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Newton C. Perkins

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Dedicated to Thos R Jennings M. D.
Professor of Anatomy in the Medical
Department of the University of Nashville.

The Anatomy & Physiology of the Liver.

From the earliest dawn of medical science to the present time, perhaps no subject has elicited more attention, and none surely called forth more talent, than that of digestion. The mechanism of various organs engaged in the process, and the function performed by each, has been an inexhaustible theme. The Liver second in importance to none of the chylopoietic viscera, except the stomach has afforded a field for investigation and research to the anatomist and physiologist, in pointing out its structure, function and sympathies. It exist in all vertebrated animals; In man it is the largest of the glandular structures, especily during foetal life. On opening the cavity of the abdomen, the grand depot of the chylopoietic organs, the liver is seen to occupy the right hypochondriac region, the upper half

of the epigastric, and a small part of the right portion of the left hypochondriac region. It is semi ovoid in shape; the ovoid being cut in its longitudinal diameter, and the larger extremity turned towards the right. It is about ten or twelve inches in length, by five or six broad, and weighing in the human adult from four to five pounds. The colour is reddish brown, with occasional dark coloured spots on the under surface, or near some of the margins, which are to be considered natural and not the result of any morbid action. This organ is bounded above by the diaphragm, into the concavity of which its upper surface is accurately fitted; below by the stomach and arch of the colon, on the left by the spleen, posteriorly by the vertebra, with the crura of the diaphragm, vena cava ascendens, and aorta intervening, while on the right and in front it is in contact with the parietes of the abdomen. The anterior edge is thin, sharp, and marked by a notch at the commencement of the falciform ligament, and sometimes another small notch is perceptible

at the fundus of the gall bladder, the posterior edge is thick and round, having a large depression for the reception of the spine, and also a small sulcus or canal for the transmission of the vena cava ascendens. The right extremity is very thick, occupying nearly the whole of the right hypochondriac region, while the left is thin and tapering. The surfaces of the liver are two in number, the superior is smooth and convex, the convexity being more projecting on the right posterior part, and is divided into two unequal parts by the falciform ligament running from before backwards. The inferior is very irregular, marked by fissures and small elevations, which have received the names of lobes, viz" Lobulus Spigelii and Lobulus Anonymous or Quartus. Commencing at the notch at the anterior edge, and traversing its whole width, in a line with the falciform ligament, is a deep fissure which has received the name of (Sulcus Umbilicalis) or umbilical fissure, from its giving transmission in the foetus to the umbi-

bical vein; but in the adult the Ligamentum Teres.
The anterior part of this fissure is sometimes formed into a canal by a bridge of hepatic substances extending from one edge to the other, the posterior contains the remains of the Ductus Venosus.
Occupying the middle third of the under surface, and running at right angles with the longitudinal fissure, is the transverse fissure; (Sulcus Transversarius) which commencing in the left lobe, extend considerably farther into the right and contains the sinus of the vena portarum, hepatic artery biliary ducts.
The falciform ligament above and the umbilical fissure beneath; divide the liver into two great lobes, viz the right and left; the right being four or five times as large as the left. Posterior to the transverse fissure, and between the posterior part of the longitudinal fissure, and the canal for the transmission of the vena cava ascendens, is a small elevation, known as the Lobulus Spigelii. It is prismatic in shape, and bifid anteriorly; one portion overhanging the transverse fissure, while the other, running off to the right and attaching itself to the great lobe of the Liver, has

received the name of Lobulus Caudatus. Anterior to the transverse fissure, and bounded on one side by the umbilical fissure, and on the other by the gall bladder, is Lobulus Quartus or Anonymous. It is larger than Lobulus Spigelii, but not so elevated, and its posterior point projecting over the transverse fissure opposite the Lobulus Spigelii. The ligaments of the liver are formed by duplications of the peritoneum, and each consist of two layers. The lateral ligaments are very short; the right lateral serving to attach the posterior part of the right lobe, to the back part of the diaphragm. The left lateral, connects the posterior part of the left lobe, to the back part of the diaphragm. The Suspensory or Falciform ligament commencing at the umbilicus, and running along the Linea Alba, and the middle of the diaphragm is reflected to the liver from the anterior to the posterior edge, containing in its anterior folds, the remains of the umbilical vein, now known as the Ligamentum Teres. The Falciform

ligament seperating posteriorly, so as to be continued into the lateral ligaments, leave a portion of the organ destitute of peritoneal covering; and forms along the edge of this space, the coronary ligament. The liver has two coats, Peritoneal and Cellular. The Peritoneal is external, and gives it a smooth shining surface. The internal or Cellular sending prolongations into the substance of the liver, binds its component parts together; and may be easily seen, at the point where the peritoneal coat is wanting. The Liver occupies a station, among the most vascular glands in the body, having the hepatic artery, vena portarum and hepatic veins ramifying through its substance. The two former conveying to it blood, and the hepatic veins returning it into the general circulation, by emptying into the vena cava ascendens, just before it passes through the diaphragm into the chest. It is also abundantly supplied with lymphatics, nerves and biliary ducts. If a rent be made in the liver, numerous small spherical granules are perceived upon the torn surface, to which the name,

