

A TIMELINE
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HISTORY OF NEPHROLOGY

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*"We have come to understand that we are who we are
is also who we were"*

John Quincy Adams (1767-1848)

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Before reporting the topics of Nephrology that were dealt with by Ancient Greek and Byzantine writers, it would be worth commenting on the etymology of the two commonest words used by them in their relevant treatises

a) The word Urology has been explained as a compound name of the Latin word *urine* and the Greek word *logos*, the latter meaning "knowledge". However there exists in Greek the word *uron*, meaning the urine. Hippocrates had already employed the word in his work "Peri uron" that is "On urines". A theory closer to the truth recognizes both the Latin and the Greek words as derivatives of the Sanscritic word *vari*, meaning water and consequently the urine.

b) The word *nephros* (in Greek: νεφρός) whence the compounds *nephrology*, *nephrological* etc derive, comes from the Greek word *nephos* (νέφος) meaning cloud. The Latin equivalent is "nebula". Both the Greek and the Latin word derive from the Sanskrit word "nabbas", meaning heaven. The use of the same word both for a cloud and for a kidney is based on the observation that both produce a liquid; i.e. rain from clouds and urine from kidneys.

1.

Author	Hippocrates and corpus Hippocraticum (5 th cent. BC and onwards)
Images	
	(SEE ATTACHED FILES)
Anatomy Pathology	<p>Describes the growing out of the kidneys from renal arteries, branches of the abdominal aorta, and the parallel direction of the nerves. He correctly defines the aorta as originating in the heart. He observed the anatomical connection of spermatic arteries with the kidneys, a fact that led to the notion that the sperm is initially created inside the kidneys, is then delivered via spermatic vessels to the testicles and finally outside the body. He remarked about the similar shape of both kidneys and likened their colour to that of apples. The calyces and pelvic cavity were observed and commented on. He also described the ureters as descending from the kidneys and ending at the bladder.</p> <p>He described the granular and sticky texture of the kidneys and the excess of humidity in their interior. He found their temperature was below mean human body temperature.</p>
Physiology	Renal vein vessels transfer blood with waste liquid product of metabolic reactions to the kidneys. There, it departs from the blood, which returns purified, to the whole body. The filtrate, excreted from the renal granules, is then directed to the bladder via the ureters, where it is further clarified and excreted through the urethra. Hesitantly, he considers the kidneys as "not alien to the excretion of urines".
Chemistry	
Disease	Hippocrates links various <i>urological symptoms with diagnosis and prognosis</i> . In his work <i>"About inner sufferings"</i> , he reported the symptoms and incidence of renal lithiasis and blamed these on drinking water when it has a high concentration of salts and poor milk quality. Urine retention accompanied by sudden renal pain is a symptom of passing stones or sand-like material. He considered gout rare before puberty. Those in the 14 to 40 yr age group were deemed more susceptible to various diseases, amongst which those affecting the kidneys. Subsequently, till the age of 63 the appearance of renal problems is attributed to a relapse of a previous disease. He stated that chronic renal diseases are never cured if the patient is older than fifty years old. He used the term "nephritic" to describe patients with a variety of renal ailments, like strangury, anuria and haematuria. He usually blamed for them generalized infections, and over-consumption of starch. There is a description of recurrent renal abscesses combined with deformity of the lower spinal column, a syndrome reminiscent of renal and bone tuberculosis (Pot syndrome). He speculated that when hair-like fleshy elements (blood-casts) are found in urine this is evidence of a renal disease, while spontaneous haematouria indicates renal vessel rupture. When a nephritic patient presents with bleeding from haemorrhoids this is a good omen (lower blood pressure?). When there are bubbles on the urine surface (due to proteinuria?) this is an indication of renal disease chronicity.
Therapy	
Technical	
General Comments	Historians accept that Hippocrates actually existed, based heavily on a passage in Plato's writings, in which his contemporary philosopher acknowledged him as an excellent doctor. There is also a coin from Cos, struck during his era with his name on it. He was born circa 460 BC on the island of Cos, at the Eastern shore of the Aegean Sea and became a famous physician and teacher of medicine. All other biographical information available today must be based on many years of oral tradition and are thus not indisputably reliable. These include his visit to Sicily and his refusal to treat Xerxes, the king of Persia.

The Hippocratic or Coan school that formed around him was of great importance in placing medicine on a strictly scientific plane, based on objective observation and critical deductive reasoning. He was held in high esteem by the medical profession and the educated classes since his lifetime till today. There is however a paradox regarding the criteria upon which this estimation is based. Till the Enlightenment, when his purely medical ideas were more or less believed and societies were deeply religious, his religious beliefs were not discussed nor even the fact that he was a pagan was disturbing. Moreover the Christian Church somehow adopted him as a semi-Christian pro-runner of Christian beliefs. From his moral teachings, the Oath in particular was reverent. The best-known quotation from Hippocrates' works concerning urology is the passage from the Hippocratic Oath forbidding lithotomy.

