs the benignity

 of

of his disposition. She gave him eyes full of affectionate expression, the indexes of a mind delighting in social sympathy—she gave him arms to embrace his fellow-creatures—she gave lips to express an union of heart and soul—she gave him *alone* the power of laughing, a mark of the joy of which he is susceptible—she gave him *alone* tears, the symbol of clemency and compassion—she gave him also a *voice;* not a menacing and frightful *yell*, but bland, soothing, and friendly—she bestowed on him *alone* the use of speech and reason; gifts which tend more than any other to conciliate and cherish benevolence, and a desire of rendering mutual services, so that nothing might be done by violence.

Variety characterises the works of God. It is impressed through the circumference of the natural, the animal, and the intellectual world. Above we behold the dazzling sun—the pale splendour of the moon—the mild twinkling of the stars—and the variegated colours which adorn the firmament of heaven. Around us, the surface of the earth is diversified into a thousand beautiful forms; and in the animal, the vegetable, and the fossil kingdoms, no two individual productions are perfectly alike. Within us, upon the slightest examination, we discern our minds stampt with an original peculiarity. From senseless idiotism, up to the piercing sagacity of Newton, how numerous are the gradations of intellect!

Minds are of various sizes. Their capacities, habits, and views are never in strict conformity with each other. *Hence diversity of opinions also flows from the very structure of our understanding.* To fall out, therefore, with any branch of God's dispensation, is to arraign his wisdom.

Naturalists have agreed to divide the works of creation into three principal divisions—into the animal, the vegetable, and the mineral kingdoms; of which the animal system, being the most numerous, is not so completely arranged as the others. The whole of this division is by Linnæus comprized in six classes. Each class has peculiar characters, orders, genera, and species. The first class is termed mammalia, which has seven orders. Man is the first order, comprizing four genera, and 88 species.

Let it not offend the pride of man to find himself classed with brutes that perish; for if the internal

ternal structure and mechanism of the frame is examined and compared with theirs, an astonishing similarity is observable. Composed of the same materials, furnished with the same organs, which are acted upon exactly in the same manner, and are equally liable to accident, decay, and putrefaction.

But man only is the image of the Creator, endued with reason and reflection, which enable him to contemplate the works of that Omnipotent Being from whom his existence is derived. The superior power of man to all other animals has endowed him with a property to enlighten his mind while he gratifies his eye, and to refine his soul while he diversifies his ideas. The Creator has not formed our bodies on a model absolutely different from that of the mere animal. If our judgment were limited to figure alone, the ape might certainly be regarded as a variety of the human species. He has comprehended the figure of man, as well as other animals, under one general plan. But, at the same time that he has given him a material form similar to that of the ape, he has penetrated his animal body with a divine spirit.

The figure of the ape, so correspondent to the dignified structure of man, may shew us how low and brutal that dignified form appears, when deprived of understanding—of revealed knowledge and of an immortal SOUL!

Among all the inventions by which man has been advanced in the scale of being above the animals around him, the faculty of speech is the most important and distinguished. In every period of learning and enquiry, the ardour of curiosity has been singularly excited, to trace and to ascertain the mysterious workings of that wondrous process, by which languages * have been formed and propagated on the earth. In order to diffuse all possible happiness, God has been pleased to fill this earth with innumerable orders of beings, superior to each other in proportion to the qualities and faculties which he has thought proper to bestow upon them. To mere matter he has given extension, solidity, and gravity; to plants, vegetation; to animals, life and instinct; and to man, REASON: each of which superior qualities augments the excellence and dignity of the possessor, and places him higher in the scale

* See Mr. Whiter's learned disquisitions, in his Etymologicon Magnum, 4to. 1800.

of

of universal existence. In all these, it is remarkable that he has not formed this necessary and beautiful subordination by placing beings of quite different natures above each other, but by granting some additional quality *to each superior order*, in conjunction with *all those* possessed by *their inferiors;* so that, though they rise above each other in excellence, by means of these *additional qualities*, one mode of existence is common *to them all*, without which they never could have coalesced in one uniform and regular system. Thus, for instance, in plants we find all the qualities of mere matter, the only order *below them*, solidity, extension, and gravity, with the addition of *vegetation;* in *animals*, all the properties of *matter*, together with the *vegetation of plants*, to which is added *life and instinct;* and in MAN we find all the properties of matter, the *vegetation* of plants, the *life* and *instinct* of animals, and to these the superaddition of REASON *.

" No productions of nature display contrivance so manifestly as the parts of animals, and the parts of animals have all of them a real, and, with very few exceptions, a known and intelli-

* Disquisitions on several subjects, Dodsley, 1782, 18mo.

 gible

gible subserviency to the use of the animal. Now when the multitude of animals is considered, the number of parts in each, their figure and fitness, the faculties depending upon them, the variety of species, the complexity of structure, the success in so many cases, and felicity of the result, we can never reflect without the profoundest adoration upon the character of that BEING from whom all these things have proceeded: we cannot help acknowledging what an exertion of benevolence creation was; of a benevolence how minute in its care, how vast in its comprehension*!"

* Arch. Paley's Nat. Theology.

CHAP.

CHAP. XII.

THE SUBJECT CONTINUED.

THE known properties of all living bodies are DIGESTION; NUTRITION; CIRCULATION; RESPIRATION; SECRETION; OSSIFICATION; GENERATION; IRRITABILITY: and SENSIBILITY.

Digestion, by some is carried on by one, or more stomachs, distinct from the œsophagus, and intestinal canal—in others it is not distinguishable but by certain expansions from them: And the alimentary canal in insects, worms, &c. is not distinguishable into these parts.

Nutrition in all animals, as well as man, is absorbed by vessels, which begin from intestinal cavities.*

* To which may be added the consideration of the lungs, and the application of the *air* to the *surface of the body*, by which it is probable, much nutriment is absorbed into the system.

Circulation in some is performed with blood, having a heart with two ventricles and two auricles as man—others have only one ventricle, divided into cavities, and two auricles. Fishes have only one ventricle and one auricle; and circulation, in insects, worms, &c. is carried on by a longitudinal vessel, tuberous and contractile, which acts as a heart, and in which there is a whitish fluid instead of blood.*

In man, quadrupeds, &c. *respiration* is carried on by lungs, free from all adhesion, and spongy. In oviparous quadrupeds, and serpents, by lungs free from adhesion, vesicular and muscular. Birds respire by lungs adhering to the ribs, and provided with appendages; and fishes by gills of different forms. Insects and earth-

* Red globules of the blood, are not universal; yet in all creatures, even in colourless insects, there seem to be formal particles in the blood; in white insects they are white, in green insects they are green, in most insects they are transparent. The scate has red globules much larger, and the ox has globules much smaller, than those of man. Fish have large globules, serpents smaller ones, and man smaller still. In man the diameter of each globule, is much less than the 3000th part of an inch. One grain weight of the red colouring matter of the blood, will tinge in a percepticle degree one thousand of pure water.

worms

worms by stigmata or holes in different rings; and aquatic worms by an opening called trachea or by external fringes. Man and quadrupeds which breathe have a *temperature* considerably higher than the atmosphere; that of man is 98. Birds who breathe in proportion a still greater quantity of air than man, have a temperature equal to 103 or 104. It has been proved, that the temperature of all animals is proportional to the quantity of air which they breathe in a given time.

Secretion, is the common property of vegetables and animals.

Ossification: In man, quadrupeds, &c. the skeleton, is *internal* and ossious; internal and cartilaginous, in cartilaginous fishes. *External* and corneous, in perfect insects and lithophytes.

In shell-fish, the skeleton is external—and insects in their first state, worms and polypes *have no skeleton.*

Generation is viviparous in man, quadrupeds, and cetaceous animals; but most others are oviparous.

As to the *irritability* of living bodies, in some we observe a body muscular and contractile, as in the tribe of worms; man and most animals, have their irritability arising from muscles, covering a skeleton—in perfect insects and crustaceous animals the skeleton covers the muscles; the *sensibility* of these, and worms, resides in the nerves and brain, which are scarce distinguishable from the spinal marrow; while in man, and other animals, the spinal marrow is easily distinguishable from them.

What is *common* in any system of organs, to all the classes of animals, is reducible to very little; and organs subservient to the *same function*, have often no other resemblance, than in their general *effect*. Respiration for instance, in the different classes of animals, is exercised by organs, that, in structure, have absolutely nothing in common.