Acini, is given. The Acini are about the size of a millet seed, each forming within itself a perfect gland or little liver, being traversed by the hepatic artery, vena portarum, and serving as a point of commencement, for the hepatic veins and biliary ducts.

According to the microscopic observations of some anatomist, they are composed, of a yellow and brown coloured substance. The vena portarum formed by the union, of the veins of the stomach, spleen, pancreas and intestines, and is about three inches in length, reaching the transverse fissure by passing under the pancreas, and over the duodenum. It then divides into two large branches, which are at right angles with the main trunk, and forms the sinus of the vena portarum, the right, the shortest and largest, radiats through the right lobe, while the left is distributed to the left lobe, Lobulus Spigelii and Lobulus Anonymous. (This vein anastomoses by some of its minute branches, with the hepatic veins and biliary ducts.

while the remainder ramify upon the yellow matter of the Acini.) The Hepatic artery is a branch of the Coliac, intermediate in size to the other two branches, viz. Gastric and Splenic arteries. This artery previous to its arrival at the transvers fissure of the liver, where it divides into three branches, distributing one branch to the right lobe, another to the left lobe and a third to the Lobulus Spigelii, send off the right Gastric, Epiloic and Cystic arteries. It enters the portae, betwixt the vena portarum and biliary ducts, accompanying the former in its minute ramifications, and conveying nutrition to this organ also ramifying by capilary anastomoses around the latter. The biliary pores take their origin in the acini, betwixt the yellow and brown substances; the larger branches uniting form trunks, while several of the smaller converging to one point give rather a pemilous arrangement. The pori biliarii ar said to anastomose freely with the lymphatics, and in this way the icterode appearance of the skin, may be accounted for, when there is an obs-

truction to the regular flow of bile. The Hepatic veins arises from their anastomoses, with the hepatic artery, and vena portarum in the acini, their branches uniting from large venous trunks, which running to the posterior edge of the organ discharg their contents into the vena cava ascendens, just before it paşes throug the diaphragm. These venous trunks are three in number, two bringing the blood from the right lobe, one from the left; some small branches may also be seen at the posterior edge of the liver some of which have their origin in Lobulus Spigelii. The hepatic veins exceed in dimentions, the vessels whith which they anastomose, and are destitute of valves. They may be known, by their converging from the circumferene of the organ to the posterior part, while the hepatic artery and vena portarum diverge from the transverse fissure, to the circumference. (In the transverse fissure, there is a collection of condensed cellular substance, called the capsule of Glisson.) This cellular substance, surrounding the hepatic artery, vena portarum and

biliary ducts in the transvers fissure, enters the liver with them, forming their sheath or envelope, and may be considered a continuation of the cellular coat. In a small depression, on the under surface of the right lobe, anterior to the transverse fissure, and forming the right lateral boundry of the Lobulus Quartus, is situated the Gall Bladder (Cystis Fellea). This receptacle for the bile, is generaly pyriform in shape, though differing more or lefs in almost every subject. The fundus or bulbous extremity of the sack, projects a little below the anterior edge of the liver, while gradualy diminishing in size so as to terminate in a narrow neck, it extends to the transverse fissure and there forms a curve so as to prevent the continual efflux of bile. The longitudinal diameter is not in a direct anterior posterior line, but inclines a little to the right. The Gall Bladder has three coats, viz" Peritoneal, Cellular and Mucous. The Peritoneal being a continuation of the Peritoneal coat of the liver, is incomplete, covering more or lefs of this cyst accord-

ing to the depth or shallowness of the fossa, in which it is placed. The middle coat is formed of condensed cellular substance, in which ramify blood vessels, lymphatics and nerves, serving also to connect the peritoneal coat to the mucous below, and the latter to the substance of the liver above. The third or internal coat is mucous, which after death is of a yellow tinge from extravasation of bile; but during life it is said to be of a light colour. Simular to mucous membranes in other parts of the body, it is thrown into numerous folds; studded with mucous follicles, and having small depressions or pits intervening, which causes it when floated in water to have a honey comb appearance. These increas towards the neck, in which not unfreaquently from seven to twelve are found forming a spiral valve, and permitting a more free ingress than egress to fluids. As before mentioned, the artery of the Gall Bladder is a branch of the hepatic, and the corresponding veins empty into the vena portarum. The Lymphatics joins those of the liver,