Today, that his medical teaching has been greatly surpassed by modern medicine, he is acclaimed as the one who separated religion from medicine excluding any divine interference from the cause or treatment of any disease. In reality, the current agnostic or even godless societies claim Hippocrates as one of their own. The father of medicine was a rather religious man. He clearly accepted the divine superiority towards the medical profession, he supported that diseases are caused by gods, but strictly on the understanding that gods created Nature, thus, creating the diseases as well, and started the famous Oath, whose authorship anyway, is dubious, with an invocation to the gods. What he strictly rejected was charlatanism and the idea that gods sent particular diseases to a person as punishment, avoidable through incantations and donations. However, this eclectic stance on the matter, if seen through a narrow-minded viewpoint, offers arguments to both sides. Hence, it can aptly said of his teaching that it is perpetuated '*loaded by the mud of his enemies and the rust of his friends*'.

Biography

Hippocrates, c.460-c.370 BC, Greek physician, is recognized as the Father of Medicine. He was born on the island of Cos, to a family of famous physicians, that claimed Asclepius (Latin: *Aesculapius*), the God of Medicine, as their ancestor. Worth mentioning that Asclepius himself had been initially a mortal, extremely competent physician, whose two sons participated in the Trojan War and are reported in Homer's Iliad. He was later deified, but his mortal descendants practiced medicine for centuries afterwards, calling themselves "*Asclepiads*". Hippocrates originated from such a family. He had studied under his father, a physician, and had travelled extensively, mainly to the shores of Marmara in Propontis, to North and Central Greece and then to Athens, practising medicine wherever he went. During his travels, he kept detailed reports of patients he treated, a kind of case notes. These were later gathered in a book in the Corpus Hippocrataticum, called *Epidemiae*, (a compound word from the Greek words *epi* meaning in this instance *going towards* and *demos* meaning the registered population of a place) and *broadly* speaking it is equivalent of visiting various towns, and it should not be confused with the current meaning of "epidemic", signifying an infectious agent "visiting" an area. He later returned to practice, teach, and write at Cos. It is almost certain that he died in the area of Larissa, in Central Greece, the legendary birthplace of Asclepius. His tombstone there was accidentally found and kept at the house of the local *pasha*. Several visitors had seen and described it and its epigram during the 19th century, but it is now lost.

Hippocrates followed the contemporary belief that disease resulted from an imbalance of the four bodily humours; namely, blood, black bile, yellow bile and phlegm. In this theory he had been influenced by similar and older Mesopotamian and Egyptian beliefs. He maintained that the disturbance was influenced by outside forces and that the humours were secretions of various organs. According to his doctrine of "the healing power of nature", or in Latin, *vis*

	<i>medicatrix naturae</i> , the body contains within itself the power to rebalance the four humours and heal itself (<i>physis</i>). He believed that the goal of medicine should be to build the patient's strength through an appropriate diet and hygienic measures, resorting to more drastic treatment only when the symptoms showed this to be necessary. Hippocratic medicine was, humbly, very kind to the patient, sterile and gentle whenever possible. For example, only clean water or wine was ever used on wounds, though "dry" treatment was preferable. This was in contrast to the contemporary Cnidian school, which stressed detailed diagnosis and classification of diseases to the point of ignoring the patient. Hippocrates probably had an inkling of Mendelian and genomic factors in heredity, because he noted not only many of the signs of disease but also that symptoms could appear throughout a family or a community, or even over successive generations.
Further reading	

2

Author	Aristotle, 4 th cent. BC
Images	
Anatomy Pathology	His observations about the location and shape of the kidneys are similar to those of Hippocrates. He (wrongly) stated that the right kidney is higher than the left, but he (rightly) described the perirenal fat. He further elaborated on the path of the renal vessels inside the kidneys. He rightly commented on the "consumption" of the arterial capillaries in the renal parenchyma and not in the cavity. We note an accurate description of the anatomical relationship between the abdominal aorta and the vein and their bifurcation. He also described the relationship between the renal vessels and those ending in the bladder.
Physiology	He considers the kidneys as not absolutely necessary for the excretion of waste products. Firstly, because there are animals who excrete this product through their lungs and skin, like some reptiles, and secondly because even those who have kidneys use them to pre-purify the blood and send the filtrate to the bladder where it is perfectly turned to clear urine and excreted. Thus, kidneys are assistants to the work of the bladder.
Chemistry	
Disease	He linked sexual over-activity to renal weakness and he reported that the kidneys frequently appear full of stones and abscesses.
Therapy	
Technical	
General Comments	
Biography	
Further reading	