Those characters in man by which he is distinguished from brutes, are in the strength of the muscles of the legs, which support the body in a verticle position above them; and in the articulation of the head with the neck, by the *middle of its base*. We stand upright, bend our body,

body, and walk, without thinking on the power by which we are supported in these positions. This power is chiefly in the muscles in the calf of the leg, other animals,on the contrary, when on their hind legs are incapable of performing these motions, but with great difficulty and for a very short space of time.

The gibbon and ourang-outang, most resemble man in construction, they can stand upright, with much less difficulty than other animals, yet the restraint they are under shews the attitude is not natural to them. The muscles in their legs are not large enough to form a calf, and consequently not sufficiently strong to support the the thighs and body in a vertical line, and preserve them in this posture. The proper attitudes of man and beast, are pointed out by the different articulations of their heads with their necks. The face of man is on a *vertical* line, almost parallel to that of the body and neck.

The jaws are very short, compared with other animals, and extend but little farther forward, than the forehead. Quadrupeds have two bones in the jaws in addition to those of man, situated at the extremity of the mouth, attached to each jaw-bone, jaw-bone, and containing the incisor teeth: the suture which separates these bones, is observable in the human fœtus.

The principal parts are nearly the same with other animals, but in the connection and form of the bones they differ: and it may be remarked, that all animals with vertebræ, have the same number of senses with man.

Were a man to try to walk on his hands and feet, he would find it unnatural, his head and feet could not be moved but with great pain. The obstacles would be from the *clavicles*, the structure of the *pelvis*, hands, feet and head. In the attitude of quadrupeds, man could only touch the earth with his fore-part, or top of his head. In man the brain is comparatively larger than in any other animal, forming the protuberance of the occiputal bone, the forehead, and that part of the head above the ears.

Dr. Sœmmering, considers the degree of intelligence of different animals to be in proportion to the bulk of the brain, compared with that of the nerves. Man has the most voluminous brain, and his nerves are very small: it is this which gives him his high degree of intelli-

gence.

gence. The ass has very large nerves, and a very small brain. Dr. Ebel has published a very interesting dissertation on this subject.*

In animals the brain is so small that most have no occiput, or the front is either wanting or a little raised. In those that have large foreheads, as the horse, ox, elephant, &c. they are placed as low, or even lower than the ears: they want the occiput, and the top of the head is of very small extent. The jaws forming the greatest portion of the muzzle are large in proportion to the smallness of the brain.

The length of the muzzle varies; in solipede animals it is very long; it is short in the ourang outang; and in man it does not exist at all. No beard grows on the muzzle, this part is wanting *in every animal.* The ourang outang sits upright with tolerable ease, handles a stick with dexterity, and has more design in his plans, than his associates. The foramen of the occiputal bone is farther back than in the human species, and the sockets of the lower jaw are made to receive the incisor teeth, of the upper, which

* Lond. Med. Review. The human brain is twenty-four times heavier than that of an ox. Monro.

indicates

indicates his relationship to the monkey-breed. He has also 13 *ribs** on each side; his arms, feet, and toes, are much longer than ours, and other circumstances sufficiently shew that he is better qualified to act as a quadruped than as *a biped*. A farther objection to his relationship with man is, his want of speech, and it is found on dissecting the organs of voice, that none of these creatures can produce any modulation like the articulation we possess.

A few particulars in the dog and cow, are worth notice. The body of a dog being horizontal, necessarily produces some variety in the disposition of its visceral parts; and in dogs, horses, cows, &c. the back-bone is *stiff and immoveable*. The midriff, is more loose and free than ours, and they make more use of it, as may be seen by observing the flanks of a horse or dog, when out of breath. The situation and number of their *mammæ* also differ from us. The faculty of smelling, dogs have in a greater degree than us; their nose is generally longer. They can also move the cone of their ears to the

* A hare has 12 ribs; a cat 13 ribs; an ox 13; a hog 14; and a horse 18 ribs.

sonorous body, a power we have not. Their perspiration is not so general over the body, but mostly from the tongue *.

In a cow there is no incisor teeth in the upper jaw, but the gums are pretty hard, and the tongue rough; this is from the papillæ which cover it; these are turned towards the throat, so that food once in their mouth is not easily withdrawn. They supply the defect of teeth by wrapping their tongue round a tuft of grass, and so, by pressing it against the upper jaw, keep it stretched, and cut it with the teeth of the upper jaw, and without chewing swallow it.

The cow has four receiving stomachs: all ruminant animals have more than one. From this difference in the structure of their stomachs, a ruminant animal will be served with one-third less food than another of equal bulk.

In birds also we observe digestion carried on by two stomachs: in the first the corn is only swelled and softened, but it is broken and dis-

* See Edwards on British Dogs, 4to. 1800; Daniel on Rural Sports, 2 vols. 4to. and 8vo. plates; Shaw's Zoology, 4 parts, 2 vols. and Bingley's Animal Biography, 3 vols. 8vo. 1802, where will be found an interesting account of these animals, with various anecdotes relating to them.

solved

solved in the second stomach, which is composed of strong muscles for that purpose. Those animals which have teeth on both jaws, have but one stomach; but most of those which have no upper teeth, or none at all, have three stomachs, as in beasts and granivorous birds; for as chewing is to an easy digestion, so is swallowing whole to that which is more laborious.

The womb also in animals is diversified, for the purposes of *superfœtation*; and, from its horizontal position, is exempted from those circumstances which accompany the vertical position of it in the human species.

In man knowledge is progressive, but brutes are always in the same state of knowledge. Those animals which are slowest in arriving at maturity have the longest lives, and are of the noblest species. And it is a very remarkable act of Divine Providence, that useful creatures are produced in great plenty, and others in less.

What a striking variety is thus observable in the organization of different animal bodies, yet each capable of pleasure, sensation, and life, though composed of such a diversity of structures.

The œconomy of nature displayed in the inferior parts of animated nature, is no less worthy of our attention.

In the insect tribe, what a variety and contrariety of qualities in the same animal, at different stages of its existence! At first the grub, as if it sought to conceal from the inquisitive eye of man, and its enemies, its helpless and unseemly form, hides itself in the bosom of the earth. If it escapes from the dangers which threaten its impotent state, it assumes a less degrading form; and at length nature, as if repentant for having played the step-mother in these first stages of its existence, recompences it with a gift of such an inviting beauty, as often becomes the means of its destruction. From being confined in the earth, it delights itself in the regions of light, sips the most luxurious sweets of vegetable nature, and enjoys, with the more noble animals of the winged race, the pleasures of aerial exercise.

To proceed in our survey—How various, how complicated, are those instinctive œconomies, by which quadrupeds, birds, and insects sustain, support, and defend life, and provide for their young, in the impotent stages of their existence. What can be more contrary and opposite, than the

the strength of the lion and the feebleness of the hare? What can be more opposite, than the sharp sight of the lynx and the blindness of the mole? Yet supple and indulgent nature adapts herself as well to the infirmities of the one as to the higher perfections of the other. Some animals increase but slowly, while others, destined as the prey of superior animals, are very prolific.

In fishes, a new world of wonders discloses itself to the attentive and inquisitive mind. Here the peculiar structure of animal creation is adapted to an element hostile to the earth-born race, and nature displays an almost endless variety. The difference between a *whale* and the smallest of the *finny tribe*, is as prodigious as between an *elephant* and the *minutest insect*. The activity of the eel, and the dormant state of the oyster, form as great an opposition as the imagination can suppose; yet are the different organizations and powers of every *genus* and species complete in their several natures, and adapted to sustain all the difficulties to which they are exposed by the arrangements and modifications of matter. Thus the parental care of the Omnipotent Creator extends not only to us, but to every part of his works.

The

The state of brutes does by no means impeach his goodness; for they are exempted from numberless anxieties, by that want of reflection on the past, and apprehension of future sufferings, annexed to their inferiority. Those who devour others are taught to dispatch them as easily as possible.

Man has no reason to repine that he is not an angel, nor a horse that he is not a man; much less, that in their several stations they have not the faculties of one another; for this would be an insufferable misfortune. It would be as inconsistent for a man to possess the knowledge of an angel, as for a horse to have the reason of a man; but as they are formed by the consummate wisdom of their Creator, each enjoys pleasures peculiar to his situation. Greatly indeed must the aggregate sum of felicity bestowed upon the universe be lessened, were there no beings but of the highest orders; and if no sensitive beings existed inferior to man, how great a quantity of happiness must have been lost, which is now enjoyed by millions who inhabit every part of its surface, in fields, in gardens, in extended deserts, in impenetrable woods and immense oceans, by monarchies of bees, republics of ants, and by immense numbers of insects dwelling on every leaf and flower, who are all possessed of as great a share of pleasure, and a greater of innocence, than their arrogant sovereign, and contribute not a little to his convenience and happiness.

