

though none of the decayed teeth had been extracted. There are in the narrative of the case considerable omissions. We have no account of the patient's habits, nor of the state of his constitution; and certainly, when credit is claimed for a new plan of treatment, it is not too much to expect that every thing connected with the case should be fully and fairly stated. *Thirdly*, how many instances do we know in which the teeth are wedged against each other, and speedily decay without giving rise to the effects here attributed to them?

The next two cases in the book were treated in the usual way; and though in both the author attributes the patients' complaints to the state of their teeth, there is nothing in them which may not be accounted for on ordinary principles. But why should we pursue the subject further? We have already placed before the reader more than sufficient to enable him to judge of the tenor of the book. We trust that the next time we have occasion to notice a book of Dr Ashburner, we may find his experience applied to the support of some more tenable doctrine than he has now laid before us, and that he will hereafter avoid periling his professional fame by adopting an opinion, which, however ingenious, will not stand the test of examination.

ART. VII.—*The Anatomy and Physiology of the Liver.* By FRANCIS KIERNAN, Esq. Member of the Royal College of Surgeons, late Teacher of Anatomy. 4to. London, 1834. (Philosophical Transactions of the Royal Society of London for the year 1833, Part ii.)

It is proposed in this article, without prefatory remark or comment of our own, to lay before the reader an abstract of some of the most interesting portions of the essay before us, which was thought worthy of appearing in the Transactions of the Royal Society of London.

The paper embraces a description, *1st*, of the Lobules of the Liver, the manner of their arrangement, their connections with each other, and with the vessels; *2dly*, of the Surfaces of the Liver, and the distribution of the vessels; and *3dly*, of the Structure of the Lobules.

1st, Of the Lobules.—The hepatic veins and lobules, Mr Kiernan compares to the trunk, branches, and leaves of a tree. The lobules may be compared to the leaves, their substance being arranged round the minute branches of the veins like the parenchyma of a leaf round its fibres. The minute vessels terminate in others resembling the branches of a tree, and these by their union with each other form the trunks. The hepatic veins may be divided into two classes, *1st*, the intralobular

branches, one of which occupies the centre of each lobule, and receives the blood from a plexus formed in the lobule by the portal vein; and 2d, all the veins contained in canals found by the lobules, among which may be reckoned numerous small branches, as well as the large trunks terminating in the inferior cava. These all resemble each other in being contained in canals, and differ from the first class in not being contained in the lobules. As the intralobular veins terminate in some, and not in others, of the second class, these vessels may be divided into two sets,—those in which the intralobular branches terminate, and those in which no intralobular branches terminate. The lobules are arranged round the veins composing the first set, the bases of these bodies resting upon them. The branches of the second set are formed upon the first.

“ Each intralobular vein is composed of a central vessel, and from four to six or eight smaller vessels, which terminate in the central vessel. The intralobular veins invariably correspond in form with the lobules, the substance of which is arranged round them; and, as these vessels resemble in some degree the fibres of a leaf, so sections of the lobules made in the direction of the vessels, assume a more or less foliated appearance. The lobules are not, however, flattened bodies like leaves; for, as the smaller veins enter the central vein in every direction, so small processes project in every direction from the lobules, the number of processes being equal to the number of veins terminating in the central veins.”

Mr Kiernan describes at greater length the lobules, the minute arrangement of the intralobular veins, and the difference between the superficial and the internal lobules. By superficial lobules, he means “ not those only which form the convex and concave surfaces, but those also, the capsular surfaces of which form the canals containing certain branches of the hepatic duct, portal vein, and hepatic artery, and the canals containing the trunks of the hepatic veins, all these canals being tubular inflections inwards of the superficies of the liver.” This portion of the essay is concluded with some observations on Mascagni and Muller’s description of the lobules, for which we cannot afford space.

2dly, *Of the Surfaces of the Liver.*—The surfaces of the liver he examines under three heads,—1st, the external surface; 2dly, the portal surfaces or canals at which the vessels enter the organ; and 3dly, the hepatic venous surfaces. The first of these we shall pass over, as, though ably described, it is less interesting than the others.

