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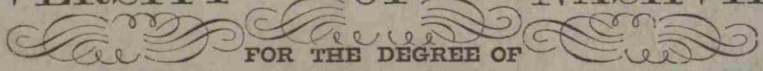
Physiology of Nutrition

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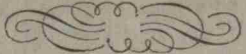
PRESIDENT, BOARD OF TRUSTEES, AND MEDICAL FACULTY

OF THE

UNIVERSITY OF NASHVILLE,



FOR THE DEGREE OF



DOCTOR OF MEDICINE.

BY

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OF

Tennessee



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Physiology of Nutrition

An Consideration of The High

esteem entertained for each member

of The Medical Faculty of Nashville

University. This humble Dissertation

is dedicated, or inscribed to them

collectively. For their kindness is fondly

remembered by their pupil and friend.

The Author.

Physiology of Nutrition.

A dissertation upon this subject involves a consideration of the following divisions, viz—

1st Food, - 2^d Digestion, - 3^d Formation of blood, -
4th Modus operandi of Circulation, and Nutrition.

Each of these divisions will be subdivided as they come up for our discussion.

First Food, divided into 1st vegetable, -
2^d Animal.

Scarcely the sable curtain had fled, and time itself been born - Light was but severed from darkness; - The chaotic mass but merged into earth's form -

The morning stars but tuned their Lyres; - Scarcely had the shouts of the sons of god echoed, and died away, in the distance; - When Lo! ere man is made, a green herbiferous carpet is thrown broadcast, over the

face of the unchristened Earth, as if to form a pleasant receptacle, for the primeval Food of Man, And from whose spontaneous luxuries he might satiate his desires for food,

But alas! some Moral Hydrocyanic was eaten, ere long Man had lived in his Edenic Paradise, And now lamentable as it is, by the sweat of his face he eels, for his consumption, the nutritious vegetable from the poisonous, And in sorrow does he this, because that light has grown dim which primevally shone in beautiful lustre, discriminating in perfection, between ^{the} nutritious and Toxicological, if indeed, the latter existed at all.

Although the Curtain of human depravation has fallen thus in saecula around us, still there is every ray of light shining forth in the the vegetable Kingdom, as seen in its germination, Growth, and adaptation to the wants of Man, as a nutriment and also as an aid to his vis medicatrix naturae in repairing his earthly bark when torn by the tempests of

time, All of which, light reflects glory upon the Creator, and illumines the path, of man to hope, at least for anodynes, amid the torturing pains in life, and for food, the antidote of innanition.

The abstract germs of the plant, and of man when seen by aid of Microscope, or physiologically examined, seem to differ very little in many respects; Indeed their elementary principles may be the same, but joined together by the laws of affinity, in different proportions, And as affinity is a law allowing compounds in different proportions, then though the elements be the same, these different proportions prevailing, the one germinates into a plant, and the other into a man. The one requiring but the fertile earth into which to be imbedded, then warmed by the genial rays of the sun, and watered by the rains of heaven to cause it to spring up, and after its sort, it breaths the atmosphere around, and thus it grows and becomes food for man. While the other is sown in an organ capable of the highest physiological functions

and around it are formed speedily nourishing and protecting membranes, when from the blood of the mother it gains its nutriment, even as the plants beneath the surface gain their nourishment from the strength of the soil, when the plant springs forth, it has the aid of the atmosphere to nourish it, then it grows by means of soil, refreshing of air, and water by means of rain. So when the original germ of man, quits life in utero, it comes forth, the more in direct contact with the atmosphere, inhaling it, for creation of its own blood, upon which, it is now dependant, for its earthly existence, and this blood is sustained by the food eaten.

Thus we see the comparative analogy existing between the growth of these different germs.

But the plant has the power of converting atmosphere into food, in this it differs from man, and also in the fact that, that part, which is nutritious in plants, if taken separately is poisonous in man, yet this quality is so changed in many plants, by its

affinity for other constituents of the plant, as not to be poisonous, but highly nutritious, and pleasant to man.

Now the effete matter of man, is being constantly cast off, by the various excretories, and this effete matter is such as has been vitalized, or else it is of such material as not to be vitalized at all, and if it be of the first named kind it has performed its office in the body, and is exhausted, and is removed by the Lymphatics, and its vacancy must be speedily filled, from the Capillaries, or else, soon death will take place from inanition.

Since as we have seen, there is such likeness in many respects, between vegetable and animal, what could be better, than a vegetable diet? It is very soon vitalized, and thus becomes a part of the living economy. All things shew forth the handy work of the allwise Creator!

Thus the physiology of man demonstrates, that he is continually, giving off, old, and taking on new particles. Now if this be conceded, I conclude that there

are fewer particles exhaled in youth, and thus the system enlarges its dimensions. In middle life, that which is received, and given off, are equal, hence permanency in stature, and strength. But in age, the effete matter is greater than the newly vitalized, hence the system deteriorates, instead of strengthening, and beautifying, as in youth.

Some of the nutritious principles of plants, are their Dextrine, Saccharine, Albumen &c

A wise providence is manifest in the fact, that everywhere on earth, designed, for man to live, vegetables either grow spontaneously, or by the sweat of the face, may be made to grow, or if indeed, this fail, then Commerce comes to his aid, for the basis, and blessing, of which, we are dependant on the same almighty, who is the Giver, of every good and perfect gift.

