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The Anatomical Legacy of the Lower Gastrointestinal Tract in Greco-Arabic Medicine

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Abstract:

This study presents a comprehensive historical review of the anatomy of the lower gastrointestinal tract as described in classical Greco-Arabic medical literature, with particular emphasis on the Unani tradition. Drawing upon the anatomical observations of Hippocrates, Aristotle, Herophilus, Rufus, Galen, and their subsequent refinement by distinguished Arab and Persian physicians, including Rabban Ṭabarī, Zakariyyā Rāzī (Rhazes), ʿAlī ibn al-ʿAbbās al-Majūsī (Haly Abbas), Ibn Sīnā (Avicenna), Abū Sahl Masīḥī, Ibn Rushd (Averroes), and ʿAbd al-Laṭīf al-Baghdādī, this review examines the classical descriptions of the intestines, mesentery, liver, gallbladder, pancreas, portal venous system, and associated anatomical structures. These scholars provided detailed accounts of the morphology, topographical relationships, vascular supply, and physiological functions of the digestive organs, introducing concepts related to digestion, nutrient absorption, biliary secretion, and hepatic metabolism within the framework of Unani medicine. Although several physiological theories, particularly those concerning humoural balance and hepatic blood formation, have been superseded by modern scientific knowledge, many of their gross anatomical observations closely correspond with contemporary anatomy. By tracing the evolution of anatomical knowledge from classical Greek medicine through its development during the Islamic Golden Age, this review highlights the scientific contributions of Greco-Arab physicians to the understanding of the lower gastrointestinal tract. The study demonstrates that their meticulous observations and systematic interpretations formed an important foundation for the historical development of gastrointestinal anatomy and continue to hold significance in the history of medicine and the evolution of anatomical science.

Keywords: Unani Medicine, Niẓām-i-Haḍm (digestive system), Tashrīḥ (Anatomy), Am‘ā’ (intestines), Kabid (liver), Warīd al-Bāb (Portal Vein), Marāra (Gallbladder), Ṣafrā’ (Bile), Bānqarās (Pancreas), Arastu (Aristotle), Jālīnūs

(Claudius Galen), Ibn Sīnā (Avicenna), ʿAlī ibn al-ʿAbbās al-Majūsī (Haly Abbas)

Introduction:

Tibb Unani, also known as Greco-Arabic medicine, is one of the oldest and most comprehensive medical traditions, rooted in the medicinal philosophies of Greek physicians such as Buqrāṭ (Hippocrates), Arastu (Aristotle), and Jālīnūs (Galen). During the Islamic Golden Age, this knowledge was preserved, expanded, and refined by distinguished scholars including ʿAlī ibn Sahl Rabban al-Ṭabarī, Abū Bakr Muḥammad ibn Zakariyyāʾ al-Rāzī (Rhazes), ʿAlī ibn al-ʿAbbās al-Majūsī (Haly Abbas), Ibn Sīnā (Avicenna), and Ibn Rushd (Averroes), whose contributions established a sophisticated understanding of human anatomy, physiology, and therapeutics. Based on a holistic approach, Unani medicine emphasises health promotion, disease prevention, and rational treatment through the balanced interaction of natural principles and bodily functions(1).

Within the Unani tradition, ***Tashrīḥ al-Badan*** **(anatomy)** forms the cornerstone of medical knowledge, providing the structural basis for understanding physiological processes and disease. The term *Tashrīḥ*, derived from the Arabic root meaning "to dissect" or "to cut open," corresponds to the Greek *anatémnein*, from which the modern term *anatomy* is derived(2-6).

The ***Niẓām-i-Haḍm*** **(digestive system)**, regarded as the foundation of nutrition, metabolism, and overall health, was meticulously studied by Greek and Arab physicians who recognised its crucial role in both the origin and prevention of disease. This perspective aligns with Hippocrates' enduring assertion that "all disease begins in the gut,"(7) which is still relevant in both conventional and contemporary medical perspectives. Greek, Arab, and Persian scholars made notable contributions to understanding the anatomy of the digestive system, detailing the structure and function of its key components. Hippocrates introduced the doctrine of the four humours, which was later adopted and elaborated in Unani medicine as *Akhlāṭ* (humours) and eminent scholars, such as Zakariyyā Rāzī and Ibn Sīnā, described digestion as being governed by *Quwwat Hāḍima* (digestive power), facilitated by *Ḥarārat Gharīziyya* (innate heat). They emphasised the transformation of food into *Kaylūs* (chyle), which is then converted into blood and humours by the liver, the vital fluids that regulate health and temperament(8). In Unani thought, the balance of these humours is essential for sustaining life and maintaining bodily equilibrium, and any disturbance in this balance leads to disease, echoing Hippocratic principles of internal harmony(9). Aláu'd-Din al-Qarshi further stressed the role of food as the primary source of body heat, linking nutrition directly to vitality. In parallel, Raban Ṭabarī conceptualised digestion as a process of decomposition, a foundational perspective that modern physiology has expanded into the biochemical conversion of food into energy(10).