Of the Portal Canals.—“ These canals commence at the transverse fissure, where they are continuous with the concave surface of the liver. They contain the hepatic duct, the portal veins, the hepatic arteries, and the vaginal branches of all these vessels, with

the nerves and absorbents enveloped in a sheath of cellular tissue, first described by Glisson, and called Glisson's capsule." The opinions of various authors regarding the structure and use of this capsule are briefly stated and discussed, and the conclusion drawn, that it "is not mere cellular tissue; it is to the liver what the *pia mater* is to the brain; it is a cellulo-vascular membrane in which the vessels divide and subdivide to an extreme degree of minuteness; which lines the portal canals, forming sheaths for the larger vessels contained within, and a web in which the smaller vessels ramify; which enters the interlobular fissures, and, with the vessels, forms the capsules of the lobules; which finally enters the lobules, and, with the blood-vessels, expands itself over the secreting biliary duct. Hence arises a natural division of the capsule into three portions,—a vaginal, an interlobular, and a lobular portion; and as the vessels ramify in the capsule, their branches admit of a similar division.

"At the transverse fissure the duct, vein, and artery divide into branches, which enter the portal canals. These branches divide and subdivide into smaller branches, which enter smaller canals, and every canal, however small, contains one principal branch of each of these vessels; frequently, however, two ducts and two arteries are contained in the same canal. To these larger vessels the terms of hepatic ducts, portal veins, and hepatic arteries may be confined, in order to distinguish them from the branches.

"The excreting ducts are composed of the hepatic ducts contained in the canals, of their vaginal branches also contained in the canals, and of the interlobular branches which, arising from the vaginal branches, ramify in the interlobular fissures. The interlobular ducts enter the lobules, in which they form plexuses. These plexuses may be called the lobular biliary, or secreting biliary plexuses, the ducts composing them being the secreting organs of the bile. The excreting ducts and their branches are invariably accompanied by the arteries and portal veins and their branches,—the former conveying blood to their coats, the latter conveying it from them; a duct is never unaccompanied by an artery and vein, the vein being always a branch of the portal vein. The veins and arteries also enter the lobules. The veins form plexuses, the branches of which terminate in the intralobular hepatic veins; from the blood circulating through the plexuses the bile is secreted. The lobular arteries are exceedingly minute, and few in number; they are the nutrient vessels of the lobules, and probably terminate in the plexuses formed by the portal vein. From the ducts, veins, and arteries, therefore, three sets of branches arise,—namely, the vaginal, the interlobular, and the lobular branches."

Of the Vaginal Portion of Glisson's Capsule and its Vessels.

—A branch of each vessel contained in a portal canal issues from the canal on the surface of each of the interlobular spaces, which are numerous and close together. The hepatic duct and artery are in opposition, with a very limited number of spaces,

but are connected with all the spaces by means of plexuses from which the interlobular branches arise. In like manner a plexus is formed by the portal vein. "The branches forming these plexuses are the first which arise from the duct, artery, and vein. They form a vascular sheath around these vessels, and may be called their vaginal branches. They ramify in a loose and fine cellular tissue, which with them constitutes the vaginal portion of Glisson's capsule." Mr Kiernan describes with great minuteness the disposition of the vaginal portion of Glisson's capsule, and concludes, that the capsule is a cellulo-vascular membrane, composed of the vaginal branches of the duct, vein, and artery, ramifying in a layer of cellular tissue. With the same minuteness he describes the distribution of the vaginal branches of the ducts. The following is his description of the ducts themselves:—"The coats of the ducts are highly vascular: the rugæ on their internal surface, and those on the internal surface of the gall-bladder, are formed by the ramifications of the larger blood-vessels, arteries, as well as veins, covered by the mucous membrane. This membrane is studded with vascular papillæ, which become remarkably developed in the diseased ducts so frequently found in sheep and oxen. The smaller ducts are furnished with papillæ only; and to the rupture of the delicate vessels forming these papillæ, is to be attributed the facility with which Soemmering and other anatomists injected the ducts from the arteries and veins, and not to any direct communication between the vessels and the ducts.