And further, there is admirable appropriateness in the creative arrangement. For in the Tropics, where men are enfeebled by heat of a vertical sun, - Systems, too

less for much labor. Their food, is more readily obtain-
-ed, and less labor is required to prepare it, as is
shown by the Bread Fruit Tree, growing its ready
made loaves! While in the more Temperate zones,
more labor is requisite, not only in its culture,
but also in its preparation, the seasons are
also shorter, but kind Providence hastens the ri-
-pening. At the same time the Muscular fibre, of
Man, is more contractile, and strong, and is therefore
the more capable of the toils, requisite in the Cul-
-ture, and preparation of his food. In Frigid
zones, the inhabitants, are adapted to the Climate &c.

I^d Animal Food. There are but few,
if any animals, which do not live upon vegetable
food, or upon other animals. There are some interme-
-diate links between vegetables, and animals, which do
not subsist thus; but as vegetables; principally
from air & earth &c. Some animals are herbiferous.
Some Carniverous, others omniverous, as Man (see
living by either vegetable or animal, one, or both.

The teeth, and the arrangement of the teeth, are different, in the different tribes, of the animal kingdom, which is a mark of Creative distinction, not void of wise designs, which if fathomed, shew the handy work of him, who maketh means adapted to their ends. Ye indeed! In the ephemeral insect, flitting gladly, but for a day, in the beams, of the summer's sun, his praise, is magnificently shewn forth; And thoughtless indeed, must be the man (not to say reckless) who needlessly tramps, beneath his feet, even the worm of the dust, or the busy ant, for they too, are creatures of God. And though in them the vulgar, see no charm, yet to the eye, from which, the scales of sin, and ignorance, have fallen, they are mirrors, reflecting the power, and wisdom, of him, who made them, and us! Nay truly! To the properly educated mind, there is not a sprig of grass, in the desert oasis, wild, nor a flower, that blows, upon the mountain-top, nor in the valley low, but that shows forth, the power, wisdom, and praise, of God. But we cease, this digression

That animal food, was eaten, by our first parents, I think, is quite probable, Their first clothing, prepared by God himself, was of skins of beasts, which beasts, were most likely slain, for the compound purpose, of food, and the rite of sacrifice. That it was eaten, more, or less, regularly before the flood, is a point clearly sustained, And Gods own, peculiar Nation. The jews, ate it, by his direction, though in a restricted sense, which fact, typified, the purity of Gods people.

There is a more thorough Concentration, of fibrin, in animal, than in vegetable food. The fibrin, of the lower order of animals, is more nearly like, that of man, than is the vegetable fibrin, which is proof, a-priori of its preferable Character, for food, in many instances. Herbiferous animals which become, food for man, are refining Mills, of fibrous matter, from vegetation, that it may be ^{more} readily, be vitalized, in man, and conform, to the uses, of his economy. That animal food, more speedily replenishes, an exhausted system, and maintains, its sinking powers, I reckon there is

No doubt, hence the frequent prescription, of Beef-
-Tea, when the system languishes, from continued fevers &c.

When we consider, the entire dependance of the an-
-imal, upon the vegetable kingdom, either directly, or
-indirectly, we are at the ultimum, left, as our only
-resource abstractly, dependant upon that simple,
-yet complicated vegetable germ, whose analogy,
-we have shown, as beautifully existing, with the
-material germ of man. But—

Secondly— We are to consider, the subject, of
-Digestion, divided into 1st Prehension, 2^d Mar-
-tiation, 3^d Secretion, 4th Chymification,
-5th Chylefication.

1st Of Prehension, In the great deluge,
-the waters, covered the highest mountains, to ^{the} depth,
-of fifteen cubits, And did vegetable, and animal
-food, prevail equally plentiful, and of the most
-luxuriant character, without prehension, it
-would not do, men a particle of good,
-Prehension may be simply defined, as the Modus—

-operandi, of bringing food into the mouth,

This power exists, more or less, perfect in all orders of animals, even the Radiata, Articulata, and Mollusca, all exhibit it, but true, 'tis far ^{less} perfect in them, than Man. But of what, has vain man, to boast? when without prehension, he must die! And Lo! the Polypi, scarce above the plant, in rank of existence has prehension too!

But, how is prehension accomplished? Simple question, it may seem, but not so simple, is the answer thereto. To accomplish this, the requisites, are the bones of the arm, with their Thoracic articulation, their articulation, with themselves, and with the Carpal bones, and these with the MetaCarpal, and yet, the phalangeal articulations, all of these with the Deltoid, Pectorales, & Extensor, and flexor muscles, of the arm, with the various, muscles of forearm & hand, with blood vessels, nerves, integument, and even the unguis, all these, and yet more, for these, might exist, and yet, the limb be paralyzed,

There must exist a brain, a centre of nervous influence, - The Throne of the Mind. To this thus enthroned, must be made known, the necessities of the body, through the media, of the reflex nerves, of the Stomach. By this, we have the sense, of hunger. When this intelligence, is thus made known to the mind, as a Monarch it sends, its edict, through the media of the Motory nerves, to the arms, and demands, effectual motion, and these as true subjects, speedily obey, and Prehension! is the result, How complicated, and yet cursorily viewed, how simple!