and its nerves are derived from the sympathetic. The Biliary ducts having their origin in the acini by minute ramifications, converge and unite so as to form three or four trunks, by the time they arrive at the transverse fissure; these trunks then uniting form a single duct. The Hepatic duct is about a inch and a half long, and uniting at an acute angle with the cystic duct, which is smaller and shorter, they form the Ductus Chaladocus, which is longer than either taken seperately. Ductus Communis Chaladocus is about three inches in length, passes in its course under the head of the Pancreas, where it is joined by the Pancreatic duct, terminating in the duodenum about four inches from the pylorus, by a very oblique valvular passage through the coat of the intestines. The Ductus Communis, Hepatic and Cystic ducts each have two coats; an external fibrous and an internal or mucous; the latter being thrown into folds, near the extremities both of the Cystic ducts and ductus Communis. According to some anatom-

ists who have made researches into the distribution of the vessels in the liver, and the structure of the lobules, the interior of the organ is hollowed into two distinct canals or channels, one for conveying the vena portarum and its branches, hepatic artery and biliary ducts; the other for the hepatic veins. The vena portarum, hepatic artery and biliary ducts, ramify so as to send a branch through each and every one of these channels; while the capsule of Glisson sending off prolongations so as to form sheaths for the larger branches, at length spreads out in a fine web, on which the small vessels ramify and passing through the interlobular fissures, forms capsules for the lobes; and finally entering their interior is lost with the vessels on the biliary ducts. The Hepatic ducts traversing the canals, and passing through the interlobular fissures; from plexuses on the anterior of the lobules, which secrete bile. The vena portarum and hepatic artery also enter the lobules, the former forming plexuses which communicate with the

incipient branches of the hepatic veins; while the latter, being few in number and serving the purpose of nourishing the lobules, proberly terminate on the portal plexuses. The hepatic veins are lodged in their appropriate channels, having their origin in the lobules, so that if one of the veins be opened its ramifications will be seen to emerge from the interior of the lobules, while those of the vena portarum pass out at the interlobular fissure. From this view of the distribution of the vessels, we conclud that the lobules consist of a plexus formed by the minute branches of the biliary ducts, and to this is attached by cellular substance derived from the capsule of Glisson, a plexus formed by the portal vein, the vessels of which may be distinguished by their converging from the circumference of the lobule to the center and terminating in the hepatic veins. That injections thrown into the hepatic vein cannot pass into the biliary duct, neither from the portal vein or hepatic artery,

without rupturing their liining membrane. The blood carried to the lobules by the hepatic artery is taken up by small veins and conveyed into the portal vein.

Having completed the general and minute anatomy of this voluminous organ, the next subject of attention is its Physiological action. In this as in every other subject of the same nature, we find speculation, reared upon the foundation of mans imagination. That it is the province of the liver to secrete a peculiar fluid, denominated bile, we believe none pretend to deny; but being supplied both with arterial and venous blood, the source of the bile has been the subject of discussion, as well as difference of opinion. Those who advocate the doctrin, that the bile is derived from the arterial blood, mention experiments in which the hepatic artery has been tied and a cessation of secretion was the consequence. The difficulty is not the impossibility of performing such

an operation, throws a veil of doubt around its truth, but even granting it to be so, the argument is counterpoised by the fact, that whenever the nutrition of an organ ceases, that organ is no longer in a healthy condition, and consequently is either totally unable to accomplish its accustomed task or performs it very imperfectly. Again it is urged by the same party, that all of the secretions are from arterial blood. For reply to this, it is only necessary to refer to comparitive anatomy where we find in some of the reptiles urin secreted from venous blood. The analogy existing betwen the distribution of blood in the Liver and Lungs, and the secretion in the latter of carbon from venous blood, is also urged to show that secretion may take place from venous blood and also that bile which contains a large amount of carbon is derivd from the portal circulation. The bile secreted from the portal blood by the extreme ramifications

of the biliary ducts, and conveyed by the hepatic and choledoch ducts into the duodenum, doubtless destined for some useful purpose in the animal economy, but its office not unlike that of its source, has been a field of controversy among physiologists; one part making it the ground agent of chylification, while the other regard it as nearly excrementitious. Let us examin the basis upon which is fabricated the latter conclusion. In the commencement of this theory, we find its supporter assuming the existence of a class of vessels to which the name, venous absorbo-ephalents is given, whose office it is to take up and convey into the venous circulation, that portion of animal matter no longer capable of nourishing the system, from which it is eliminated by the liver, lungs, and cutaneous surface. It is said in support of the above, that it is not reasonable to suppose that nature, whose chief aim is to conduct a perfect union in all her actions, and