This review aims to examine the anatomy of the lower digestive tract through the lens of Greek and Arab physicians, tracing the historical development of their anatomical concepts and its enduring relevance in holistic medicine. By examining classical texts and integrating historical perspectives, the study seeks to highlight the timeless wisdom of Unani medicine and its contributions to understanding the human body as a dynamic and interconnected whole.

Literature Review:

Tashrīḥ-i-Am‘ā’ (Anatomy of Intestines):

The *Am‘ā’* (intestines), positioned within the *Baṭn* (abdominal cavity), extend from the pylorus of the stomach to the anus, coiled and twisted intricately from left to right and back again. *Ribāṭāt* (Ligamentous structures) bind them to the vertebral column(11). Classical Unani scholars divided the intestines into six parts: three upper thin intestines, known as ***Am‘ā’ al-Diqāq*** or ***Am‘ā’ al-‘Ulyā*** (small intestines), and three lower thick intestines, known as ***Am‘ā’ al-Ghilāẓ*** or ***Am‘ā’ al-Suflā*** (large intestines). The *Am‘ā’ al-Diqāq* (small intestines) comprise the ***Ithnā ‘Asharī*** (duodenum), ***Ma‘y al-Ṣā’im*** (jejunum), and ***Ma‘y al-Daqīq*** or ***Ma‘y al-Lafā’if*** (ileum). The *Am‘ā’ al-Ghilāẓ* or *Am‘ā’ al-Suflā* (large intestines) consist of ***Al-A‘war*** (caecum), ***Qūlūn*** (colon), and ***Ma‘y al-Mustaqīm*** or ***Al-Surm*** (rectum) (12).

Aristotle recognised several parts of the intestinal tract, including the jejunum, caecum, sigmoid flexure, and rectum, although he did not identify the duodenum(13). Later, Herophilus made significant contributions to intestinal anatomy by identifying both the jejunum—derived from the Greek term *nēstis* (meaning “fasting”)—and the duodenum, which he named for its approximate length of “twelve fingerbreadths”(14). He thus designated the duodenum as the first segment of the small intestine(15,16). Al-Baghdādī stated that the total number of digestive organs, including the stomach and intestines, is seven(17). Rufus described the jejunum as the fleshiest segment of the small intestine. He characterised the ileum as a long, thin intestinal segment measuring approximately thirteen cubits in length, extensively folded upon itself and extending from the region of the umbilicus to the lower abdomen(18). Ibn Sīnā further distinguished the duodenum, jejunum, and ileum based on their anatomical and vascular characteristics. He observed that the jejunum is richly supplied by branches of the *Warīd al-Bāb* (hepatic portal vein), making it the most highly vascularized segment of the small intestine(19). He also noted that the jejunum possesses larger, taller, and more densely packed circular mucosal folds (*plicae circulares*) than the ileum. Furthermore, Ibn Sīnā described these folds as being present in the jejunum and ileum but absent in the duodenum, and proposed that they slow the passage of *Kaylūs* (chyle), thereby facilitating digestion and enhancing nutrient absorption(20).

Regarding the large intestine, Alī ibn Abbās Majūsī, Al-Baghdādī, and Ibn al-Quff Masīḥī described the caecum as the first part of the large intestine. They stated that it is thick and strong, with a smooth, fatty inner surface adapted to withstand the passage of *Barāz* (faeces)(8,11,21). Abū Sahl Masīḥī compared the caecum to a *Kīs* (purse), while Rufus described it as a pouch that receives faeces from the small intestine before transmitting them to the colon(18,22). Ibn Sīnā observed that the caecum and colon are the most dilated portions of the intestine and explained that their functions include the collection, compaction, and absorption of excess fluid from the faeces. He supported this view by noting the consistent distribution of tributaries of the portal vein throughout the colon, indicating its absorptive function(20). Raban Ṭabarī, in *Firdaws al-Ḥikma fi’l-Ṭibb*, described the colon as being composed of “cold” (*bārid*) nerves, although he considered its upper part to be

relatively warmer and moderately moist(23). Rufus described the course of the caecum as descending along the right flank and ending in a blind pouch. According to him, the colon originates from the right side, ascends upward, curves around the liver and both hypochondriac regions in the form of the Greek letter pi (Π), and then descends along the left flank to continue as the rectum(18). Abū Sahl Masīḥī stated that the terminal end of the rectum is known as the *Musarrah*, which opens externally as the *Al-Maq'ada* (anus)(22,24). Alī ibn Abbās Majūsī described the anus as containing voluntary muscles that enable conscious control over defecation(11). Rufus referred to the rectum as the fleshiest part of the intestine and explained that it descends in a straight course, from which it derives its name. He further described the anal region as possessing two sphincters: one firm and nervous, and the other fleshy and corrugated(18). Ibn Sīnā described the rectum as a straight, dilated tube that continues into the anal canal and noted its close anatomical relationship with the pelvic floor muscles and the *'Aẓm al-'Ajuz* (sacrum), which assist in defecation. He also stated that all the intestines are attached to the vertebral column by mesenteric ligaments(17). Rufus also described the mesentery (*mesaraion*) as a membranous structure situated centrally among the intestines(18).