I^d Mastication and Insalivation.

For the accomplishment, of the important office, of Mastication, the superior, and inferior, Maxillaries, are brought into requisition, having set within their alveolar processes, thirty two teeth, ^{Food} they being brought into the mouth, by prehension, as just described, then the mind will its mastication, and call upon the motory nerves, of the face, (branches of 7th pair)

and in obedience to this requisition, at once, the
Masseter, Buccinatti, Temporal, Lingual, Pterygoïd and
Stylo-gastricus &c Muscles, are engaged moving the jaws,
in various ways, and with considerable forces, for
the grinding, of the food, of the food.

Situate in the glenoid cavity, partly, and adjacent
thereto, on either side, and at, or near, the articula-
tion of the inferior Maxillary, are the Parotid glands,
and from these, on both sides, passes the duct of
Steno, and in such connection, to the Masseter, and
Buccinate Muscles, as that their movements, in the
act of chewing &c, is constantly pressing, the salivary
secretions, of these glands, through these ducts, into
the mouth. Also the submaxillary glands situate,
at the angle, of the lower jaw, on both sides, having
an entrance, into the mouth, through the duct of
Wharton. With the two sublingual glands, beneath
the tongue, having each 10 or 12 ducts, of Rivianii,
These also emptying, their secretion, into the mouth,
by the movements, of the nerves and muscles, Hence as

Mastication, goes on, insalivation likewise, takes place; for the double purpose, of moistening, and thereby lubricating, the food, and of forming, a chemical combination, for the promotion, of digestion in the stomach.

By the increase of muscular action, in masticating, there is an enlarged quantity of blood, invited to these six glands, and from this, increase, of blood, an increase of saliva, is secreted, just as needed, for mixture, during mastication, and while it has so much physiological, work to perform, preparatory to deglutition, and digestion, yet, I have no doubt, but that, it is a depuratory process, of the blood. An ancient man, exclaimed (and well too) "I am fearfully, and wonderfully, made!"

3^d Deglutition.

The food, being thus prepared, then by an effort of the tongue, it is brought, into the fauces. - The velum palati, covering the posterior Nares, thus preventing, a refluxitation, into nasal fossae.

Then an effort, of the Muscles, of the Pharynx, causes it to enter, the Esophagus, the Trachea, being closed temporarily, for its passage, Having gone, thus far, the voluntary Muscles, have nothing farther, to do with it, Neither, is it subject, to the will, but by its gravity; and, the force of the involuntary Muscles, it finds its way, through the Esophageal, or Cardiac orifice, into the Stomach.

4th Chymification. - The Stomach, into which, the food has now passed, is a very important organ, in the animal economy, It is an enlargement of the alimentary Canal, inviting the stay of food, until partially digested. It has 4 Coats, viz Peritoneal or External; Muscular having fibres running, Longitudinally, also Circularly, and obliquely, Next to this, is the Vascular coat, being well supplied, with blood vessels, and nerves, And in this coat, is the Gastric Glands. The inner coat, is a Mucus one, and, when the Stomach, is empty, it lies folded in upon, Through this coat the

Gastric follicles penetrate, to empty the gastric juices,

Above The Stomach, is The Diaphragm, in The right Hypochondriac region, is The Liver. In The left, is The Spleen. Posteriorly, is The Pancreas, connected, to it, by a duplicature, of The Peritoneum, so also, is The Spleen connected. And inferiorly, is The pyloric ~~office~~, and Duodenum.

Thus The Stomach, presents itself, as an organ of importance, situate, at a point, most suitable for performance, of The high function, of digestion. It is in the midst, of warmth and protection.

The food entering, while The Stomach, is not distended, is received, into The rugae, of The Mucous Coat, and by actual contact, with the billi- of small filaments, of nerves, belonging to The Gastric glands, at once gastric secretion is induced; as has been seen, by Dr Beaumont, in his case, which offered, such uncommon facilities, of research. This juice, being secreted, in all parts, of The

Stomach, it trickles down, to the most pendant part,
and surrounds the food, And now commences,
Chymification (one part of digestion) It is a Chem-
-ical process,

There is existing, in the Saliva, and gastric Juice,
proportions of acid, and alkali, with other things.

These having affinity, one for another, and for
certain properties, of the food, hence it is decom-
-posed, and new Compounds, are formed. often leav-
-ing, some single gas, having no affinity for the new
Compound, to escape, as a flatus. And it is well,
we are allowed, to get clear of it, for it might
frequently, prove unhealthful,

In the course, of a few hours, this Chemical Com-
-pounding is complete, and the result, is a thoroughly
masticated, and partially digested substance,
which is Chyme, and being duly, and truly, pre-
-pared it knocks, at the pyloric door, for the
further lights of—

5th Chylification— Before entering

The Duodenum, the food, passes around, and around,
in the Stomach, giving off, at each round, that
portion, which is Thoroughly Chymified, The
Pylorus guards well, lest, that which is unpre-
pared, should pass.