Thus the universe resembles a large and well regulated family, in which all the officers and servants, and domestic animals, are subservient to each other, in a proper subordination; each enjoys the privileges and perquisites peculiar to his place, and at the same time contributes, by that just subordination, to the magnificence and happiness of the whole.

A brute is no less sensible of pain, than a man. He has similar nerves and organs of sensation; and his cries and groans, in case of violent impressions on his body, though he cannot utter his complaints by speech, or human voice, are as strong indications of his sensibility of pain, as the cries and groans of a human being, whose language we do not understand: pain, we are all averse to, and our own sensibility, should teach us to commiserate it in others—to alleviate it, if possible, but never wantonly or unmeritedly to inflict it. The most striking attribute of the DEITY is MERCY. Exercise this therefore to the numerous tribes of inferior beings, whom the

kindness

kindness of heaven has permitted to look up to man, as a merciful, not an unfeeling protector *, How little has man to be proud of worldly grandeur! obliged to the pig, the sheep, the ox for daily support †: nay, the very worms and insects gratify his palate, and impart nourishment to his body.

Every animal, more or less, contributes to his comfort, or the general good, the boon of life is given to each, by the same good being; and therefore that existence ought not to be trifled with, wantonly injured, or destroyed. When we notice the affectionate look of the dog, and witness the domestic attachment of the cat—let not the speaking silence of their petitioning countenances, plead in vain for hospitable protection and humanity.

---

* The elegant mind of Sir Wm. Jones, was peculiarly sensible on this subject: see his works (Vol. 1. 4to. p. 153,) where he quotes, a couplet of Firdausi;

> " Ah! spare you Emmet, rich in hoarded grain;
> He lives with pleasure, and he dies with pain."

† For the infinite variety of uses to which the parts of our domestic animals are applied, and the variety of trades, which they contribute to support by their bodies, see Campbell's Political Survey, vol 2 4to. p. 144.

On

On the meanest worm or fly, we should look with wonder and silent admiration; not dare to lift our hand to extinguish, what a benevolent being has graciously seen proper to create. We see the type of providence in all his works, and ought to respect *him*, in them.

The establishment of the Veterinary College, for the study and cure of diseases incident to horses &c. reflects a permanent honor on the humanity of the present age—in this however, other nations have anticipated us, and, even the Gentoos for more than a century past, have appropriated a part of their gains in trade to the erection of a hospital for sick and aged animals; this hospital consists of a plain, nearly square, occupying an extent of 25 acres, surrounded by a high wall, inclosing proper sheds &c. for its inhabitants; and they are also peculiarly cautious of hurting the smallest fly or insect*.

What epithet of disgust should we not bestow on a superior being, whose whole endeavours

* For a farther account, consult Stavorinus's voyages, 8vo. 1798, vol. 2d. Of the national advantages of dogs; consult Campbell's Political Survey of Great Britain; and *Edwards ut supra.*

were

were employed, and whose pleasure consisted in terrifying, ensnaring, tormenting, and destroying mankind. Yet if we impartially consider the case, and our intermediate situation, we must acknowledge; that with regard to inferior animals, just such a being is a sportsman.

An attachment to birds, dogs, cats, &c. allowing it to be carried to an improper excess, is praiseworthy, compared to the tyranny, and death, inflicted oftentimes by persons, on every creature that unfortunately gets into their power.

The kindness shewn any animal gives a secret satisfaction, and a complacency of feeling which is highly desirable, provided it be not carried to such an excess, as to diminish, or exclude attention, to higher duties and objects. Do what we can for the comfort of animals—God has gone infinitely beyond us—he has given them life, which they enjoy as perfectly (comparatively) as we do, and if we observe the cheerful activity and joy, demonstrated in their actions, exceed us, apparently in happiness.

Experiments are not unfrequently made upon living animals by the faculty, for the purpose of ascertaining the property of drugs, or other facts of importance, in medical and anatomical science. Neither the right nor the propriety of making these experiments on reasonable occasions, can be disputed, but every degree of inconsiderate and needless cruelty, in prosecuting them will be avoided by men of feeling and reflection.

The prejudice with which we are taught to view, certain animals, on account of what is denominated a noxious form, is as unseasonable as cruel. We are initiated to inflict instant death on spiders, &c. without reflecting one moment on their relative utility and importance. A spider has been known under certain circumstances, to be a cheering companion of man *.

The divinity shines through all his works. The frog is particularly inoffensive, and the toad has certainly various useful qualities. Mr. Arscott, of Devonshire, nourished one, which had

* This interesting anecdote of the Duke de Lauzun and the spider in the Bastile, will be found in Ireland's Tour through Holland, vol. 2. p. 130. Egerton, 1796.

The spider forms a beautiful object when examined by the microscope; they have four, six, or eight eyes placed various ways; for being deficient of a neck, they cannot turn their heads like other creatures: providence has therefore remedied this defect, by the number and situation of their eyes.

been

been recollected 36 years in the family, as a domestic favorite; it was uncommonly large, would visit the hall every evening, and solicit by its gesture, to be placed on the table, where it was fed. For particulars of this domesticated toad,* see the works quoted below. Buffon, also bears testimony in favour of this persecuted harmless animal; of whom an erroneous idea prevails that it is venomous: snakes makes them their prey, and consequently are nourished by them. This defenceless creature seeks the darkest retreats, not from the malignancy of its nature, but from the multitude of its enemies. The common toad is perfectly innoxious (Shaw, part 3. 1802) though its appearance is not captivating, yet its eyes are remarkably beautiful; being surrounded by a reddish gold-coloured iris, the pupil when it is in a state of contraction appearing transverse.

Montaigne observes, there is nothing ih nature useless, not even uselessness itself. Nothing exists in the world but what is *convenient*. That nature makes nothing in vain is the only undisputed maxim in philosophy. In the womb of nature is the wisdom of his hand discovered. Out of this rank Solomon chose the object of admi-

* Pennant's Zoology—Shaw's ditto—Polwhele's Devon. folio.

-ration; indeed what reason may not go to school to the wisdom of bees, ants, and spiders.

There is a general beauty in the works of God, and therefore no deformity in any kind of creature whatsoever. I cannot tell (says Sir Thomas Brown) by what logic we term a toad, a bear, or an elephant ugly, they being created in those outward shapes and figures which best express the actions of their inward forms; and having passed that general visitation of God, who saw that all he had made *was good*, that is, is conformable to his will which abhors deformity, and is the rule of order and beauty.

That a merciful or righteous man regardeth the life of his beast, we are told in the scriptures; and the prophet Jonah finely exemplifies the compassion of the great God of heaven and earth for animals; as one of the reasons why the Almighty did not destroy the *great city* of Nineveh, was on account of the quantity of cattle therein *.

It is impossible to finish this short review of nature, without observing the wonderful har-

* See also our sentiments on this subject, European Magazine January, and March, 1796.

mony

mony and connection, that subsists between all the different branches, without observing how happily one part supports another, and how every thing contributes to the general good. How infinitely great must be that eternal mind, who framed all with such amazing skill, who sees with a single glance, the operation and mechanism of the whole, from the minute anatomy of the ant, from the almost inconspicuous vegetation of the various tribes of mosses—to those innumerable worlds, those vast and splendid orbs, that gild the unbounded expanse of the universe *.

TO CONCLUDE.

THE production of happiness seems to be the only motive that could induce infinite goodness to exert his infinite power, in the creation of man and beast, he has blessed each with life and sensation—He has made all his creatures capable of happiness, and our actions ought to promote his intention; and also excite us to promote the happiness of one another! As in the constitution

* Buffon Abrid. vol, 2d.

of the natural body, the several parts are adapted to promote the advantage of the other members, so the whole race of mankind may be considered as one community organised by its supreme governor, with such consummate skill and contrivance, that all the parts are mutually dependent on each other.

To each individual in this large and compact society, his proper station is assigned, in which he may act with the greatest effect, and where his powers may be exerted for the general benefit. And the well being of the community, as in the animal machine, depends upon the harmonious co-operation of all its parts *.

With great humility and self-abasement, does it become us to think and speak of every dispensation of God †, we cannot fathom the depth of his councils, we cannot reach the sublimity of his designs, we cannot apprehend the wisdom of the means by which he worketh out the happiness of the universe.