Galen described the intestinal wall as consisting of two layers composed predominantly of transverse fibres(25). Alī ibn Abbās Majūsī similarly stated that the intestines have two concentric layers resembling those of the stomach, with the inner layer lined by a protective mucous secretion(11). Zakariyyā Rāzī explained that the movements of organs correspond to the orientation of their fibres. He stated that the two circular muscle layers of the intestines facilitate peristaltic contractions without traction(17). Ibn Rushd noted the presence of viscous, sticky fluids lining the inner surface of the intestines, where they accumulate as part of the natural digestive process(26). The extensive coiling of the intestines ensures prolonged retention of food, facilitating complete digestion and reducing the frequency of defecation. The fixed position of the duodenum allows the entry of bile, consistent with Galen's description of its connection to the bile duct. The upper intestines, richly supplied by branches of the hepatic portal vein, were regarded as the primary site of nutrient absorption and were supported by nerves, blood vessels, and ligaments (*Marabiz*). Galen observed rhythmic peristaltic movements during vivisection and emphasized the roles of the diaphragm and abdominal muscles in maintaining intra-abdominal pressure. He also described the intestines as serving two principal functions: nutrient absorption and waste elimination, noting that the well-developed large intestine in humans permits controlled defecation. Furthermore, his spinal cord experiments demonstrated that injuries to the lower spinal cord could result in intestinal paralysis, and he distinguished renal colic caused by kidney stones from pain of intestinal origin(27).

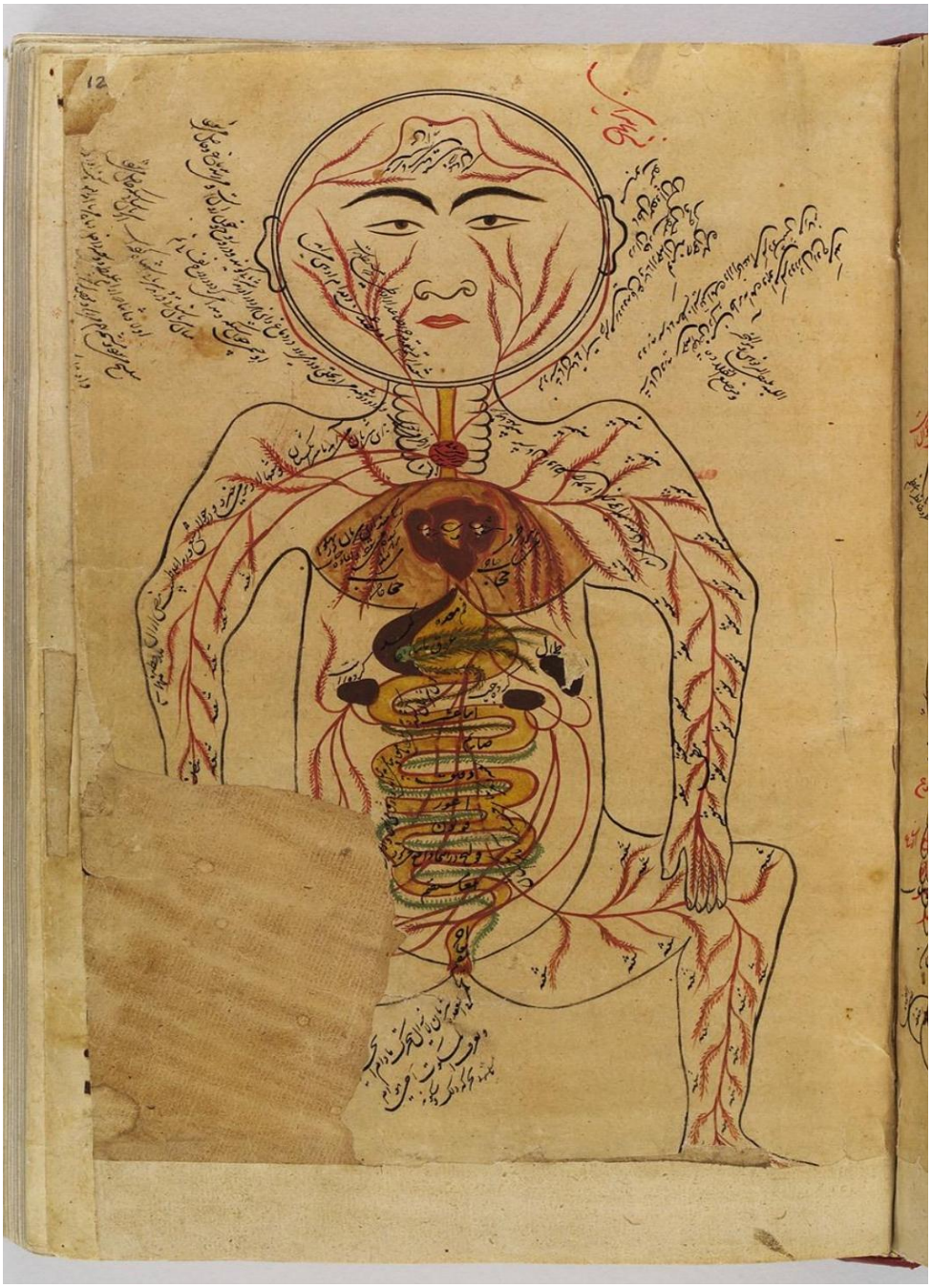

Fig. 1: Ibn Sīnā's drawing of the gastrointestinal system in the *Canon of Medicine*. The image was obtained internet open source courtesy of Wellcome library.