During Chymification, there is just enough
gastric juice secreted, to digest a sufficiency,
of food, to supply the wants, of the system, Hence
one of the evils of gluttony, is imperfect diges-
tion, with its train, of Consequences

The Par Vagus Nerve, which seems to reign as
Sicgerent, ~~over~~ the function, of digestion, makes
known to the brain, when a sufficiency of food
taken. And unless by indulgence, this medium
is perverted, the knowledge conveyed, by it, is
ordinarily correct.

The food having entered, into the Duodenum,
for Chylification (a further process of digestion)
It becomes us to consider, the structure of the
Duodenum, and its relations, to the surrounding

viscera, which aid, in the formation of Chyle.

The duodenum, is the first division, of the intestine, and is about, twelve inches long, as its name indicates. It has three coats, but the Mucus coat, differs from the Mucus coat, of the Stomach, in having circular folds, called Valvula-Conventes, thickly set, instead of rugae. These are, for the purpose, of retaining, and admixing, the food, with the secretion, of the glands of Brunner, (which glands are in these folds) And also, with the Bile, and pancreatic juice, which are poured, into the duodenum, four inches, below the pylorus. And below this, there are a great many Lacteals, and the retention, of food, by this vascular structure, affords absorbing facilities, by lengthning the stay, of the food, and admitting more lacteals, from the enlargement, of the space.

The Pancreas, as before stated, is situate; posterior, to the Stomach, and is connected, with it, by peritonium, This is a large conglomerate

gland, being several inches in length, In its centre, runs its duct, made up of small transverse ducts, from all parts of the gland. This longitudinal, or large duct, is continued, to the duodenum, at the point, before mentioned. And the juice, it conveys, is secreted, from the blood, and in a degree, depurates it. This juice, being in the duodenum, it seems to be alone, for purposes of digestion.

The Liver, in the right hypochondrium, is also, a conglomerate gland. And is much the largest gland, in the economy. It is divided, into right, and left lobes, by its umbilical fissure. The right lobe, is much the larger. It also has anterior, and posterior, surfaces, or superior, and inferior. The superior surface, is smooth, only marked, by the umbilical fissure, and falciform ligament. The inferior, is not so smooth, but has the gall bladder, and transverse fissure, &c. The whole gland, is enveloped, in peritonium, making a shining coat, upon its exterior.

This gland is peculiar, in having, three sets, of blood vessels, viz Vena Portae, Hepatic arteries, and Hepatic veins. The Vena Portae, enters the liver, in its transverse fissure, and ramifies minutely, in the whole gland, The Hepatic artery, ramifies in connection with, and is most probably, a source of nutriment, to the walls of the Potarum.

The Potarum, is made up, by veins, from most of the abdominal viscera, hence, these veins, do not enter, the vena Cava ascendens, but come together to form, this large vein, From the minutia, of this vein, & the accompanying Hepatic artery, is secreted (by small cells) the bile, which is conveyed, by many small ducts, into the great hepatic duct, and thence the hepatic bile, is conveyed, to the Duodenum. And when, there is, a surplus, it regurgitates, and is stored, in the gall-bladder, for cases of emergency, And I think it is probable, that the cystic bile, undergoes more or less modification, and that a small proportion, of it is always, required for digestion, as well as, Hepatic.

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Hence for Chylification, a small portion, passes the gall duct, into hepatic, thence into duodenum, for its office, in the digestive process &c.

The properties of Bile, are Biline, Cholitrine, various Phosphates &c. It is yellowish, or greenish, and bitter, and Alkali, predominates.

That it aids in digestion, when in the duodenum, does not admit of doubt, but it is partly excrementitious, and it is ^{this} excrement, that gives the natural color, to the feces.

Galen supposed the liver, to have a great deal, to do, in digestion:— In depuration of blood, and that, it sent its serum, to the duodenum. its drops, to the Spleen, and its 'pure wine' to the heart, Thus making it, a mighty Monarch, reigning over many provinces. His theory none molested, for many centuries. It was thought to be firm as the unshaken bluffs of Gibraltar, and likely ever to stand.

But at length, almost every province, was taken away, leaving it as a gland, secreting only a

clebris, altogether unmentioned, and worthless, but at least, a medium ground, has obtained, and many of its undoubted rights, has been restored to it.

I look upon the liver, and The Portal Circulation, as highly important, in Nutrition, and Depuration,

1st It secretes a hepatic bile, for ordinary purposes, of digestion. and a cystic, is always in store, for cases of emergency, as well as, its use ordinarily, hence at no time, need digestion, be unnecessarily stayed, even though perchance, there is a deficiency of hepatic,

2^d By this secretion, it depurates, the blood, and fits it, for the important functions, of Nutrition.

This depuration, by secretion of bile, is quite necessary, for when there is no secretion, a jaundice is the result, than which state, there is not many, more unpleasant, and depressing, to the system.

The stupor of jaundice, shows the presence of a surplus of Carbon, and a ~~deficiency~~ deficiency of oxygen, The compound of bile, with Carbon, is evident, and this is decomposed, by the secretion of bile, leaving the Carbon

to escape by respiration, and there^{then} is a more perfect oxygenization. If this failure of secretion occur, then the blood containing the bile, in its regular round, of circulation, brings the particles of bile, to the cutaneous capillaries, hence the yellowish appearance, of cutis in jaundice, these particles of bile, in capillaries, retard circulation, and cut off, the usual supply of oxygen, hence they, by this mean, cause stupidity, then were biliary secretion, entirely cut off, an unceasing jaundice, would follow, and life thus depressed, would soon, wane away, and be entombed, in the sable shades, of death.