Let the consideration of the wonderful powers of the soul, make us praise that GOD who is

* Jardine. † Bishop Watson.

the joy of every SOUL, and the desire of all nations. For if in the verdure of the fields, and the azure of the sky, the unlettered rustic admires his creative power, how blind must that man be, who contemplating his *living structure*, and his *moral frame* discerns not the forming hand divine! How various and complicated the machinery of the one, how extensive and noble the powers of the other!

How sublime are all the faculties of the mind, thoughts that wing infinity, apprehensions that reach through eternity, a fancy that creates; an imagination that contains an universe; wishes that this world cannot satisfy, desires that know neither end nor bound! Endued by the creator with divine perogatives, invested with spiritual powers, and enabled to aspire ardently after the felicities of Heaven!

END.

ERRATA.

Page 1, for Reattie, read *Beattie*.
. . . . 34, line 9, from the bottom, for parts read *part*.
. . . . 82, note, for Darxy, read *Davy*.
. . . . 268, for Horniton, read *Honiton*.
. . . . 166, for pay, read *par*.
. . . . 183, note, for The, read *Legum*.
. . . . 371, for XII, read *XI*.

AN

EXPLANATION

OF

TERMS USED IN WORKS TREATING ON THE

ANIMAL ŒCONOMY;

&c.

The following explanation of terms has been enlarged beyond what was requisite to the reading of this volume, in order to render it more extensively useful.

AA, in prescriptions; signifies equal quantities; from the word *ana*, separately.

Abdomen; the belly; so called from the Latin word, signifying to hide, as its contents lie hid in it.

Absorbent medicines; kinds of earths, suited to take acids into their pores, and at the same time destroy their acid quality.

Absorbent system; vessels which open their mouths into the sides of the intestines, and suck in the nutriment, which they carry into the blood.

Acetabulum; a large cavity in a bone, receiving a convex bone, for the convenience of the circular motion of the joint thus articulated. The cavity which receives the head of the thigh-bone.

Acrimony; corrosive sharpness.

Acute; this term is applied to a disease which is violent, and tends to a speedy termination.

Adult; of mature age.

Alæ; wings.

Alexipharmic; a medicine supposed to expel poison or noxious humours through the pores of the skin.

Alterative; a medicine suited to clear the blood from certain impurities, with which it is supposed to be tainted.

Alveoli; the sockets in which the teeth are placed. There are usually *sixteen* of those in each jaw of a grown person.

Analeptic; reviving, comforting, strengthening.

Anarsarca; dropsy of the whole body.

Anarsarcous; a dropsy from a serous humour between the skin and flesh.

Anastomosing; uniting by contact; vessels running into each other.

Anatomy; the knowledge of the body, by cutting or dissecting it: when applied to animals, it is termed *comparative* anatomy.

Aneurism; a tumour caused by the rupture of an artery; a diseased artery.

Angeology; a knowledge of the blood-vessels.

Animal electricity; a peculiar species of electricity, discovered by Mr. Galvani to be resident in most animal parts, manifesting itself in the muscles and nerves. It seems to be secerned in the brain from the blood, whence it is communicated through the

nerves

nerves to the different parts of the body; but it appears chiefly to reside in the muscles.

Animal Magnetism; a magnetic or sympathetic influence, producing various effects on the body, by the imagination being strongly worked upon, and the influence of other unknown causes: called also *Mesmerism.*

Anodyne; a medicine to assuage pain.

Annular; round, like a ring.

Antacid; good against acidities.

Anthelmintic; destroying of worms.

Antihysteric; good against hysterical or nervous complaints.

Antiscorbutic; good against the scurvy.

Antirheumatic; good against the rheumatism.

Antiseptic; medicine which resists putrefaction.

Antispasmodic; whatever tends to prevent or remove spasms.

Anus; a contraction of the word *annulus,* a ring; the end of the intestine called rectum.

Anchylosis; a contraction of the joints, impeding their motion, occasioned by the bones growing together.

Aorta; the large blood-vessel rising immediately from the heart, to convey the blood *from* it to all parts.

Aperient; of an opening quality.

Aphthæ; small whitish ulcers appearing in the mouth, and generally known by the name of *thrush.*

Apophysis; a process or protuberance growing at the end of a bone.

Aponeurotic; an expansion of the tendon or tail of a muscle, becoming thinner, till lost in the cellular membrane.

Apohlexy; a disorder which strikes a person down instantly, depriving them of sense or voluntary motion.

Aqueous; watery.

Artery; those vessels which carry the blood *from* the heart *to* every part of the body, are termed arteries.

Articulation; a term applied to the joining of the bones, which is divided into three principal kinds.

Arthritic; a disease in the joints.

Ascites; a dropsy in the belly.

Asthma; frequent attacks of short-breathing.

Astragalus; the first or upper bone of the foot, on which the tibia rests.

Astringent; binding.

Astronomy; the knowledge of the heavenly bodies.

Attenuant; diluting.

Auricles; two bags which receive the blood at the basis of the heart: so called from a supposed resemblance to ears.

Axilla; the cavity commonly called the arm-pit.

Azote; azotic gas, air which is fatal to life; same as meant by phlogiston.

Azygos vena; a vein without a fellow; a considerable branch of the vena cava. *Azygos* is also applied to a bone, and muscle.

Biceps; muscles having two distinct heads.

Bile; a thick, yellow, bitter liquor, secreted from the liver, and collected in the gall-bladder: thence discharged into the intestines, to promote digestion.

Botany; the science of vegetables; the knowledge of plants, flowers, trees.

Brachialis; the name of two muscles in the arm; also of an artery which runs down the arm.

Bronchial; the wind-pipe, before it reaches the lungs, divides into two branches, called *bronchia*; arteries going to the lungs are termed bronchial.

Brunonian system; that peculiar mode of practice in medicine taught and published by Dr. Brown.

C, in prescriptions, signifies *capiat*, let him take.

Cachectic; an unhealthy state of body.

Calculous; stony, or gravelly.

Callus; wounds growing into a substance like skin, by hard labour, are said to form a callus: also a kind of swelling without pain. The edges of ulcers not shooting out kindly, are said to be callus.

Cancer; a hard tumour of a glandular part, painful, and obstinate, and terminating in the foulest ulcer.

Capillary; applied to small hair-like ramifications of vessels; from *capillus*, a little hair.

Caput mortuum, what is left in a vessel after all the moisture has been distilled from it; the mere useless dregs.

Carbonic acid air; fixed air, mephritic acid.

Cardiac; the Greeks termed the heart Cardia; the left orifice of the stomach is now thus termed. Things supposed to influence the heart immediately as cordials, are called cardiacs.

Caries; a rottenness of any bone.

Carminitive; warm; dispelling wind; promoting perspiration.

Carniverous; an animal that feeds on flesh.

Carotids; two blood vessels which spring out of the great artery, and send branches towards the head, &c.

Carpus; the wrist, made up of 8 bones of different sizes in two rows of 4 bones each.

Cartilage; a smooth, elastic substance, which covers the ends of bones; and is found chiefly in those places, where a small and easy motion is required, as the ears, nose &c.

Catalepsy; a sort of apoplexy, attended with sudden loss of sense and motion, the limbs retaining any posture into which they are put.

Cathartic; a purgative.

Cauda Equina; the name given to a bundle of nervous ropes, in the canal of the lumbar vertebræ and sacrum: from its resemblance to a horse's tail, when extended in water.

Caustic; a burning application.

Caul; a most delicate and fine membrane, in which the intestines &c. are wrapped, called also omentum.

Cava (Vena) the large vein, into which all the blood is poured, and conveyed to the heart.

Cellular membrane; an infinite number of minute cells which is found to invest the smallest fibres; an universal connecting medium of every part of the body.

Cephalic vein; so called because blood taken from it was supposed to relieve the head; a vein that runs down the arm, and below the bending, divides into two, the inner branch termed median, is the one cut to let blood.

Cerebellum; that part of the brain, which lies in the back part of the head.

Cerebrum; that portion of the brain, which lies in the fore-part of the skull.

Chalybeate; impregnated with iron or steel.

Chemistry; the knowledge of unorganized solids and fluids: and the properties of matter in general.

Cholera morbus; a disorder arising from a great quantity of bile.

Chlorotic; relating to the green sickness.

Chronic; an epithet applied to a disease the progress of which is slow.

Chyle; the name of the juice, that the food is converted into immediately after digestion.

Chylopoetic viscera; this name includes, the liver, spleen, pancreas and omentum.

Clavicles; two bones situated at the base of the neck, sometimes called channel bones, easily felt with the fingers, crossing the body above the breasts.

Cineritious; of an ash colour; or like ashes.

Circulation; the motion of the blood, which is propelled by the heart through the arteries and returns by the veins.