preserve untainted the animal economy, would discharge this deliterious agent into the thoracic duct, the grand reservoir of nutrition, from whence it must pass the whole round of the circulation; but that she could convey it directly to some depuratory organ, by which it is thrown off, before any injurious impression is made upon the system. Taking it for granted that this system of vessels actualy exist, and that the innutritious material is conveyed to the liver where it undergoes a change necessary for elimination, it is offered as a strong argument, to prove the excrementitious nature of the bile, that in experiments performed upon animals for the purpose of examining the different stages of digestion, this fluid was never discovered to be mixed with the chym, but was always found to occupy its external surface, thus forming as it were its sheath envelope.

The great comparitive size of the liver, and the accumulation of meconium in the intestines during foetal existance, is thought to be relevant to this theory. This

speculation, might well have suited the dark ages of antiquity, when religious scruples founded upon superstition prescribed the limits of investigation. but since the light of modern sienc has overcome this barrier, and human disection no longer prevented, the workmanship of fancy like the airy vision of the novelist, must sink into perfect insignificance before the touch-stone of truth. Go and ask the indifatigable anatomist of the present day, as he patiently follows the meanderings of a minute injection by the dim flickering of midnight lamps, or wheather amidst the refulgent light of mid-day sun, he, has been able to discover and point out that class of vessels, the existence of which has been already assumed. Eager for the advancement of knowledge, and unframed by any previous notions to which dessection are mad to bend, he either asserts the fallacy of their existence, or boldly denies their having

been revealed by the researches of man.
This assertion of itself is sufficient to sap the foundation of this fair fabric, could no other proof be adduced. When however we come to test the argument, in which the body is said to carry on her purpose in the best manner to promote the purity of her mechanism and action, it is found to be its own condemner. For if such be natures motive, and this fluid be detrimental, would she not have refused it admission into the thoracic duct? and have made a deposit in the duodenum, the very fountain from which the nutrient stream flows? Would she not, if it be material which it is desirable should be gotten rid of as speedily as possible, have formed a distinct exit, as in the case of the urin, or at least have extended the Ductus Choledocus and caused its orifice to open in the jejunum, from whence it would have been expelled more rapidly, and not have placed it in that portion

of the alimentary tube the peristaltic action of which is very tardy? Such would undoubtedly be the dictates of reason. But again, the bile is found on the external surface of the chyme and not blended intimately with it? If such be the case, which however is denied by some Physiologist, we have only to advert to the stomach for a simile. None pretend to say, (at least those that I have examined) that the whole mass of food is penetrated and dissolved by the gastric juice at the same time, but rather that the external layer or that in contact with the internal surface of the organ, is first dissolved and carried by the contractions of the mucous coat, towards the pylorus, thus allowing another portion to occupy its situation. Such in all probability, is the manner in which the bile is distributed through the chymous mass. In the third and last place, the meconium found in the intestines of the foetus is said to be an excrementitious fluid. This is in all probability correct,

but what aid is to be derived from this source, since it is avowed by good authority that though bile is frequently mingled with the meconium, yet there are instances mentioned in which the latter fluid was found without the presence of the former, undoubtedly proving the distinctness of the two fluids. Although the finite mind of man is unable to unravel the mysteries of nature, and point out the office allotted to the bile during foetal life; we are by no means justified in saying that it is merely excrementitious. If this be its nature, why should we not expect to find a cessation of this secretion as soon as the foetus becomes an isolated being, as well as that of meconium. The changes wrought in the system at the moment of birth, will not certainly account for this fact; for it must be evident, that the quantity of effete matter in the adult is greater than that of the foetus, and consequently the former would stand in greater need of its purifying effect than

the latter. If then what has been said be true, it is justifiable to assign the bile a laudible stand among the class of fluids, entrusted with the preparation of nutrition which the system requires.

Although it must be acknowledged, as is evident from the different views taken, that we are ignorant of the precise manner of its action, yet that which seems to be most reasonable is a chemical process. The food when taken into the stomach, undergoes the process of chymification by being dissolved in gastric liquor; passes into the duodenum imbued with acid properties and then meeting with the bile, it is neutralised by the alkalies of the latter; The bile is divided into two portions, one of which uniting with the chyme prepares it for being absorbed by the lacteals, while the other is excrementitious and stimulates the coats of the intestines to contract. This is evident from their extraordinary torpor in jaundice, where the bile instead of entering the intestines is diffused through the system.