Then with these views, we discover, the liver, and Portal^{System} of chief importance, both of matters of digestion, and general circulation, and through these, to Nutrition.

The Spleen, has been thought by some Physiologist, to have much to do, in digestion. I confess I know, but little about its physiology.

in this respect. But experiment has demonstrated, it is not being, a vital organ, as it has been excised, and yet the person lived. But that it is important, in the economy, its presence is prima facie evidence, and further evidence exists, in the fact that the Divine Creator, deals in no superfluities, but, has made, all organs, for special uses.

It probably serves more uses, than physiologists are aware, and there is room, for new discoveries, concerning its offices. And he that demonstrates, its entire office, will have a name, for many years, in the literature, of the Profession.

Galen. thought that the Spleen, was the receptacle, of the chyle of the liver.

Mush thought, it a reservoir, for the blood, to prevent congestion, of the vital organs.

Professor Bowling thinks, that when Malaria, is inactive in the body, it is cribbed, in the Spleen. Hence ague Cachexia, and other Splenic affections.

These ideas, are all probably true, but are not

fully demonstrated, as yet. - Though quite plausible,

It is also thought, the Spleen, has something to do in elaborating the contents, of the Thoracic duct, as it passes from the receptaculum Chyli, to be poured, into the Circulation.

With these remarks, we bid adieu, for the present, to Pancreas, Liver, and Spleen, and return through the Pancreatic, and Hepatic ducts, into the duodenum, for there is no Spleenic duct, leading that way.

Upon return, we find, that by means, of the juices, of Glands of Brunner, and Pancreas, with aid of the bile, from the liver, that the Chyme, during our absence, of exploration, has wisely changed itself, in to Chyle. (save the debris, which is to be eliminated, per ano). And this Chyle is ready, for absorption, by the Lacteals. Thus adieu to Digestion!

Thirdly. - Formation of Blood, by Absorption.

So long as the aliment, in the intestinal canal, it

affords no nutrition, But in the vertebra, there is a set of vessels, interposed, between the walls of the intestines, and the sanguiferous system, which are called Lacteals, These receive, the Chyle and convey it, to the Thoracic duct, where it meets with the Lymph, from the Lymphatics, these having passed through, the Lymphatic glands, and the Lacteals, through the Mesenteric glands, they both, by these glands, are more or less, influenced, and fitted, for further use, The Lacteal, with a portion, of the Lymphatics, empty into the receptaculum Chyli, While the Thoracic duct, receives the intercostal Lymphatics, and the duct from the glands, on right Cervical region, and adjacent parts, empty into the junction, of subclavian, and internal jugular, of the right side, thence into the Circulation,

The Lymphatics, are absorbents, coming from the skin, and all, or near all, of the tissue, of the body, passing as has been stated, through their

Glands, and then pouring, into the circulation, as has just, been described. They are a part, of the absorbent system, Conveying from without, towards the intestines, or the Circulation,

The Lacteals arise, from a small cell, situate back, of the epithelial Coat, of the Bowel, Their office is, to take up the alimentary substance, after it is mixed, with Brunum, & pancreatic juice, and bile, And this this matter, is not Chyle properly, untill absorbed, by the Lacteals.

That the sanguiferous vessels, in their small ramifications, absorb a portion, of the alimentary contents, seems to be certain, And in the invertebrata, this is said, to be the sole way, of the entrance of nutriment, into the blood, as there exists, no Lacteals, nor Thoracic duct, in that order of Animals.

The Lymphatics take in many substances, from the skin, and by this means, affect the general system, for instance, water thus absorb

-ed, may allay Thirst, and Medicines, when enderm-
-scally applic'd, enter the system, through them, and
affect the nerves, intestinal Canal, or circulation,
as their nature, may incline them, (ie) if they be ca-
-thartic, they purge if, sedative, they quiet, the nerves,
and circulation, By removal of the epidermis,
or scaly skin, their mouths are exposed, hence
a surface is blister'd, for endermic medication,
When a medicinal effect, is desired through this
media, about three times, as much is applic'd, as
when taken, per mouth,

These absorbents, are constantly, taking in from
the surrounding elements, something for the support,
of the system, or in contagious, or malarious at-
-mosphere, that which is derogatory, to it,

When from Dysphagia, the food cannot enter,
the Stomach, or when the ingesta, will not re-
-main, on the Stomach, when taken, in either,
of these Cases, the Lymphatics may save from
evacuation, by letting the patient, remain in a

Nutritious Bath, as one of Milk, and Water. Worms;
Nutritive injection, per ano, may materially aid,
in such case.