Coccygis; the fine little bones which terminate the range, forming the back, &c.

Cœcum; the blind gut, so called because it is perforated at one end only; whatever it receives passes the same way back.

Cœliac passion; a discharge of indigested food, resembling chyle, a species of diarrhœa.

Colic; generally signifies any disorder in the stomach or bowels, which is attended with pain, originally it meant only a disorder in the colon.

Colon; from the greek signifying *hollow*; the greatest and widest intestine of the body.

Comatose; inclined to sleep.

Comparative anatomy; that kind of anatomy that relates to the structure of animals compared with each other, and with human anatomy.

Condyle; signifies an oblong process, or protuberance, about the joints of bones, making them thicker, as on the knuckles.

Congeries; a mass, or heap.

Conglobate gland; a little smooth body wrapped up in a fine skin, by which it is separated from all other parts.

Conglomerate gland; is composed of many little conglobate glands tied together and wrapped up in one common tunicle, having one common excretory duct, as the sweetbread, &c.

Contagion; infectious matter.

Convalescent; in a state of recovery to health.

Convulsions; involuntary contractions, or spasms of the muscles; whereby the body and limbs are distorted.

Cornea; a coat of the eye, also called *Sclerotica*; the first and outermost coat which is proper to the eye.

Corona; a sharp process of the lower jaw bone.

Coronal suture; the first suture (or joining) of the skull: it reaches transversely from one temple to the other.

Coronary veins, &c; vessels spread over the outside of the heart for its supply with blood and nourishment, the vessels which surround the left orifice of the stomach, are also so called.

Corpus callosum; the covering of the two lateral ventricles of the brain, formed by the union of the medullary fibres of each side.

Cortex; the outer rind: the bark.

Corroborant; strengthening.

Costæ; the ribs.

Cotyle; applied to bones; a round deep cavity, (the same as *Acetabulum*.)

Cranium; the skull composed of several pieces of bone joined, which forms a cavity like a box to hold the brain.

Crural; the name of an artery, running under the muscles to the lower part of the thigh: it runs to the ham, and then takes the name of poplitœus.

Crisis; a certain period in a disease at which there happens a decisive alteration either for the better, or the worse.

Critical; decisive or important.

Croup; an inflammation in the throat, affecting the wind pipe: a sort of quinsey.

Cutaneous; of or belonging to the skin.

Cuticle; the outer covering of the body, or scarf skin, sometimes called also Epidermis: formed to protect the true skin from injury, &c.

Cutis; the true skin, which lies under the visible surface of the body.

D: dosis, a dose.

Dr, *Drachma*; the weight of a dram.

Delirium; a temporary disorder of the mental faculties usual in fevers.

Deltoid; the triangular muscle on the shoulder, is thus termed from a supposed resemblance to the Greek letter Δ *delta*: it lifts up the bone of the arm.

Dentes; the latin word for teeth; dentes incisores or occulares, are the eye teeth; dentes molares, are the grinders; dentes sapientiæ, wise-teeth, are the hind ones, as they do not come until about the 21st. year.

Deobstruent; to remove obstructions; to open the passages.

Descicative; having the power to dry up.

Detergent; cleansing.

Diabetes; an immoderate flow of urine.

Diagnostic; the knowledge of the nature of a disease.

Diaphoretic; promoting perspiration.

Diaphragm; the midriff, two muscles form this, which are

are spread across the body, and divide the breast parts, from the lower part or belly.

Diaphragmatic arteries and veins; blood vessels spread over the diaphragm; sometimes called phrenic arteries.

Diarrhœa; a constant looseness.

Diathesis; the particular disposition of the body.

Diarthrosis; that kind of articulation, or joining of the bones, which is moveable; admitting of three kinds or species.

Digitus; the finger, the fingers and thumb of each hand consist of 15 bones, there being 3 to each: termed the 1st. 2d. 3d. phalanges.

Dioptrics; the knowledge of the refractions of light passing through different mediums, as the air, water, glasses, &c.

Diploe; from the Greek signifying *double*, the soft part is thus called, between the two tables of the bones, of the skull.

Discutient; repelling, driving back.

Dispendium; waste.

Dispensary; a place where medicines are made up, and distributed.

Dispensatory; a book describing the doses of medicines, &c,

Diuretic; promoting urine.

Dropsy; a collection of water in some part of the body.

Drastic; medicines which operate briskly, and powerfully, as emetics and purgatives.

Duodenum; from the Latin signifying *twelve*: an intestine

tine about 12 fingers breadth long: it receives the bile and pancreatic juice, by two canals, which open into its cavity.

Duplicature; any thing doubled.

Dura-mater; a strong thick membrane, which covers the brain, and the whole cavity of the skull, it gives a coat or covering also to the nerves which issue from it.

Dysentery; a painful discharge from the bowels, sometimes with blood.

Dyspeptic; belonging to bad digestion.

Dysuria; difficulty in discharging urine.

Edulcorated; made milder or sweetened.

Electricity; that property of bodies, whereby after being rubbed, they acquire a power of attracting or repelling other bodies; and frequently of emitting sparks and streams of light: it is a science full of experiments, and the electric fluid, has been used successfully in medicines.

Encephalon; the contents of the head.

Endemial; native, or resident in a place.

Enarthrosis; that species of joining where the round head of one bone, moves in the cavity of another; as the head of the thigh bone: called also, ball and socket, articulation.

Embrio; the rudiments of a child, before it is perfectly formed.

Emetic; that which excites vomiting.

Emmenagogues;

Emmenagogues; medicines calculated to promote certain salutary evacuations.

Emphysema; a windy tumour, formed by the air getting between the skin and muscles, into the cellular membrane, somewhat like the manner in which butchers blow up veal: it is generally occasioned by a fracture of the ribs, or some extraneous body, puncturing the lungs.

Emulgent; milking out: it is applied to the blood vessels which go to and return from the kidneys.

Emunctories; passages by which any thing is discharged from the body.

Empyema; a collection of purulent matter in the cavity of the breast, the consequence of an inflammation.

Epidemic; infectious: occasionally resident.

Epidermis; the outer skin: see *Cuticle.*

Epigastric region; the upper part of the belly ending just above the navel.

Epiglottis; a part thus called from its position above the root of the tongue, one of the cartilages of the windpipe, which the food presses down as it passes into the gullet, and thereby prevents any food from going the wrong way.

Epilepsy; a falling sickness: a sudden loss of sensation, produced by various causes.

Epithem; a formentation, &c.

Epiphysis; is when one bone grows to another without any proper articulation, or joining: a distinct ossification which afterwards grows to the bone, and makes it perfect.

Epispastic;

Epispastic; drawing, blistering.

Epulotic; tending to a cicatrix.

Errhines; a kind of stimulating snuff.

Erysypelas; an inflamed surface of the skin &c. called sometimes St. Anthony's fire; the violet, and the rose.

Escharotic; a caustic: producing an eschar.

Ethmoides; the sieve-like bone, in the middle of the basis of the frontal bone; full of small holes, through which the nerves of smell pass: from its under side, the thin bone proceeds, which divides the nose in two.

Eustachian tubes; parts pertaining to the ear, discovered by Eustachius; called also the auditory passage.

Evanescent; extremely minute.

Exacerbation; the increase of any disease.

Excretion; an ejection of an animal substance out of the body.

Exhalent; evaporating, send out a vapour or steam.

Expectorants; medicines which promote discharges by coughing and bringing up phlegm, &c.

F. or *Formula*, signifies a prescription.

Fæces; food after it leaves the body; in chemistry, the settlings after distillation, &c

Fœtid; emitting an offensive smell.

Falx; a process of the covering of the brain, which divides it into two hemispheres.

Farinaceous; meally.

Fasciculi; a little bundle, a small portion.

Fauces; the top of the throat, which can be seen when the mouth is open and the tongue depressed.

Fibres; animal threads of different kinds; as fleshy, cartilaginous, or bony; the groundwork of all the different parts of the body.

Febrifuge; having the power to cure fevers.

Fibula; sometime called prone; the outer and lesser bone of the leg. The tibia and fibula touch only at their ends; the space between them is filled by a strong ligament and some muscles, which extend the feet and toes.

Femur; the thigh-bone, the longest of any in the frame; so called from *ferendo*, bearing, because it sustains the whole animal.

Fœtus; the name of a child as soon as it is distinctly formed; before which, it is termed *embryo*.

Follicles; small glands or bags.

Foramen; a hole.

Fossa; a little depression, or sinus: it signifies properly a ditch, but is used to express a cavity between two bones.