Tashrīḥ-i-Kabid (Anatomy of the Liver):

The liver occupied a central position in the medical traditions of Mesopotamia, Egypt, Greece, and the Unani system. Mesopotamian medicine (c. 2100 BCE), preserved on clay tablets, regarded the liver as the organ of life and the principal focus of hepatoscopy, a form of divination based on examining the liver of sacrificial sheep(28). These clay liver models included identified features such as the left and right lobes, caudate lobe ("middle of the liver"), processus caudatus ("finger of the liver"), papillaris ("fruit of the liver"), gallbladder

("bitter part"), and hepatic duct ("output"), with the portal fissure referred to as the "gate of the liver"(14). Similarly, the Ebers Papyrus (c. 1550 BCE) described the liver as the seat of emotions and suggested that vessels carrying air, water, and blood were connected to it. Babylonian physicians also regarded the liver as the centre of life, emotions, desire, and sexual vitality(29). Among Greek philosophers, Aristotle regarded the *Kabid* (liver) as one of the *A'ḍā' Ra'īsa* (principal organs), deriving its *Ḥarārat Gharīziyya* (innate heat) from the heart. Hippocrates considered the liver the source of *Quwwat Ṭabī'iyya* (natural faculty), responsible for digestion (*Haḍm*), maturation (*Nuḍj*), absorption (*Injidhāb*), and excretion (*Indifā'*), emphasising that impairment of these functions resulted in systemic diseases such as *Istisqā'* (dropsy). Plato regarded the liver as the vegetative centre regulated by the brain through the vagus nerve(30,31). Herophilus recognising its variations in size, shape, and number of lobes, describing the portal venous system, mesenteric lymphatics, lymph nodes, and occasional left-sided livers(32,33). Galen further advanced hepatology by considering the liver the first organ to develop during embryogenesis, the origin of the venous system, the source of the *Ajwaf* (vena cava), and the principal organ of sanguification, although these concepts were later proven incorrect(34,35). His views strongly influenced later physicians, including Manṣūr ibn Ilyās, Zakariyyā Rāzī, and Alī ibn Abbās Majūsī, who also considered veins to originate from the liver.

Fig. 2: Babylonian clay model of sheep's liver (19–18th century B.C.) used in divination © Trustees of the British Museum.

Khalq al-Kabid (structure of the liver) was described in the *Corpus Hippocraticum* as originating from the coagulation of liquid blood. Aristotle and Galen described its structure as round, dense, and moist, resembling coagulated blood. Galen characterised the liver as "simple" due to its morphological uniformity and heavy venous nature(29). Rufus described the liver as reddish, venous, and lentil-coloured. Ibn Sīnā and Ibn al-Quff Masīḥī similarly compared its texture to coagulated blood, noting that its substance contains numerous fine vessels and little nervous tissue. Ibn Sīnā observed that nerves are confined to the liver's outer membrane rather than its parenchyma and described its attachments to the stomach, diaphragm, and heart through the omentum, ligaments, and inferior vena cava. Ibn Sīnā further elaborated on the ligaments anchoring the liver, such as the falciform and coronary ligaments, and its embryologic development guided by the umbilical vein(20). Ancient physicians consistently described the liver as occupying the right upper abdomen beneath the diaphragm. The number of hepatic lobes was considered variable. Hippocrates and Galen described five lobes, whereas Celsus reported four(17,29). Herophilus and Alī ibn Abbās Majūsī recognised considerable individual variation, describing livers with two, three, four, or even no distinct lobes(33). Galen further attributed distinct functions to each of the liver's five lobes: the right lobe processed food and drink, the left produced bile, the right posterior formed *Manī* (semen), the right anterior nourished the veins, and the middle lobe maintained the balance among the remaining lobes(36,37). Ibn Sīnā described the close relationship between the liver, diaphragm, and stomach, noting that the liver's convex surface lies beneath the right dome of the diaphragm and is protected by the lower ribs. He also explained that the liver is attached to the diaphragm and stomach by the omentum and ligaments, and recognised the inferior vena cava as the vascular connection between the liver and the heart(20).

Warīd al-Bāb (hepatic portal vein) was described by Aristotle, who identified the Bāb al-Kabid (porta hepatis) and its associated veins, although he did not recognise any connection with the aorta. He was the first to distinguish the portal vein from the hepatic arteries and veins, identifying it as a distinct component of the venous system with open intrahepatic ends(13). Herophilus accurately described the portal venous system and recognised that the intestinal veins drain into it, although he continued to believe that the venous system originated from the liver(38). Galen provided the most comprehensive account of the intrahepatic vasculature, distinguishing the hepatic arteries, portal vein, hepatic veins, and lacteals carrying *Kaylūs* (chyle) from the intestines(39). Zakariyyā Rāzī described the portal vein as arising from the concave surface of the liver and discussed the splenic and short gastric veins as channels connecting the spleen with the liver and the stomach, respectively. He also described the gallbladder, cystic duct, hepatic ducts, common bile duct, and its opening into the duodenum. Al-Baghdādī accepted Galen's theory that blood flows unidirectionally from the liver to the organs but proposed that water accompanies the blood to facilitate its movement before being excreted as urine through the kidneys and urinary bladder(17).