The absorbing powers, of the Lymphatics, are
demonstrated, by applying madder to the skin, and
then detecting it, in the color, of the urine. Also
by external application, of Gallie acid, the exper-
imenter, is enabled to detect it, in the urine also.
While Garlic applicd externally, effects the breath,
showing that it is absorbed, and conveyed to the
Cells, of the Lungs

Saline Medicines, endermically applicd, are read-
ily taken in, and when taken intoth Stomach, the Lactes
of the intestines, do not absorb them, but the sangui-
ferous vessels, of the Stomach,^{do}. The pyloric extremity,
of the Stomach, might be ligated, and yet a dose
Epsom salts, would purge, because it enters the
circulation, and by its chemical union, with the
blood a portion of the serum, of the blood is cast off;
hence the philosophy, of watery discharges, from

Saline purgatives, is demonstrably shown.

The Lymph, has less fatty matter, Albumen, and Fibrin, than Chyle, as it is not, so nutritious, as the Chyle, yet there is some resemblance, between the two, Lymph being in a degree nutritious, but a great deal of excrement, is thrown off from the system, by them. By the interstitial absorption, performed by them, the disintegrated, and exhausted parts, are conveyed away, while all that is nutritive, in them is so remodelled, as to be again, taken into the circulation. And as this fact, has been demonstrated, we may adopt the language, of a Physician, who once said "A sort of digestion is carried on, in all parts, of the body."

The office of the Lymphatic system, is to take up, and convey, to the circulation, such matter, as is nutritious, gotten by interstitial absorption, and such as is excrementitious, they convey out of the system, through the intestines. They also receive, from external elements, substances either nutri-

tious, or deleterious, the quality being dependant, on the nature, of the surrounding elements. Thus they aid, in the nourishment, of the system, negatively, and positively. Negatively, by removing the exhausted atoms, and making room, for newly vitalized matter. Positively, by conveying the remaining nutriment, of these disintegrated parts, again into the circulation, and by receiving from external sources, nutrient substances, and conveying them, likewise, into the circulation. Thus they are, of great importance, to the system, as is thus shown. They will absorb; almost anything, which comes into their way, and in this, they differ from the Lacteals, for they take up nothing save, that which is nutritious, generally.

The Chyle, and Lymph, being poured together, into the thoracic duct, are further elaborated, by the convolutions, of the duct, and its bifurcations, also by the influence, of Spleen, Renal capsule, Thymus, and Thyroid glands, all of which, have been sup-

-posed to elaborate it, fitting it well, for Nutrition.

This admixture enters, at the juncture of sub-clavian, and internal jugular veins, on left side. Thence through vena innominati, to vena cava ascendens, and then in to the right auricle of the heart, while the lymph, from the right side, enters as before stated. The receptaculum-chyli, is situate at inferior of dorsal, and superior portion, of Lumber region. from thence the thoracic duct ascends, on the right side of verte-bræ ^{or aorta}, and empties, as just specified.

The blood of vena cava ascendens, differs considerably, from that of vena cava descendens, (which it meets, in the right auricle,) First because, it has none, of the fresh mixture, of chyle, and acrimonious matter, of lymphatics, from the thoracic, and superior lymphatic ducts. Secondly because the liver, has greatly elaborated, that part which passed the Portal Circulation, by secreting from it the bile; and probably conferring upon it, some new

properties. These two portions, of blood, so different, are mixed, in the right auricle, of the heart and right ventricle, and are thus ready, to enter, into the pulmonic circulation.

Fourthly. Circulation and Nutrition.

The blood having been spent, in a good degree, by its previous systemic round, it is replenished, as stated above, and we find it, in the right auricle, ready, for circulation.

And first, by an intuitive principle, existing in the heart, aided by the stimulating presence, of blood filling the auricle, the fibres contract, and expel the blood, it passing through, the auricular ventricular opening, immediately, the tricuspid valves close, to prevent the regurgitation, of blood, and now, by aid of Columnae carneae, the blood is further mixed, when again contraction, takes place, and it is forced into, the pulmonic opening, and three semilunar valves, close, with corpus aurantia, in their centre, to prevent regurgitation again,

And now by the vis a tergo, of the heart, caused by its
ventricular contraction, the blood is conveyed, to the
Cappillaries, of the Lungs, which are in juxtaposi-
-tion, with the minute air cells, being partially
emptied, by a previous expiration, admit of the
escape, of the surplus of Carbon, into their Cavities,
which is cast off at the next expiration, And by
inspiration, oxygen is received, and it having great
affinity, for the blood, passes these thin cell walls,
into the Cavity, of the Cappillaries, and forms a
Compound, with it, making the Arterialized blood,

Or again, the escape of the Carbon, may be effected,
by elective affinity, in the blood, which has such
fondness for oxygen, that immediately, upon its com-
-ing into its presence, it rejects the Carbon, gotten by
the previous systemic round, and expels it into the
air cells, and takes at once the oxygen, for creating,
and Caloracising itself, and the system generally,

The oxygenization being completed, the blood hastens
to return, to the heart, through the media, of four

Pulmonary veins, carrying arterialized blood, These enter, the left auricle, on opposite parietes, two veins on each side, This auricle being full, it contracts, and the blood passes, the auriculo ventricular opening, The Mitral ^{valve} close at once, to prevent the reflow, into the auricle, The blood is now found, in the left ventricle, the walls of which, is 6 lines thick, ^{and} admits of powerful contraction, which soon takes place, forcing the blood, into the aortic opening, when semilunar valves close, with *cuspa Aurantia*, in the centre, again preventing, the return of blood.