Flatulent; producing wind.

Flexor muscles; the name applied to several muscles, from their office, which is to bend the parts to which they belong.

Fracture; to break: if a bone is broken in one place only, it is termed a simple fracture; if in more parts than one, a compound fracture, &c. &c.

Frænum; a bridle; a ligament under the tongue, sometimes cut in children, to give room for the motion of the tongue.

Frontis os; that bone of the skull which forms the forehead, and upper part of the orbit of the eyes.

Fungus; proud flesh.

Furrow; a term applied to bones; the same as groove, which see.

Galvanism; those new experiments in animal electricity discovered by Professor Galvani.

Ganglion; a tumor on a tendon, mostly about the wrist, formed by lymph secreted within the tendons: a knot of nerves is also called a ganglion, or plexus.

Gangrene; mortification.

Gas; raw, elastic fluid, obtained from bodies by a certain process; species of air, distinct from common atmospheric air; sometimes it takes the name of air; as alkaline, and inflammable air; (gases). Subtle aeriform fluids.

Gelatin; any thing approaching to the consistence of a jelly.

Gelatinous; gluey. Viscid.

Ginglimus; a joining, where the bone both receives and is received; admitting flexion and extension only, is called by mechanics *Charnel*, and is commonly used in hinges: it has three sorts: as in the humerus and ulna. 2. radius and ulna. 3. as the vertebræ.

Glands;

Glands; those parts which secrete, or strain off from the blood the various humours of the body, as spittle, milk, tears, &c. See Conglobate. There is a great number of them in the body.

Glandulæ Renales; glandulous bodies, lying on the upper part of the kidney; larger in the fœtus than in the adult, or grown person: their use is not known.

Glenoid; a shallow cavity in a bone.

Glutæus; the buttock; the name of three muscles which extend the thigh.

Gomphosis; the fastening of a bone, like a nail driven into wood, as in the teeth.

Graminiverous; graniverous; those animals which eat grass and corn.

Gr: Gt: abbreviations of *granum*, a grain; *gutte*, a drop.

Groove; a deep channel in any bone.

Grumous blood; is that, which is too thick for circulation, and stagnates.

Hæmorrhage; a discharge of blood.

Hæmorrhoids; the piles.

Head; applied to bones, signifies a round process with a neck; denoting the upper extremity of a bone.

Hectic fever; a slow consuming fever generally attending the absorption of purulent or other acrid matter into the blood.

Hemisphere; the half of a globe when supposed to be cut through the center.

Hermoptöe; a spitting of blood.

Hepatic; belonging to the liver.

Hernia; a rupture: of which there are various kinds.

Heterogeneous; a mixture of things of a different nature.

Humerus; the bone of the arm.

H. S. in prescriptions; *horâ somni;* the hour of sleep, or bed time.

Hydatid; a transparent bladder of water in any part.

Hydragogue; that which carries off water by purging.

Hydrocarbonate gas; carbonated Hydrogene gas, formed by the union of Hydrogene with a portion of Carbon and Caloric. It may be obtained by distillation from moistened charcoal.

Hydrocephalus; swelling of the head; dropsy in the brain.

Hydrophobia; canine madness: a dread of water.

Hydrogene air, or gas; inflammable air.

Hydropic; dropsical.

Hydrops Pectoris; a dropsy in the chest.

Hyoides os; a small bone, at the root of the tongue, for its basis and support.

Hypochondriac; melancholy, without apparent cause.

Hypochondriac region; that division, or part of the body, in which the liver and spleen are placed; hence disorders of those viscera especially of the spleen, are called Hypochondriacal.

Hypogastric region; that division of the belly, which begins a little above the navel, and extends below it.

Hysterics; disorders of the womb, or proceeding from violent passion.

Ichor; thin matter of an acrid kind; corrosive fluid.

Isteric; good against the jaundice.

Idiopathic; an original cause in nature, not produced by or dependent upon any other disease.

Jejunum; one of the three small intestines.

Iliacs; Ilia; the flanks; beginning about the lowest false ribs.

Ilium; one of the three small intestines.

Impacted; driven close and hard.

Impetus; the blow or force with which one body strikes another.

Imposthume; a collection of purulent matter.

Inanition; want of proper fulness.

Incisors; the front teeth; they appear first, being the thinnest and sharpest

Incrassant; thickening the blood.

Indigenous; a native of the same country.

Infarction; stuffing up.

Inflammation; an increased action of the blood vessels.

Inflection; bending.

Inguina; the groins.

Inhaling; to draw in.

Innominatum; without a name; many parts of the body have this indistinct term.

Insanity; a deranged imagination.

Integuments; any common covering of the parts of the body, as the true and false skin, &c.

Intercostal muscles; are 44 in number, external and internal, one of each running between every two ribs.

Inter se; among themselves.

Intestines; that long hollow pipe, about six times the length of the body, commonly called the gut: taking different names in its course, and distinguished into six parts although but one pipe; three thin and small, and three, thick and great: the former are termed, duodenum Iejunum, Ilium; the latter, Cœcum, Colon, Rectum.

Ischuria; a suppression of urine.

Jugular veins, &c; blood vessels ascending towards the ears where they divide into two branches: internal and external.

Labia; or Labium; lips.

Lacteal veins; long slender pipes, invisible when not distended with chyle or lymph. They arise from all parts of the small intestines by fine capillary tubes. Their mouths which open into the cavity of the guts, and suck in the chyle from the food, are so small as not to be seen by the best microscope.

Lactiferous; bringing milk.

Lamdoidal; the name of the suture or joining of the bone called occiput, at the back part of the head, from a supposed resemblance to the Greek letter Λ, lambda.

Laminæ; the division which bones and shells form: the skull forms two plates called *laminæ*; shells are divisible

divisible into many such plates lying one over another generally called *Lamellæ*: is synonimous with *Tables* of the skull.

Larynx; the upper part of the wind-pipe.

Laudanum, from the Latin word *laus*, praise; implying a medicine worthy of praise; but is now generally applied to preparations of *Opium*.

Lientery; a disorder in the bowels, the food passing through suddenly and little altered, with wasting of the body.

Ligament; from *ligo* to bind; a white solid body softer than a cartilage, and harder than a membrane: it fastens the bones, lest they should be dislocated by exercise.

Ligature; a bandage.

Lithontriptic; good against the stone.

Locked Jaw; a rigid contraction of the muscles which raise the lower jaw, closing the jaws, with great pain.

Lumbar region; the posterior part of the abdomen; the space from the last ribs downward; its lateral parts are termed loins.

Lumbago a kind of rheumatism in the loins or small part of the back.

Luxation; the slipping of any thing out of it's place; a dislocation.

Lymph; a transparent fluid.

Lymphatics; slender pellucid tubes, which arise in all parts of the body; they are furnished with valves which permit a thin and transparent liquor, to pass towards the

the heart, but oppose its return: it's use is to dilute and perfect the chyle before it mixes with the blood.

M. and M. F. mix and make: *m*; sometimes signifies a *handful*; and is put for *morning* also, in prescriptions. M. N. M. signifies about the size of a nutmeg; abreviated frcm the Latin.

Malæ; the prominent part of the cheeks.

Maleolus; the ankle bone.

Mammary; from the word mammæ; breasts: breast-like, or relating to the breast.

Mandibulum; from *mando* to chew. The jaw.

Mania; a raving, or furious madness.

Martial medicine; such as are prepared from iron; such as may be impregnated therewith.

Masticatory; medicine to be chewed only.

Materia Medica; the whole collection of remedies.

Maxilla; from the Greek, signifying to chew; the cheek or jaw.

Meatus Auditorius; the opening of the ear.

Mediastinum; a double membrane, dividing the cavity of the thorax straight down, into two parts.

Median Vein; a vein of the arm; so called as being situated between the Cephalic and Basilic.

Medulla Oblongata; that part within the skull, which is the beginning of the spinal marrow: the supposed seat of sensation.

Medulla Spinalis; the spinal marrow.

Membrana Propria musculorum; is that which covers all and every one of the fibres of a mascle; and is immediately attached to them.

Membrane;

Membrane; a web of several sorts of fibres interwoven together, for the covering and wrapping up various parts of the body.

Meninges; same as the dura and pia mater, which see; a covering of the brain.

Menstruum; all liquors used as dissolvents, or for extracting the virtues of any ingredients by infusion or decoction.

Metallic Tractors; two pointed pieces of metal, used (by drawing them over the parts) to cure a variety of complaints; their influence is said to be on the nervous fluid.