* * * The coats of the ducts may be as highly injected from the portal veins as from the hepatic artery; but they cannot be injected from the hepatic veins if the injection is confined to these vessels, and does not return by the portal veins. * * * The ducts cannot be injected in a direct manner from the hepatic vein, no branches of this vein ramifying on their coats. Fluid may, indeed, be made to pass from this vein into the ducts, but only through the medium of those branches of the portal vein which ramify on the coats of the ducts. The ducts are injected from the portal vein and from the hepatic artery in the same manner as the foetal intestine is frequently filled with injection from the umbilical vein or aorta, viz. by the rupture of the minute vessels of the mucous membrane. Hence it is evident, that the ducts, so far as they have been yet traced, are abundantly supplied with arterial blood; that this blood returns into the branches of the portal, and not into those of the hepatic veins; and that the hepatic portal vein has branches of origin in the coats of the excreting ducts from the terminations of the hepatic artery, as the abdominal portal vein arises in the coats of the intestines, in the spleen and pancreas, from the arteries of these organs.

"From their extreme vascularity alone, we might infer, that the ducts serve another purpose besides that of the conveying of the bile. All anatomists are acquainted with the muciparous follicles of the lining membrane of their larger branches. In the smaller

branches, the existence of the follicles has been denied. In the former they are irregularly distributed over the surface,—in the latter they are closely arranged in two longitudinal lines occupying opposite sides of the ducts; and, arranged in this manner, they will be found in the smallest duct that can be examined. * * * Their number renders it probable that the fluid furnished by them serves another purpose besides that of lubricating the surfaces of the ducts. Some estimate of the quantity of this fluid may be formed by examining the ducts after having injected them with alcohol. These follicles are probably the secreting organs of all the mucus found in the bile.”

Mr Kiernan proceeds to point out the distribution of the vaginal arteries and veins. The arteries accompany the ducts; they are more or less tortuous in their course, and anastomose freely with each other. Their ramifications do not correspond exactly to the fissures. The left artery communicates with the right by vaginal branches given off by the former in the fissure, and anastomosing with similar branches of the latter.

“The vaginal branches of the vein anastomose with each other,” forming a much more complicated plexus in the human liver than in that of most animals.

The nerves and deep-seated absorbents ramify in the portal canals. Mr Kiernan has not been able to trace them into the interlobular fissures. “The absorbents may always be injected from the duct, and the bile is frequently propelled into the former vessels by injecting the latter.” Mr Kiernan has frequently found, like Mascagni, that an injection thrown into the ducts returns colourless by the absorbents; but he has as frequently seen the injections in the absorbents of the same colour as that thrown into the duct, and has frequently filled all the absorbents of the right edge of the lesser omentum with red size from the duct. In the only instance in which the trial was made, the thoracic duct was injected with mercury from the hepatic duct. After mentioning that Panezza has refuted Lippi’s opinion, that there is an infinite number of communications between veins and lymphatics in other parts of the body besides the thoracic duct and right subclavian vein, Mr Kiernan observes, that no absorbents accompany the hepatic veins, and that it is not probable that any of the absorbents of the liver terminate in the branches of the portal veins, the fluids in these two systems of vessels proceeding in different directions. The superficial absorbents ramify in the proper capsule. Injections sometimes pass from the arteries and portal veins into the absorbents.

Of the interlobular portion of Glisson’s Capsule, and of its Vessels.
—“As the interlobular ducts, veins, and arteries arise from the vaginal ducts, veins, and arteries, so the interlobular cellular tissue

is continuous with the vaginal cellular tissue, the vessels, and cellular tissue, together constituting the interlobular portion of Glisson's capsule, which occupies the fissures, and forms the capsules of the lobes. The interlobular vessels, at their origin from the vaginal vessels, enter the spaces: in the spaces, therefore, we find the largest branches; these divide into smaller branches, which ramify in the fissures."

An injection of size or mercury will pass from the left hepatic duct to the right without extravasation and without passing into other vessels, and will be found in the interlobular and vaginal ducts, as well as in the trunks. This communication does not take place through the medium of the vaginal branches of the transverse fissure, "the injection being found in interlobular branches arising from the right duct." From this it appears that the right and left duct anastomose with each other through the medium of the interlobular ducts.

"The interlobular branches of the portal vein cover with their ramifications the whole external surfaces of the lobules, with the exception of the bases of these bodies, and of those extremities of the superficial lobules which appear on the surfaces of the liver." The freest communication takes place between these vessels through the medium of the interlobular branches; "for though the vaginal branches in the same canal anastomose freely with each other, yet those of one canal communicate with those of another through the medium of the intervening lobular branches alone. The interlobular veins also form communications between the lobular veins of a lobule and those of the contiguous lobules. Hence it appears, contrary to the assertions of Bichat and Mappes, that the freest anastomoses exist between all the branches of the portal vein, and that the interlobular branches form the medium of communication."