The Sounds of the heart, (1st and 2^d) are said, to be produced, by the synchronous contraction, of the ventricles, for 1st And regurgitation, of blood against, the semilunar valves 2^d. They are similar, to the pronunciation, of the following monosyllables, accenting, the first, with some emphasis, Sub, dub.

The contractions, and their sounds, being done, we find the blood, in the Aorta (2^d at each contraction) abounding with oxygen; and nutriment, in person,

of the protein compounds, This Caloricized, and nutrient fluid, passes through the arteries, with speed, and we might say, bounding with delight, to the distal Minutiae, of the body, to ^{give} the needful warmth, and nourishment.

The arterial Circulation, is carried on, by the vis-artergo, of the heart, and elasticity, and Contractility, of the arteries,

Just after passing, the semilunar valves, the Coronary artery, is given off, for the supply, of nutrition, to the muscles of the heart. And after minute ramification, the blood is returned, by coronary veins, through the valve of Thebesius, to the right auricle. Then on the arch of the aorta, the arteria innominate, is given off, which is $\frac{3}{4}$ to $1\frac{1}{4}$ inches in length, and it divides, into right, subclavian, and Carotid. The subclavian arches up, beneath the clavicle, thence down into the axillary region, giving off, Mammary arteries, &c. Thence it becomes Brachial, and ramifies through the various tissues.

of the arm, and forearm, and hand. Next in course, is given off, the left subclavian, and left primitive Carotid. This subclavian, passes (with some slight variations) as the other, on the opposite side, and gives nutriment, to the left axillary space. arm forearm, and hand,

The Primitive Carotids, pass obliquely, under the Clavicles, and at a point, opposite the superior margin, of the Thyroid Cartilage, They each bifurcate, and these bifurcations, are called external, and internal Carotids. One of these branches, goes to nourish, the soft parts outside, of the Cranium, and facial bones. The other entering through the Carotid foramen, on either side, of the Cereb. Turcica, and ramifies through various parts, of the intercranial substance. In fact, these by aid, of the vertebral artery, (which becomes Basilar, after it enters at foramen Magnum) supply nutriment, to the Brain, and its meninges. Then by means of the external, and internal Jugulars,

veins, and the vertebral vein, the blood is conveyed back again, into the vena cava descendens, receiving the contents, of the thoracic duct, by the way then emptying, into the heart.

The aorta by its curvature, takes a downwards course, on the anterior portion, of the vertebral column, giving off the intercostal, Gastric, Splenic, Renal, Mesenteric, and Spermatic arteries, and probably a few others, which all go, to their respective organs. And their returning veins, go to make up the vena portarum, unless it be, the Spermatic, of this I am now, not certain.

Opposite the Lumbar vertebra, the aorta bifurcates, into Common Iliaes, these then divide, making internal, and external Iliaes, The internal, gives nutriment, to the Gluteal region partly, and around about, the organs of Generation, and mostly supply these organs. The external, passes beneath Poupart's Ligament, and then becomes the femoral artery. About

Two inches below, pampart's ligament, the Profunda
artery is given off, which ramifies through the
femoral Muscular Structure. The femoral pas-
ses beneath the Sartorius Muscle, and through
the fascia of Longus Magnus, into the Popliteal
Space, and it is then, called popliteal artery,
After this it divides, into various branches,
to supply the tissues, of the leg, and foot, and
then passing the Cappillaries, the blood enters, the
venous circulation, The blood now returns to
the heart, through veins, they having valves, and
in this differing ^{from} arteries, which have none, save
at their junction, with the heart,

The venous circulation, is accomplished, ^{by} aid of
valves, and balance of power, received from
the arterial tubes, with a force given, in the
Cappillaries, by absorption of the nutritious partic-
les, for use of the adjacent tissues, And last, but
not least, is the aid, given by Muscular contrac-
tility, as a cause of venous circulation, This

is exemplified by the fact, that much muscular exercise, greatly increases circulation. And familiar illustration, is seen in venesection, when by the Muscles, and tendons a staff is grasped, by the contraction, the blood is made to flow much faster. This is incontestible evidence, of the aid, given to venous circulation, by muscular contractility. By all these means, we find the blood, of Vena Cava's ascendens, and descendens, again in the right auricle, and it, ready to contract, to commence again, the Pulmonic Circulation, as well as the Systemic. There is about three pulmonic rounds, to one systemic.

But a query now justly arises. What has been done, all this round, of Absorption, Sanguification, and Circulation? We ~~find~~ find; that the great vital process, of Nutrition, has taken place, and excrementitious matter, has been eliminated, through Media, of Bowels, Skin, Respiration, and Kidneys, and their appendages. But again the query. How are these processes, of excretion and nutrition, accomplished?

Ans:— The blood in its normal state, is fraught with
Nutriment, in person of the Protein Compounds, of Albu-
men, Casein and Fibrin, &c. Nutriment enters the blood,
to give out its Nutrition, unless perchance, it be in some
cases, of Nutriment to nerves, when it enters them di-
rectly, without entering first, into the Circulation.
This is a mooted point, to my mind,

Now the question:— What is Nutrition? Ans.— It
is the process, by which waste places, of the several
organs, are renewed, and development and growth,
of the body, is maintained. Digestion, Absorption,
Sanguification, Circulation, Secretion, and Respi-
-ration, all, are but links, of the beautifully com-
-plicated Chain, of Nutrition. This, we have antici-
-pated, in the divisions, of our subject.