Metacarpus; the bones behind the hand, which answer to the fingers. the outer wrist.

Metatarsus; consists of 5 bones, longer than the bones of the metacarpus, they join the toes, as the latter do the fingers.

Mesentry; a fat membrane to which the intestines are curiously fastened, to prevent their entangling.

Mesmerism; animal magnetism; which see.

Miasma; subtle particles arising from marshy places producing fevers.

Midriff; same as the diaphragm, which see.

Miliary eruption; an eruption of small pustules resembling the seeds of millet.

Molares; the hinder teeth; the grinders.

Moles; called also false conceptions; a formless concretion of extravasated blood.

Morbid; an unsound constitution; diseased.

Morbific; causing disease.

Momentum; a word applied to motion; the quantity of motion.

Mucilage; a glutinous liquor made with warm water; as by dissolving gum arabic in it: a humour separated from glands about the joints, for their easy motion.

Mucous; resembling the matter discharged from the nose, lungs, &c.

Mucus; the matter discharged from the nose, lungs, &c.

Mumps; a disease of the glands of the jaws, a quinsey.

Muscle; a bundle of fleshy threads or fibres, inclosed in a common membrane—flesh in general.

Museum; a collection of curiosities, in the different departments of science.

Myology; a description of the muscles.

Narcotic; taking away pain; an opiate.

Nascent-ens; the growing form, or being.

Nasi (ossa); bones of the nose.

Nausea; an inclination to vomit.

Nephritic; good against the stone.

Nerve; a long and small bundle of very fine pipes, or hollow fibres: wrapped in a fine membrane, and issuing from the brain to every part of the body; they are the organs of sensation.

Nervous; irritable.

Neurology; the doctrine of the nerves.

Non-Naturals; air, aliment; exercise and rest; passions and affections of the mind; wakefulness and sleep; repletion and evacuation, are termed non-naturals, because they affect man without entering into his composition, or constituting his nature.

Nosology; the arrangement of diseases, into genera, species, &c.

Nodes; enlargements of the bones arising from the venereal disease.

O. h; an abbreviation of *omni hora:* signifying every hour. *O. 2 h:* every two hours.

Obtund; to blunt.

Occipitis; the hinder part of the skull.

Optics; the science of sight in general: when light is considered as *reflected,* the science then is termed *Catoptrics*; when the laws of the refraction of light is considered, it is called *Dioptrics.*

Orbicularis; the name of a bone in the ear; several muscular fibres running circularly take the title; for instance the muscle that draws the lips together, the circular fibres of the eye-lids, &c.

Organ; a part by which some function is performed.

Os; a bone;—os, a mouth.

Osophagus; the gullet, a large, long, round canal which carries the food from the mouth into the stomach.

Ossification; is when a cartilaginous substance gradually hardens, and assumes the name of bone.

Osteology;

Osteolgy; a description of the bones.

Ovum; an egg.

Oxyds Metallic; are calces of metals.

Oxygene; the basis of vital air; or acidifying principle.

Oxymel; a mixture of honey and vinegar, formed into syrup.

P. in prescriptions, sometimes signifies *pugil,* which is the 8th part of a handful: *p.* is also put for *parts; p. æ;* equal parts; *p. p.* pulvis patrum; or jesuits powder.

Palati ossa; bones of the palate.

Pancreas; a gland, called the sweet bread, about five ounces weight: it discharges its liquor into the intestines.

Papillæ; many parts of the body are thus termed from their likeness to a nipple or teat; from *papilla,* a nipple; small eminences.

Paralysis; from the Greek word, signifying to dissolve or weaken; a palsy.

Parietalia; from *paries* a wall, two side bones of the skull, which defend the brain like a wall.

Patella; the knee-pan; a small round bone about two inches broad; soft in children, but very hard in older persons.

Pathology; the theory of the diseased state of the body:—the arrangement of diseases, is termed nosology.

Paroxysm; a fit.

Pectoral; medicines adapted to cure diseases of the breast.

Pelliculæ; pellicle; is a film or fragment of a membrane from pelis, the skin, or hide of any creature, thin skin-like appearance.

Pelvis; signifies a bason; several cavities in the body are called by this name, particularly the space formed by the bones at the lower part of the body.

Pericardium; the membrane which incloses the heart.

Perichondrium; a continuation of the periosteum, the inner layer of the capsular ligament, reflected over the cartilage extremely fine.

Pericranium; a membrane that covers the skull, same as the periosteum.

Peripneumonia; an inflammation of the lungs.

Periosteum; a membrane which covers the bones; it is wanting over the enamel of the teeth.

Peritoneum; a thin and soft membrane, which incloses the bowels.

Peristaltic motion; is that vermicular motion of the guts made by the contraction of the spiral fibres of the intestines, whereby their contents are pressed downwards, and expelled.

Permeability; open, to be passed through.

Perspiration; the matter discharged from the pores of the skin in the form of vapour or sweat.

Pertussis; the hooping cough.

Petecchiæ; red or purple spots on the skin, which frequently appear in the small-pox.

Petrosum os; a hard part of the temporal bone.

Pharmacy; the art of making medicines.

Pharynx; the upper part of the gullet.

Phenomena; appearances.

Phlebotomy; bleeding.

Phlegmon; a superficial inflammation, attended with great pain, and ending in an abscess.

Phlegmatic; relaxed, and abounding with phlegm.

Phrenic; nerves and vessels running to the midriff take this name.

Phthisical; consumptive,

Physiology: the study of nature with respect to the cure of diseases; particularly the human body, its parts, structure, health, life, functions and œconomy.

Physiognomy; the study of character by the external form of the head, features, &c.

Pia-mater; the inner covering of the brain, next to the dura-mater: a thin and delicate double membrane.

Pineal gland; a small part like a pea, situate in the skull; formerly supposed to be the seat of the *Soul*.

Pinguidinous ducts; ducts conveying the fat.

Pituitary membrane; (or gland) which separates the viscid moisture of the nostrils.

Pituitous; phlegmatic.

Placenta; that mass or cake which is commonly called the *after-birth*.

Planum os;

Planum os; a small smooth bone in the orbit of the eye.

Plethoric; full of blood.

Pleura; a double membrane which covers all the cavity of the thorax; subject to inflammation, called pleurisy.

Plexus; a complication of vessels; a term applied to many parts; a plexus of nerves is a union of nerves, forming a sort of ganglion or knot.

Plexus Choroides; a production of the pia-mater, spread over the lateral ventricle of the brain.

Pneumatics; that part of philosophy, which teaches the properties of air,

Podagra; the gout.

Pomum Adami; a protuberance easily seen, or felt, in the fore part of the throat; formed by the first cartilage of the windpipe.

Popliteal; a nerve spread on the leg; a muscle that assists in bending the leg and turning it inwards. An artery and vein also, take this name.

Portio mollis; a branch of the 7th pair of nerves, spread over the labyrinth of the ear. *Portio dura* a branch of the same, spread upon the face.

Posology; a knowledge of the doses of medicines, adapted to the age and constitution.

Pouparts Ligament; the lower border of the descending oblique muscle of the belly, stretched from the ilium to the pubes.

P. r. n. pro re nata: as occasion may require.

Prognosis; to know before hand, to foretell the event of a disease; to prognosticate.

Processes; several protuberances or prominences of the bones and other parts; distinguished according to the parts they are in.

Prolapsus; a protrusion: a falling down of a part.

Pronation; the hand when the palm is downward or the thumb towards the knee; a name added to some muscles to signify the action of the part they assist.

Prophylactic; preventative.

Proximity; nearness.

Proximate cause; the immediate cause of diseases; in contrast to the *remote*, or inducing cause.

Psora; the itch.

Ptyalism; a continued flow of salvia.

Pudenda; from *pudor* shame; a term applied to certain parts.

Pulmonary; relating to the lungs.

Pus; matter contained in a boil the consequence of inflammation.

Pustulous; full of matter.

Pylorus; from the Greek, signifying a porter; the right orifice of the stomach.

Pyrosis; the heart-burn.

Q. *Pl. Quantum placet*; as much as you please,

Q. V. Quantum vis; as much as you will.

Q. S. Quantum sufficit; as much as sufficient.

6. q. h. every six hours.

Quinsey; an affection of the throat, of various kinds.

R. in prescriptions, is put for *recipe*, take of—

Radius; a bone of the fore arm, to which the hand is joined.

Recti muscles; the straight muscles of the eye.

Rectum; the last of the large intestines; it is not covered with the peritoneum, as the others are.

Resorbents; those vessels which reconvey back into the system, fluids secreted, in order to relieve nature.