Though no anastomosis can be shown to exist between the interlobular arteries, yet Mr Kiernan concludes, from the vaginal arteries communicating freely with each other, from the ducts also communicating with each other, and from the arteries ramifying in the coats of the ducts, that the interlobular arteries anastomose.

The capsular arteries, which are small and most numerous in those subjects in which the capsule is most developed, emerge from the superficial lobular fissures, and ramify in the proper capsule, in the convex and concave surfaces of the liver and the ligaments. Where these arteries are numerous, they cover the surfaces of the liver with a beautiful plexus. Those of the right lobe anastomose with those of the left, "and both anastomose with branches of the phrenic internal mammary and suprarenal arteries; some, leaving the liver, ramify under the peritoneum, covering the right kidney; others pass along the

ligamentum teres to the umbilicus, and anastomose with the epigastric arteries." The capsular veins are branches of the portal vein; these vessels communicate freely with branches of the phrenic veins. In some cases of atrophy of the liver, and in cases in which the circulation through the liver has been for some time obstructed, a collateral circulation is established by means of the communications which take place between the capsular branches of the hepatic artery and portal vein, and those of the phrenic artery and vein. "All the *vasa vasorum* of the liver are branches of the hepatic artery and portal vein * * * All the veins arising in the coats of the vessels, and terminating in the portal vein, constitute the hepatic origin of this vein. The trunks of the duct, vein, and artery in each canal terminate in interlobular branches. Vaginal vessels giving off interlobular vessels, ramify in the transverse fissure, in the fissure of the gall-bladder, and in that containing the obliterated umbilical vein and *ductus venosus*; these fissures, therefore, must be considered as portions of portal canals."

Of the Hepatic Veins, and of the Hepatic-Venous Canals.—The hepatic veins, contained in what the author calls the hepatic-venous canals, commence in the interior of the liver, and terminate at the fissure of the inferior cava. "Those containing the hepatic trunks are formed by the capsular surfaces of a limited number of lobules; those containing the sublobular hepatic veins are formed by the bases of all the lobules."

Mr Kiernan proceeds to show that the hepatic veins have no branches corresponding to the vaginal branches of the duct, portal vein, and artery, and that, as Glisson's capsule is composed of vaginal vessels, ramifying in cellular tissue, nothing similar is to be found around the hepatic veins which have no vaginal branches.

On the internal surface of the sublobular veins, numerous minute orifices are found, which are the mouths of the intra-lobular veins, all of which terminate immediately in these vessels. Each orifice corresponds to the base of a lobule, consequently the number of orifices is equal to the number of lobules forming the parietes of the canal in which the vein is contained. The base of every lobule is in contact with a sublobular vein, and the hepatic venous canals are formed by the bases of all the lobules of the liver. The parietes of the portal canals are also composed of lobules, but only of their capsular surfaces, and all the lobules do not enter into their formation. It is thus evident that the hepatic venous canals are more numerous than the latter.

The differences between the sublobular hepatic veins and the hepatic trunks are minutely described, and the formation of the

hepatic venous canals thus explained. "The smallest of the canals and greater number of them are formed by the bases alone of lobules; the next in dimensions are formed by the capsular surfaces alone of these bodies. As the base of every lobule rests on a sublobular hepatic vein, it is evident that those lobules, the capsular surfaces of which enter into the formation of canals, are in contact with two hepatic veins." From reasoning and experiment, the author comes to the conclusion, that the sublobular veins anastomose with each other, and that their intralobular branches do not. As a conclusion to this section, we extract Mr Kiernan's comparison between the hepatic vein and the portal vein.

"By contrasting the hepatic veins with the portal vein, we find that no two intralobular branches of the former anastomose with each other; that the interlobular branches of the latter form one continuous plexus throughout the whole liver; that the sublobular veins anastomose directly, and not through the medium of the intralobular branches: that the portal veins have no direct communication with each other, but anastomose by means of their interlobular branches; that the hepatic veins, like the other veins of the body, proceed in a direct course to their termination in the cava; that the portal vein, accompanied by an artery, resembles an artery in its ramifications; that the larger hepatic veins having longitudinal fibres in their coats, differ in structure from the portal vein, and that the blood contained in the liver after death is almost invariably found in the hepatic veins, the portal vein being usually empty."