Manāfiʿ al-Kabid (functions of the liver) were described extensively by ancient physicians, who unanimously regarded the liver as one of the body's three principal

organs, together with the heart and brain. Galen proposed that *Pneuma* (Rūḥ), the vital force responsible for sustaining life and regulating the body's functions, enters the body through respiration and is differentiated into three forms: the natural spirit (*Pneuma physikon*), located in the liver; the vital spirit (*Pneuma zotikon*), located in the heart; and the psychic spirit (*Pneuma psychikon*), located in the brain. The liver, regarded as the site of blood formation and nourishment, was considered the seat of *Quwwat Ṭabīʿiyya* (natural faculty) and the source of the four *Akhlāṭ* (humours): *Dam* (Blood), *Balgham* (phlegm), *Ṣafrā'* (yellow bile), and *Sawdā'* (black bile). Before Galen, physicians believed that digested nutrients were transported from the intestines to the liver, where they were converted into blood and distributed throughout the body. Galen refined this concept by proposing that food is first transformed into *Kaylūs* (chyle), which reaches the liver through the *Warīd al-Bāb* (hepatic portal vein). Within the liver, the *Quwwat Mughayyira* (transformative faculty) converts chyle into blood and infuses it with the natural spirit before it enters the *Ajwaf* (vena cava) to nourish the entire body. He rejected the concept of blood circulation, maintaining instead that blood is continuously produced in the liver and consumed by the tissues, with only a portion reaching the heart to acquire the vital spirit before being distributed through the arteries(40). Greek and Unani physicians regarded the gallbladder and spleen as accessory organs of the liver, responsible for removing yellow and black bile from newly formed blood. Galen believed that the liver, gallbladder, and spleen collectively maintained humoral balance and recognised the role of yellow bile in stimulating intestinal peristalsis. Rufus similarly considered black bile to be the sediment of blood and yellow bile to be its waste product. Ibn Sīnā stated that the humours formed in the liver are distributed according to their nature: pure blood is conveyed to the body through the blood vessels, water is transported to the kidneys via branches of the inferior vena cava, yellow bile is carried to the gallbladder through the hepatic ducts, and black bile is directed to the spleen through its vessels(17).

Tashrīḥ-i-Marāra (Anatomy of the Gallbladder):

The *Corpus Hippocraticum* described the gallbladder as being situated on the fourth lobe of the liver among the five lobes(41). Aristotle recognised that *Ṣafrāʾ* (bile) is produced in the liver and stored in the gallbladder, although he also observed that some animals lack this organ. Rufus described the gallbladder as a bladder-like sac located beneath the liver, connected to the intestines by a duct through which bile enters the digestive tract. He compared its structure to that of the urinary bladder and considered it a reservoir for locally produced bile. Galen identified the gallbladder as a reservoir that stores bile and releases it into the duodenum when required. He attributed its close relationship with the liver to its function of receiving the yellow bile produced by the liver and also described several diseases affecting the gallbladder(18). Zakariyyā Rāzī described the gallbladder as lying close to the liver and possessing two ducts: one communicating with the liver and the other dividing into branches supplying the upper intestine and the stomach. Alī ibn Abbās Majūsī stated that small arterial and nervous branches supply the gallbladder, providing vitality and sensation, and that its principal function is to remove excess bile from the blood, thereby preventing overheating of the body(11). Raban Ṭabarī regarded the gallbladder as an organ that warms the

stomach and liver, facilitates digestion, purifies the blood, and maintains the normal flow of bodily fluids(23). Ibn Sīnā described the gallbladder as a sac attached to the liver's concave surface near the stomach, communicating with the liver through one opening and with the duodenum through the common bile duct. He also mentioned occasional communication with the stomach and recognised individual variations in the biliary openings into the duodenum. He believed that bile aids intestinal cleansing and contributes to blood purification(20).

Ṣafrāʾ (bile) was described by Aristotle, who was the first to identify the extrahepatic bile ducts and challenged the Hippocratic belief that bile was one of the essential bodily fluids responsible for disease, instead regarding it as a waste excretion(29). He stated that pale or clay-coloured stools are caused by issues in the biliary system, particularly the gallbladder, liver, and pancreas. Since bile gives stool its brown colour, a lack of bile or a blockage in its flow results in pale stools. Rufus classified bile into three types: yellow (bitter and yellow), leek-green (sour and greenish), and rust-coloured (highly concentrated). He noted that bile imparts colour to the faeces and facilitates its passage, while obstruction of bile flow causes jaundice and produces white, clay-coloured stools(18). Galen observed that excessive bile could produce severe fever(42). Raban Ṭabarī described bile as a hot, bitter substance stored in the gallbladder on the right side of the liver, where it warms the stomach, promotes digestion, and enhances the movement of bodily fluids. He also explained that excess bile reaching the brain could cause dryness, insomnia, anxiety, and impaired memory, emphasising the body's natural tendency to eliminate excess waste from vital organs(23).