Refrigerant; to cool; to allay heat.

Regimen; regulation of diet.

Regress; going back.

Regurgitation; to throw back again.

Respiration; the art of breathing.

Restringent; binding.

Resuscitation; the art of bringing to life; a resurrection to life.

Retroceded; going back.

Retropulsion; forced back.

Rete Mucosum; the true skin, on its whole surface, is covered with two lamellæ; one is the rete muscosum; the other the scarf skin. It is the principal seat of colour in man.

Reticular; made in the form of a net.

Retina; so called because it resembles a net, a membrane that lines the bottom of the cavity of the eye; a fine expansion of the fibres of the optic nerve.

nerve. On this the impressions of objects are made.

Rubifacient; to make red.

Rugæ; folds.

S. or *sumend*; an abbreviation in prescriptions for *sumendus*, to be taken.

Saccharine; formed of sugar.

Sacrum os; the five vertebræ of the loins; they are broader than the others, and the last is the largest of any: they grow so close in adults, that they make but one large and solid bone.

Saliva; spittle.

Sanies; a thin and generally acrid matter discharged from a sore.

Saturated; fully impregnated.

Scaphoides os; a small bone of the tarsus.

Scapulæ; the shoulder blades; two large, thin, broad bones, situated on each side the back part of the thorax.

Scarf skin; the outer skin; called also *cuticle*, and epidermis.

Sciatica; a fixed pain in the hip, like the rheumatism; the hip-gout.

Scirrhus; a diseased, hardness of glandular parts.

Scr; scrupulus, a scruple.

Scrophula; the king's evil; tumours in the glands, &c.

Scutiform os; same as Patella; the knee-pan.

Scutiform

Scutiform Cartilage; the point of the breast-bone called the ensiformis; or sword-like bone.

Sebacous Glands; glands secreting a sort of fat, situated under the skin; often visible in the face, and easily on squeezing, throw out their contents.

Secretion; that separation of juices from one another, which is performed by the glands.

Secundines; the after-birth.

Sedative; composing, relieving.

Semilunar; resembling a half moon.

Sensorium Commune; common sensory; that part of the brain where the nerves unite; the medulla cerebri.

Sentient; perceiving; having perception.

Septum; applied to a thin partition, which divides various parts of the body.

Sesamoid bones; seed like, little bones most frequently found at the joints of the toes and fingers.

Sessima, or *Ss*; signify half.

Shingles; a peculiar kind of small pimples.

Sialiagogues; medicines which produce saliva.

Sinew; the cords or tendons of muscles.

Sinus; a cavity, applied to various parts of the body.

Slough; a part separated from a cavity by suppuration.

Spasm; a cramp or diseased contraction.

Specifiic; such remidies as have an infallible efficacy in the cure of disorders.

Spemoides; a particular bone in the skull so called; from the Greek, signifying a wedge-like form.

Spermatic; relating to the seed.

Spachelus;

Spachelus; a complete mortification of a part.

Spine; the back bone; also a long, sharp process.

Splenic; parts going to, or concerned with the spleen; which is composed of membranes filled with blood, of an oblong shape, situated between the ribs and stomach, above the left kidney.

Stamina; the solids of the human body.

Stapes; a little bone in the ear so called from its resemblance to a stirrup.

Sternum; the breast bone; it defends the heart, and receives the extremities of the true ribs.

Sternutatory; causing to sneeze.

St. Vitus's dance; a convulsive motion, and twitching of the limbs.

Strangury; a difficulty of making water.

Styptic; a medicine for stopping the blood.

Subclavian; applied to any thing under the arm pit or shoulder, whether artery, vein, nerve, or muscle.

Subcutaneous; any thing just under the skin.

Sublingal; under the tongue.

Subluxation; partial dislocation; where the head of a bone is not quite out of its socket, but rests upon the brim.

Sudorific; medicines producing sweat.

Supercilium; the eye brow.

Superfœtation; when more than one is contained in the womb.

Supination; the palm of the hand is said to be in a state of supination, when it is turned upwards.

Muscles

Muscles which turn the hand upwards are termed *Supinators.*

Suture; a species of joining of the bones as those of the head are.

Sychondrosis; a term applied to bones that are joined by means of an intervening cartilage.

Symptomatic; depend upon another disease.

Synarthosis; applied to those joinings of bones, mutually indented, resembling the teeth of a saw, or are placed like a nail in wood.

Syncope; a fainting.

Synovia; a gluey transparent fluid, in the joints; to keep their motions free and easy.

Tabes; a wasting of the body.

Tarsi; the edge of the eye lids.

Tarsus; small bones (seven in number) occupying the space between the leg bones and metatarsus, each bone has also its proper name.

Temperament; a peculiar habit of body of which there are four kinds, the sanguine, the bilious, the melancholic, and phlegmatic.

Temporum ossa; the bones of the temples.

Tendon; the extremity of a muscle where the fibres run into a sort of cord.

Tetanus; spasmodic contractions of the muscles, as in the locked jaw.

Theraputic; from the Greek, to make well; that part of physic which respects the prescription of medicine, or the method of cure.

Thoracic duct; the canal which conveys the chyle into the left subclavian vein.

Thorax;

Thorax; the breast, or chest.

Thyroid glands; lymphatic glands at the lower part of the wind pipe.

Tibia; the inner and bigger bone of the leg: its fore and sharp edge is called the skin.

Tibialis antica, and Postica; muscles of the leg, concerned in moving the foot *inwards*, and *forwards*.

Tone; activity with strength.

Tonic; that which increases the tone, or elasticity of the fibres.

Topical; disease confined to some particular part.

Torpor; sluggishness, inactivity.

Trachea: the wind pipe, situated or the fore part of the neck, before the gullet; called also *Aspera Arteria.*

Trapezius; the name of a muscle, called also *Cucullarius* which moves the shoulder blades.

Trochanter; the upper part of the thigh bone called also rotator, divided into the greater and lesser.

Tuberosity; a rough knotty eminence.

Tubercles; small tumours often found in the lungs.

Tubuli; small tubes.

Tunica; a word applied to many parts, which cover others, several membranes, have it attached to their names.

Tympanum; a drum; applied to the ear.

Tympany; from the Greek, signifying to sound like a drum; that sort of dropsy that swells the belly up like a drum.

V. Vespere; the evening.

V. o. s; in ovi vitello solutus, dissolved in the white of an egg.

Vaccine Pox; from the Latin *vaccus* a cow; the cow-pox.

Valves; little flaps so contrived, as to prevent fluids passing onward, from returning.

Vapours; low spirits.

Varix; an enlargement of a vein.

Vassa; a term applied to all the parts of the body, having any resemblance to vessels.

Vasa Vasorum; those minute invisible vessels which nourish other vessels, aad are ramified through the coats of the blood vessels, intestines, &c. visible by injection.

Vasculai; full of vessels.

Veins; the extreme ends of those vessels which carry the blood from the heart; continued back *towards* the heart; vessels that bring the blood back to the heart.

Velum palati; see *uvula*.

Vena azygos; see azygos.

Vena portæ; the blood vessels which go to, and are spread about, the liver.

Vena cava; the great blood vessel, which brings the blood to the heart.

Ventricle; a small cavity.

Vermifuge; good against worms.

Vermicular; a term applied to parts, having either the shape, or the motion of worms.

Vertebræ; that chain of bones which reaches from the neck down the back.

Vertigo; giddiness.——*Vesicating*; raising blisters.

Veterinary; that branch of medicine which has bodies of animals for its object.

Viscera; the bowels or entrails, the chief contents of the head, chest, and belly.

Viscous; glutinous; sticky.

Vis insita; applied to the flesh, means the natural contractility of the moving fibres.

Vital air; pure air, air necessary to life; oxygene gas; the dephlogisticated air of Dr. Priestley.

Viviparous: such creatures as bring forth their young living and perfect.

Ulna; the name of the bone which lies inside the fore-arm, reaching from the elbow to the wrist; sometimes named *cubitus*.

Unc. uncia; an ounce weight.

Umbellical; belonging to the navel.

Unguis; the name of a little bone in the great angle of the orbit of the eye: it has an hole in which the lacrymal bag lies.

Ureters; two long, small canals, which carry the water from the kidneys to the bladder.

Urethra; the canal which conveys the water from the bladder.

Uterus; the womb.

Uvula; that soft bit of flesh that hangs down from the roof of the mouth, acting as a valve.

Vulnerary; healing.

Page 268—with Mr. Brooks, add also Mr. Blair—Mr. Taunton.

J. Cundee, Printer, Ivy-Lane.