From longitudinal fibres, similar to those found in the coat of the iliacs, inferior cava, and some superficial veins, being met with in the coat of the larger hepatic veins, which are so firmly connected to the substance of the liver as to admit of no motion, the author concludes that these fibres cannot be muscular.

Of the Structure of the Lobules.—"The lobules constitute the secreting portion of the liver. Examined with the microscope, a lobule is apparently composed of numerous minute bodies of a yellowish colour, (imparted to them by the bile they contain,) and of various forms, connected with each other by vessels. These minute bodies are the *acini* of Malpighi."

After briefly stating the opinions of Malpighi, Ruysch, Boerhaave, Ferrein, Mascagni, and Muller, and criticising a passage in Dr Hope's work on Morbid Anatomy, Mr Kiernan thus describes the constituents of a lobule. "Each lobule is composed of a plexus of biliary ducts, of a venous plexus formed by branches of the portal vein, of a branch of an hepatic vein, and of minute arteries; nerves and absorbents, it is to be presumed, also enter into the formation, but cannot be traced into them."

“The hepatic ducts, commonly so called, and their vaginal and interlobular branches, constitute the excreting portion of the biliary apparatus; they are also organs of mucous secretion, being furnished with mucous follicles; the secreting portion of the liver is also composed of ducts which form a plexus in each lobule. These plexuses may be called the lobular biliary, or secreting biliary plexuses.” Mr Kiernan attributes the difficulty of injecting the ducts to their extreme minuteness, to their being filled with bile, and to the bile contained in the excreting ducts being propelled by the injection into the secreting ducts, from which it has no exit. He has succeeded, however, in injecting these ducts, by first tying the portal vein and hepatic artery, in a living animal a few hours after feeding it. The animal survives several hours, during which time the ducts will discharge the bile which they contain. After preparing a liver in this way, Mr Kiernan has succeeded in partially injecting the lobules from the hepatic duct. He has done the same, but with less success, in the human body. “Examined by the microscope, the injected interlobular ducts are seen dividing into branches, which, entering the lobules, divide and subdivide into minute ducts,” which anastomose with each other, and form a reticulated plexus. When an uninjected is contrasted with an injected lobule, it will be found that the *acini* of Malpighi of the former are identical with the injected lobular biliary plexus in the latter. The blood-vessels are easily distinguished from the ducts. The ducts forming the plexus appear by the microscope like cells; an appearance which probably induced Mascagni to consider the liver as an assemblage of minute cavities giving origin to the ducts. “The form of the lobules bears no relation to the arrangement of the ducts, the form of each lobule being always correspondent to the branches of the intralobular hepatic vein occupying the centre of the lobule. The coats of the lobular ducts, on which the blood-vessels next to be described ramify, constitute the proper secreting substance of the liver, as the coats of the central ducts of the kidney, and those of the *tubuli seminiferi*, constitute the secreting substance of their respective organs.”

The left lateral ligament Mr Kiernan considers to be a rudimentary liver in which the organ is presented in its simplest form. “From the edge of the liver connected to the ligament, numerous ducts emerge, which ramify between the two layers of peritoneum of which the ligament is composed. These ducts were discovered by Ferrein, but this anatomist did not ascertain their termination. * * * These ducts, the smallest of which are very tortuous in their course, divide, subdivide, and anastomose with each other.” They are sometimes very numerous, in which cases two or three of them are of considerable size. “They sometimes extend only half way up the ligament, where they divide into branches,

which, forming arches, return and descend towards the liver, anastomosing, or being continuous, with other ducts issuing from it. The spaces between the layer, or excreting ducts, are occupied by plexuses of minute or secreting ducts."

Mr Kiernan has not succeeded in injecting the ducts on the inferior surface of the diaphragm to their termination, but he supposes that, like those just described, "they form arches, the branches returning towards the ligament and being continuous, with others ascending from it. Branches of the portal and hepatic veins, with arteries and absorbents also, ramify in the ligament, which, including between its layers a plexus of secreting and excreting ducts, with blood-vessels ramifying within parietes, admirably displays the structure of the liver."