The Human body, is as a machine, receiving its
Motor power, by food through the blood. And there is a
continual removal of exhausted atoms, by the Lymphat-
-ics, and simultaneously, there is a filling up, of the
vacated space, by deposits from Capillaries.

Every organ in the body, is possessed, of an elective, of-
fivity, by which it imbibes, from the Cappillaries,
that which is suited, to its own composition, and use.

Thus the Muscles select, mostly, from the protein
of fibrine, while $2/3^{\text{rd}}$ or $3/4^{\text{th}}$ of bone, is composed, of
Carbonate, and Phosphate of lime. The remainder is
mostly, a gelatinous substance, And Cartilage, Serous
Cavities, and Synovial Capsule, Mucous Membranes, Dur-
-ose, Teeth, and Nervous Structure, all select, such por-
tions, as suit for their recombination, And here
is Resident, a vital principle, worthy of its Creator!

We know that it is so, but who, who can fathom it,
and tell, of its winding Labyrinth? How is it?

Can a man tell how, while yet, in Utero, Change is
going on, Growth maintains, and decay Comes not?

Or why in veteran age, decay superabounds, and the
once erect, and healthful statue, is now bent in
feebleness, and decrepitude? We know that it is,
because in the first instance, there is more depos-
-ited, by Lacteals, than is taken away, by Lymphatics,

These growth, as by this, new cells are made to spring up, and man, who is composed, of conglomerated Labyrinthian Cells, is thus, by the superabounding deposit, of Nutrition, eventually grown to his full Statue, when the waves of Nutrition, (thus to speak) are stayed! Why are not all men, as small as Tom Thumbs, or as large, as the Sons of Anak? Is God, that governs the Statue, and we can neither, add a cubit thereto, nor make a single hair, white, or black!

Here at, his given Statue, man stands permanently, till by the blasting, of disease, or approach of age, when the Lymphatics prevail, and sooner, or later, he sinks, into the cold vault, of the Grave! Ah! tis God, who is the Beach, against which, the billows, of Nutrition break, and recede through the pained declivities, of time into, the Matrix, of Eternity, - The Tomb! How interesting these thoughts!

While all this we know, - Still -
Naught, we know perfectly!

Why have Crystals, a peculiar shape, or shapes?

Why do trees, grow erect? Why do children, resemble
parents, in color, features, &c? Why is man, who is chang-
ing the particles, of his composition, every hour, still
one year, resembling, and really the same, in fewer,
that he was, the year previous? These all, are such
as that, vital principle, of which, we have been speaking,
and we can answer them, only, by saying, they are laws
of God!

But again, some food, is not capable of chylification,
and is hence, not nutritious, this with the wastes, of the body,
is excrementitious substance, And by means, of the
peristaltic motion of intestines, and eliminatory qual-
ities, of the glands of Peyer, the excrement, of the bowels,
and liver, is thrown off, while the kidney secretes, and
cast off, the uric acid, And from the 8 miles, of per-
spiratory tube, of the skin, perspirable excrement, is
passed out, The sebiferous glands cast out their ame-
tious matter, as a lubricant, and excrement. And
the Carbon generated, by the decaying parts in every organ,
is eliminated, by expiration, How wisely arranged!

How fearfully is man complicated, and yet how depressed! How beautiful once, ~~was~~ man, but alas he has fallen! But worthy is thy name, O Brain, O Lord, for thou didst make him, in thine image! And though fallen, still his Physiology is beautiful!

But again:—How unseemly, is the ill-shapen silkworm, or the caterpillar, whose appearance, is forbidding! but a few hour, or days, of toil, wraps them up, in their silken nest, untill the bitter blasts, of winter are blown, and when the genial, vernal rays, strips the earth, of her white garments, of winter, and clothes her, in embroidery of Spring, then it is, that these, unseemly worms, come forth, the beauty of beauties, and instead, of their former snail-like motion, they now untrammelled, plume their wings, and joyfully fly away, reflecting beautifully the sun's rays, 'yea in dazzling splendor, as they are wafted, on the gentle Summer's Breeze!

And now, by analogy, man, is the worm toiling, for the silken nest, And if in his wormlike

condition, his physiology, be so beautiful, and complicated, how inconceivably glorious, will he be.

Who gains his self a nest, in which to pass, the dreary grave, while long around him, lingers, the chilly winds, of death!

Ah! me, when at the Arch angels bidding, he plumes his wings, and flies from the wintry main, away, to his vernal home! How beautiful then! And when in that world, all radiant with light; emanating, from the Divine throne, and him, that sits thereon; Amid this light, from unfalling flowers of bliss, to bliss flowers un fading, how gladly will he fly! while the rays of light, in their angle of incidence, will fill his soul, with everlasting peace, and in their reflection, give glory to God!

Oh then, how beautiful will be, the physiology of Nutrition, in Sainted Man!

Finis

John, Charles, Mathews.