Tashrīḥ-i-Bānqarās (Anatomy of the Pancreas):

Herophilus was the first physician to investigate the pancreas, providing the earliest description of its structure and function(15). Galen referred to the pancreas on several occasions in *On the Usefulness of the Parts of the Body*, particularly in his discussion of the omentum, which he considered to be naturally attached to both the spleen and the pancreas. He described the pancreas as a soft, glandular organ whose primary function is to surround and protect the numerous blood vessels distributed throughout the region of the liver, pancreas, and duodenum, thereby safeguarding the vascular branches in this area. As Galen stated, "Nature, understanding this, created a glandular structure called the pancreas, positioning it beneath all the vessels, surrounding them, and filling the spaces where they divide"(27).

Discussion:

The anatomical descriptions of the digestive system, specially ***Am'ā'*** **(intestines)** provided by Greek and Arab scholars demonstrate remarkable observational accuracy despite the absence of modern investigative techniques. Herophilus' naming of the duodenum based on its approximate length closely corresponds to the modern concept of the first segment of the small intestine. Galen correctly recognized the importance of the intestinal muscular wall in peristalsis; however, he considered both intestinal muscular layers to consist of transverse fibres and did not recognize the outer longitudinal muscle layer identified in modern anatomy.

Likewise, his observations of intestinal peristalsis and nutrient absorption anticipated later discoveries, even though his explanation of nutrient transport and blood formation through the liver reflected the physiological concepts of his era rather than the modern understanding of digestion and circulation. Rufus accurately described the general course of the colon, the pouch-like structure of the caecum, and the supportive role of the mesentery. Similarly, Ibn Rushd's description of the caecum as a blind pouch and Abū Sahl Masīḥī's comparison of the caecum to a purse effectively illustrated its pouch-like morphology, although current evidence has clarified the direction of intestinal transit through the ileocecal valve into the colon. Ibn Sīnā's explanation of the relationship between intestinal length, convolutions, and nutrient absorption is consistent with current anatomical and physiological knowledge. Modern research has further clarified these functions through the identification of villi, microvilli, digestive enzymes, and specialized transport mechanisms. Alī ibn Abbās Majūsī accurately described the hepatic portal venous drainage, mesenteric vessels, and supporting membranes, observations that correspond closely to the modern concepts of the mesentery and portal circulation. In contrast, descriptions based on humoral theory, such as Raban Ṭabarī's characterization of the colon as possessing "cold" qualities and Al-Baghdādī's classification of seven digestive organs, represent the philosophical and medical concepts of their time rather than anatomical facts.

Ancient physicians regarded the ***Kabid* (liver)** as one of the body's principal organs and considered it the centre of blood formation, nutrition, and metabolism. The *Corpus Hippocraticum* proposed that the liver developed from the solidification of blood, whereas current embryological knowledge demonstrates that it arises from the embryonic endoderm through complex genetic and cellular mechanisms. Similarly, Galen's theory that the liver was the origin of blood and the venous system, with blood flowing unidirectionally to nourish the body, was later disproven by William Harvey's discovery of the closed circulatory system, which established the heart as the central pump of blood circulation. Hippocrates and Galen described the liver as having five lobes, whereas modern anatomy recognizes four anatomical lobes and eight functional segments based on vascular and biliary distribution. Despite this discrepancy, saveral classical observations were remarkably accurate; Rufus correctly identified the liver's position in the right upper abdomen, with a convex diaphragmatic surface and a concave visceral surface, findings that closely correspond to contemporary anatomical knowledge. Ibn Sīnā accurately described the liver's relationship with the diaphragm, stomach, ligaments, and surrounding membrane, observations that are consistent with the modern understanding of the Glisson's capsule and peritoneal attachments. Likewise, Zakariyyā Rāzī, Alī ibn Abbās Majūsī, and Ibn Rushd recognized the importance of the hepatic portal vein in transporting nutrients from the intestines to the liver, although they incorrectly believed that it carried digested food or chyle and that blood originated within the liver. Present-day physiological knowledge has established that the hepatic portal vein carries nutrient-rich blood to the liver for metabolism, after which it drains through the hepatic veins into the inferior vena cava.

Greek and Arab physicians also provided remarkably accurate descriptions of the ***Marāra* (gallbladder)** and ***Ṣafrāʾ* (bile)** despite the absence of modern investigative techniques. Aristotle correctly recognized that bile is produced in the liver and stored in the gallbladder, and he also noted that some animals naturally lack a gallbladder, observations that are supported by modern comparative anatomy. Galen accurately described the gallbladder as a reservoir that stores and releases bile into the duodenum, laying the foundation for the modern understanding of the biliary system. Ibn Sīnā's account of the biliary passages closely resembles the current anatomical knowledge of the biliary tree, although the detailed anatomy of the hepatic ducts, cystic duct, common bile duct, and sphincter of Oddi was established much later. Ancient physicians also regarded bile as essential for digestion and the purification of the bodily fluids. While these concepts were based on humoural theory, modern physiology confirms the essential role of bile in fat digestion and the absorption of fat-soluble vitamins. Classical observations on biliary disorders also show notable clinical insight. Aristotle and Rufus associated obstruction of bile flow with pale stools and jaundice, findings that remain important diagnostic features of biliary obstruction in contemporary medicine. Although Galen's theory that excessive bile caused fever is no longer accepted, it reflects an early attempt to relate pathological changes in bile to disease.