After alluding to other ducts, the author gives it as his opinion, that, as no branches of hepatic veins ramify in the coats of the gall-bladder, the absence of these vessels sufficiently proves the non-existence of ducts. "The cystic veins are branches of the abdominal portal, and not of the hepatic portal or umbilical vein; they are therefore efferent, and not afferent vessels, conveying blood from, and not to, the gall-bladder. It necessarily follows that biliary ducts ramifying on the parietes of this receptacle would receive the materials of this secretion from arterial blood—that of the cystic arteries." But Mr Kiernan affirms that if in any case ducts should be found in the gall-bladder, branches of both the portal and hepatic veins will be found also. The portal ducts however, "in such a case, will be branches of the hepatic portal vein, will convey blood from the coats of the excreting ducts, and to the coats of the secreting ducts, and not from the gall-bladder.

"Branches of the hepatic artery and portal vein accompany the *ligamentum teres*. These veins convey blood to the hepatic portal vein, and must therefore be considered as separate branches of the abdominal portal system."

Of the Lobular Venous Plexuses.—The interlobular branches of the portal vein divide into branches which enter and form a plexus in each of the lobules. This plexus constitutes the venous part of the lobule, and may be called the lobular venous plexus. Its branches terminate in the intralobular hepatic, situated in the centre of the lobule. By the aid of a powerful microscope, the vessels constituting the plexus are seen converging from their origin at the circumference towards their termination in the centre of the lobule, and communicating with each other by smaller transverse branches, between which are minute spaces occupied by portions of the lobular biliary plexus. "The venous plexus of one lobule communicates with the plexuses of the surrounding lobules, by means of the intervening lobular branches of the *vena portæ*, this vein forming one

continuous plexus through the whole liver." The converging branches of each plexus unite at the centre of each lobule to form an intralobular hepatic vein, which has no communication with the corresponding veins of the contiguous lobules, except through the medium of the intervening plexus and portal veins. "No branches of the hepatic veins are found in any other part of the liver, occupying the centre alone of each lobule. Their only office is to convey the blood from the lobular venous plexuses, and not from the arteries."

"The venous plexus ramifies on the biliary plexus; the blood circulating through it is composed of the portal blood, and certainly if that portion of the arterial blood, which having nourished the excreting ducts, and supplied them with mucus, and having circulated with the *vasa vasorum* of all the vessels becomes venous and is received into the branches of the portal vein, by which, with the portal blood, it is conveyed to the plexus, and from this mixed blood, the bile is secreted."

Of the Lobular Arteries.—The lobules are sparingly supplied with arterial blood. From several experiments, Mr Kiernan concludes, that the secreting part of the liver is supplied with arterial blood for nutrition only. As all the branches of the artery, of which the termination can be ascertained, end in branches of the portal vein, "it is probable that the lobular arteries terminate in the lobular venous plexuses formed by that vein, and not in the intralobular branches of the hepatic veins, which cannot be injected from the artery, the blood of these arteries, after having nourished the lobules, becoming venous, and thus contributing to the secretion of the bile."

Of the red and yellow substances of Ferrein, and of the appearances produced in the liver by congestion.—Of these subjects Mr Kiernan states his opinion in these words. "The structure of all lobules is similar, and each lobule of the same structure throughout; one part of a lobule is not more vascular than another. There is, therefore, no distinction of red and yellow substance in the liver; the red colour results from congestion only." It would be impossible, with any justice to Mr Kiernan, to abridge that portion of his paper on which these views are defended. The opinions of different authors regarding the alleged existence of the red and yellow substance of the liver are briefly examined, and the sources of these errors pointed out.

We regret that we must pass over his able remarks on congestion of the liver. We can make room only for his conclusions, and for his remarks on Mr Abernethy's celebrated case.

"The physiological deductions arising out of the preceding anatomical facts are extremely simple. If it could be shown that two substances exist in the liver, it might be fairly presumed that this

organ executes two functions; but each lobule being, in itself, a perfect gland, and of the same structure throughout each lobule, and consequently the whole liver executes but one function, the secretion of bile."

"It has been shown that all the *vasa vasorum* of the liver are branches of the hepatic artery and portal vein; that branches of the portal vein arise in the coats of the hepatic veins themselves; and that the veins of the coats of the vessels constitute the hepatic origin of the portal vein. The arterial blood having circulated through the coats of the vessels becomes venous, and is conveyed by the veins arising in the coats of those vessels into those branches of the portal vein which correspond to the vessels in the coats of which the veins arise; thus, from the coats of the vaginal ducts, veins, and arteries, they convey the blood into the vaginal veins; and from the coats of the interlobular ducts, veins, and arteries, into the interlobular veins. From the coats of hepatic veins and inferior cava, the blood is conveyed into the interlobular portal veins. In the vaginal and interlobular veins the blood conveyed from the coats of the vessels becomes mingled with the proper portal blood. This mixed blood is conveyed by the interlobular veins into the lobular venous plexus, in which the lobular arteries probably terminate, after having nourished the secreting ducts. From the mixed blood circulating through the plexus, the bile is secreted by the lobular or secreting biliary plexuses.

"The blood which enters the liver by the hepatic artery fulfils three functions; it nourishes the liver, it supplies the excreting ducts with mucus, and, having performed these purposes, it becomes venous, enters the branches of the portal vein, and contributes to the secretion of the bile. The portal vein fulfils two functions; it conveys the blood from the artery, and the mixed blood to the coats of the excreting ducts. It has been called the *vena arteriosa*, because it ramifies like an artery, and conveys blood for secretion; but it is an arterial vein in another sense, being a vein to the hepatic artery, and an artery to the hepatic vein. The hepatic veins convey the blood from the lobular venous plexuses into the *vena cava inferior*."

The following is Mr Kiernan's account of the appearances of the liver of the child mentioned by Mr Abernethy. After alluding to Mr Green's and Sir C. Bell's opinions, he thus proceeds.

"I examined the liver of this child, which had not been examined by Mr Abernethy, in the presence of Mr Stanley, Mr Mayo, and several other gentlemen, in the museum of St Bartholomew's hospital. Mr Abernethy had injected the arteries with red, and the hepatic veins with yellow, size. As had been happily conjectured by Mr Green and Sir Charles Bell, we found the open and uninjected ramifications of the umbilical vein (the hepatic portal vein) accompanying as usual the branches of the hepatic artery and duct. By making sections of portal canals, we found the arteries, as Mr Abernethy had described them, much larger than usual. In

ordinary cases, one principal artery is found in each canal; in this case two, and in some places three, arteries of equal calibre were found in each canal. The branches of the umbilical or portal vein, which are usually so much larger than those of the artery, were found on the surfaces of sections of the liver, to be, as nearly as we could judge, equal in calibre to the united dimensions of the two or three arteries which accompanied each branch of the vein. * * * * * Bichat's opinion * * is completely refuted by the dissection of the liver in this case. The branches of the duct were much smaller than those of the artery; in one canal, in which there were three arteries of equal dimensions, the duct was of about half the size of one artery. This case, therefore, does not establish an analogy between the biliary organs of the vertebrated and invertebrated animals; but, on the contrary, it shows that the class of monstrosities to which it belongs forms a much slighter deviation from the ordinary vertebrated type than was imagined. Nor does it militate against the conclusions maintained in that paper upon the physiology of the liver, although, as Mr Mayo observed, it cannot be supposed that the arterial blood in its passage through the *vasa vasorum* into the branches of the umbilical vein underwent the usual change into venous blood; and it was still, he contended, arterial blood, though less pure in character, which was conveyed through venous canals into the secreting part of the liver."

We conclude this necessarily imperfect sketch of Mr Kiernan's views, by strongly recommending the reader to avail himself of the first opportunity to peruse the paper itself. We can assure him that it will bear more than one reading, or rather that one perusal will not do it justice.

Mr Kiernan has promised a paper on the morbid anatomy of this organ, and we trust that we shall soon see both papers printed in such a form as to bring them within the reach of every member of the profession.

ART. VIII.—*Outlines of Human Physiology*. By HERBERT MAYO, F. R. S., F. G. S., Professor of Anatomy in King's College, London; Surgeon to the Middlesex Hospital; formerly Professor of Anatomy and Surgery to the Royal College of Surgeons. The Third Edition. London, 1833. 8vo, pp. 478.

IN the twenty-ninth volume of this Journal is a short account of the first edition of this work, sufficiently minute, however, to convey an idea of its nature and merits as an elementary treatise. It will there be seen that we formed so favourable an opinion of the treatise of Mr Mayo, as to take some pains to suggest various amendments, the introduction of which, we pre-