The anatomical understanding of the ***Bānqarās* (pancreas)** evolved gradually through the work of early Greek physicians. Herophilus was the first to investigate the pancreas as a distinct organ, establishing the foundation for later anatomical studies. Galen described the pancreas as a soft glandular structure located near the liver and duodenum, emphasizing its role in protecting the major blood vessels of the region. Modern anatomy confirms its close relationship with the duodenum, portal vein, and surrounding vascular structures, although its protective function is now considered secondary to its digestive and endocrine roles. Rufus described the pancreas as a glandular structure situated near the beginning of the small intestine, an observation consistent with its anatomical location. Subsequent anatomical and physiological research has greatly expanded this understanding, demonstrating that the pancreas is both an exocrine gland, secreting digestive enzymes and bicarbonate into the duodenum, and an endocrine gland, producing hormones such as insulin and glucagon that regulate blood glucose.

Greco-Arabic physicians made remarkable contributions to the anatomical understanding of the lower gastrointestinal tract through meticulous observation, critical reasoning, and systematic interpretation. Scholars including Herophilus, Galen, Rufus, ʿAlī ibn ʿAbbās al-Majūsī, Ibn Sīnā, Abū Sahl Masīḥī, Ibn Rushd, and many others accurately described the morphology, position, and functions of the intestines, liver, and associated vessels. Collectively, their observations demonstrate the remarkable anatomical insight of Greco-Arabic physicians and highlight their enduring influence on the historical development of gastrointestinal anatomy. Although several physiological concepts, such as humoural theory and hepatic blood formation, have since been superseded, their works represent important milestones in the evolution of anatomical science and laid the

foundation for subsequent advances in gastrointestinal anatomy.

Conclusion:

The present review highlights the substantial contributions of Greco-Arabic physicians to the anatomical understanding of the digestive system. Through careful observation, dissection, and clinical experience, scholars such as Herophilus, Hippocrates, Aristotle, Galen, Rufus, Alī ibn ʿAbbās Majūsī, Zakariyyā Rāzī, Ibn Sīnā, Ibn Rushd, and Abū Sahl Masīḥī described the morphology, position, vascular supply, and functions of the digestive organs with remarkable detail for their time. Although several physiological concepts, particularly those concerning humoural theory, hepatic blood formation, and circulation, have been superseded by modern scientific evidence, many of their anatomical observations closely correspond with contemporary knowledge. Their works not only preserved the anatomical heritage of classical Greece but also introduced important refinements that influenced the subsequent development of anatomy and medicine. Collectively, these contributions represent a significant milestone in the history of gastrointestinal anatomy and continue to demonstrate the enduring scientific legacy of the Greco-Arabic medical tradition.

References:

1. Encyclopaedia Britannica. Unani medicine [online]. The Editors of Encyclopaedia Britannica; 2025. Available at: https://www.britannica.com/science/Unani-medicine (Accessed: 25 Aug 2025).
2. Jilani HG. Makhzan-ul-jawahar tibbi wa doctorí lugat. Ejaz Publication House. New Delhi 1998; p 219.
3. Haq A. The Standard Urdu English Dictionary. J.S. Sant Singh & Sons. New Delhi YNM; p 112.
4. Shin EK, Meals RA. The historical importance of the hand in advancing the study of human anatomy. J Hand Surg 2005;30(2):209–21.
5. Venes D, ed. Taber's Cyclopedic Medical Dictionary. 22nd ed. FA Davis Company. Philadelphia 2015.
6. Standring S, ed. Gray's Anatomy: The Anatomical Basis of Clinical Practice. 41st ed. Elsevier 2016; pp Preface, 507–516.
7. Lyon L. 'All disease begins in the gut': was Hippocrates right?. Brain 2018;141(3):e20-
8. Baghdādī IH. Kitāb al-Mukhtārāt fi'l Ṭibb. Vol 1. Trans. CCRUM. CCRUM, Ministry of Health and Family Welfare. New Delhi 2005; pp 64-68.
9. Chandpuri K. Mojazul Qanoon. Qaumi Council Barai Farogh Urdu Zuban. New Delhi 1998; pp 15-30.
10. Siddiqi MZ. Studies in Arabic and Persian Medical Literature. Calcutta University. Calcutta 1959; pp 91-95.
11. Majūsī AA. Kāmil al-Ṣanā'a. Vol 1. Trans. GH Kintūrī. CCRUM, Ministry of Health and Family Welfare. New Delhi 2010; pp 231, 233, 247-253.
12. Laari JA. Human Anatomy. Malegaon: Alhuda Offset; 2008.
13. Persaud TVN, Loukas M, Tubbs RS. A History of Human Anatomy. 2nd ed. Illinois: Charles C Thomas Publisher LTD 2014; pp 28, 29, 42-44.

14. Sprumont P. Anatomical terms: towards development of Terminologies (terminogenesis). European Journal of anatomy. 2016;20:249-80.
15. Reverón RR. Herophilos, the great anatomist of antiquity. Anatomy. 2015;9(2):108-11.
16. Bay NS, Bay BH. Greek anatomist Herophilus: the father of anatomy. Anatomy & cell biology. 2010 Dec 1;43(4):280-3.
17. Alghamdi MA, Ziermann JM, Diogo R. An untold story: The important contributions of Muslim scholars for the understanding of human anatomy. The Anatomical Record. 2017 Jun;300(6):986-1008.
18. Gersh CJ. Naming the Body: A Translation with Commentary and Interpretive Essays of Three Anatomical Works Attributed to Rufus of Ephesus (Doctoral dissertation). University of Michigan, Ann Arbor, USA; 2012.
19. Breitenfeld T, Jurasic MJ, Breitenfeld D. Hippocrates: the forefather of neurology. Neurological Sciences. 2014 Sep;35(9):1349-52.
20. Mazengenya P, Bhikha R. Revisiting Avicenna's (980–1037 AD) anatomy of the abdominal viscera from the Canon of Medicine. Morphologie. 2018 Sep 1;102(338):225-30.
21. Masīḥī IQ. Kitāb al-'Umda fi'l Jarāḥa. Vol 1. Trans. CCRUM. CCRUM, Ministry of Health and Family Welfare. New Delhi 1986; pp 111-116, 120-128.
22. Masīḥī AS. Kitāb al-Mi'a. Vol 1. Trans. CCRUM. CCRUM, Ministry of Health & Family Welfare. New Delhi 2008; p 81–99.
23. Ṭabarī AR. Firdaws al-Ḥikmat. Trans. MA Shāh. Idāra Kitāb al-Shifa. New Delhi 2017; p 45-60.
24. Rāzī ABMZ. Kitāb al-Manṣūrī. 1st ed. Trans. CCRUM. CCRUM, Ministry of Health and Family Welfare. New Delhi 1991; pp 40-46.
25. Ansari FB, Quadri MAB, Ansari NA, Malik A, Khan MI. A review of Galen's contribution to anatomy with special reference to the digestive system. *IOSR J Dent Med Sci.* 2024 Apr;23(4):53-57.
26. Rushd I. Kitāb al-Kulliyāt. 1st ed. Trans. CCRUM. CCRUM, Ministry of Health and Family Welfare. New Delhi 1980; pp 6, 22-25.
27. Balalykin DA. Galen's understanding of the digestive system in the context of the commensurability of medical knowledge in different periods. History of Medicine. 2019;6(2):98-110.
28. Sutcliffe J, Duin N. A History of Medicine: From Prehistory to the Year 2020. United States: Barnes & Noble Inc.; 1992.
29. Kuntz E, Kuntz HD. Hepatology: Textbook and atlas. Springer Science & Business Media; 2009 Mar 11.
30. Ansari FB, Bano S, Ansari NA, Ansari MA. Anatomical knowledge of the upper digestive tract in Greco-Arabic medicine: A historical review. Journal of Applied Bioanalysis. 2025 Dec;11(10s):1030-1038.
31. Zuhr I. Kitāb al-taysīr. Trans. CCRUM. CCRUM, Ministry of

Health and Family Welfare. New Delhi 1980.
32. Wills A. Herophilus, Erasistratus, and the birth of neuroscience. The Lancet. 1999 Nov 13;354(9191):1719-20.
33. Dobson JF. Herophilus of alexandria. Proceedings of the Royal Society of Medicine. 1925 Mar;18(Sect_Hist_Med):19-32.
34. Reynolds SW. The historical struggle for dominance between the heart, liver, and brain. The Proceedings of the 16th Annual History of Medicine Days. 2007 Mar 30.
35. Tubbs RI, Gonzales J, Iwanaga J, Loukas M, Oskouian RJ, Tubbs RS. The influence of ancient Greek thought on fifteenth century anatomy: Galenic influence and Leonardo da Vinci. Child's Nervous System. 2018 Jun;34(6):1095-101.
36. Sjöstrand NO. The medical illustration as the expression of illusion and imagination—the liver as an example from history. Svensk Medicinhistorisk Tidskrift. 2007;11(1):17-51. PMID: 18548944.
37. Amjad F. *An Investigation of the Galenic Influence on the Artistic Depiction of Anatomical Concepts During the Renaissance* (Master's thesis, University of South Carolina).
38. Von Staden H.*Herophilus: The art of medicine in early Alexandria.* Cambridge: Cambridge University Press; 1989.
39. Pasipoularides A. Galen, father of systematic medicine. An essay on the evolution of modern medicine and cardiology. International journal of cardiology. 2014 Mar 1;172(1):47-58.
40. Bano S, Ansari FB, Ansari NA, Amreen. Physiological Role of the Liver in the Synthesis and Regulation of Akhlāṭ (Humors) in Unani Medicine: A Classical Perspective. African Journal of Biomedical Research. 2024 Dec;27(4s): 17593-17596.
41. Najjar J. From anesthetic sponge to nonsinking skull perforator, unitary work neurosurgery in the ancient Arabic and Islamic world. World neurosurgery. 2010 May 1;73(5):587-94.
42. Rothemich K. Galen's Anatomical Anomalies & Discoveries. Science Technology and Society a Student Led Exploration. 2020 Jul 29.

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