3

Author	Erasistratus, 3 rd century BC
Images	

Anatomy Pathology	He introduced the word "parenchyma" which we use even to day, in attempt to explain the rich blood supply of the kidneys. He could not apparently see the glomeruli and he assumed that the blood was purring out and beside the renal arterioles, in Greek " <i>parenchyneto</i> ". .
Physiology	He was the first to state that urine is formed in the Kidneys, but Galen later challenged this pioneering statement. He also experimented with a hen, which he enclosed in a cauldron, trying to estimate the transpiration and he succeeded to it.
Chemistry	
Disease	
Therapy	
Technical	
General Comments	
Biography	Greek physician and anatomist, was born around 250 BC, his year of death being uncertain. He founded the school of anatomy at Alexandria. He is credited with being the first to distinguish between motor and sensory nerves. He traced veins and arteries to the heart, and named the trachea and the tricuspid valve of the heart. He was the first major exponent of the theory of pneuma.
Further reading	

4

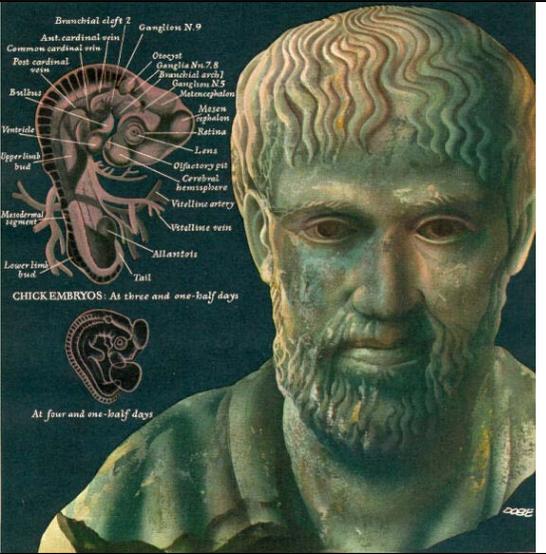
Author	Philo Judeus, 1st cent. BC
Anatomy Pathology	He correctly suggested that the role of perirenal fat is to support and protect the kidneys, but incorrectly hypothesized that it also protects the ureters to deliver unobstructed sperm to the genitals.
Physiology	The kidneys are sanguineous pools where the clearing of the liquid excrements takes place.
Chemistry	
Disease	
Therapy	
Technical	
General Comments	
Biography	A Hellenised Jew of Alexandria, and a very famous historian and writer, born about 30 B.C, died about 45 A.D. He was a great mystic and his works abound with metaphysics and noble ideas, while in esoteric knowledge he had no rival for several ages among the best writers.
Further reading	

5

Author	Pedanius Dioscurides, 1st cent. AD
	(SEE ATTACHED FILES)

Anatomy	
Pathology	
Physiology	
Chemistry	
Disease	
Therapy	<p>Dioscurides' celebrated work '<i>Materia Medica</i>' includes many substances that can be used for renal ailments. Namely, he recommends 12 mineral, 16 animal, and 48 liquid and 192 vegetable products. Only three examples are presented here:</p> <p>Kyklaminos: <i>Cyclamen europaeum</i>: Cyclamen, sowbread</p> <p>This herb's name (cyclamen means "circle" in Greek) derives from its bulb-like, underground stem. Dioscurides suggested its use as a purgative, antitoxin, skin cleanser, and labour-inducer. When used as a purgative, juice from the tuberous rootstock was applied externally, either over the bowels and bladder region or on the anus. Dioscurides also mentioned its use as an aphrodisiac. Many English farmers called Cyclamen "stag-truffle" or "sowbread" as they often observed deer and swine digging up and eating the roots. The variant '<i>Colchicum Autumnale</i>' was recommended for the treatment of gout, and the drug colchicin derives from this.</p> <p>Strychnos Megas Kepaios: <i>Solanum nigrum</i>: Black Nightshade</p> <p>A relative of the notorious <i>Atropa belladonna</i>, or Deadly Nightshade, the Black, or Garden, Nightshade is potentially harmful, but its poison is relatively mild. Dioscurides recommended its leaves for treating skin diseases. He also suggested a decoction of the plant's leaves for earaches, indigestion, and internal bleeding as well as colics.</p> <p>Artemisia</p> <p>An early medical reference to it was made in <i>Materia Medica</i>, wherein its properties as a warming, drying and purgative drug are described. The plant was also called oxetesia, ephesia, anactorios, sozusa, lea, lycophrys, sanguis hominis, chrysanthemon, herba regia, rapium, tetrabageta, ponem, and zuoste. It was synonymous and/or likened to absinth. It was recommended for many diseases such as parasites of the bowel, kidney stones and intended miscarriage of dead embryos.</p> <p>Animal products</p> <p>We have traced several nephrological drugs of animal origin in Dioscurides's <i>Materia Medica</i>. They range from the common, e.g. earthworms, to the exotic, e.g. camel's milk.</p> <p>Mineral products</p> <p>Twelve minerals and fossils were traced, which were prescribed for anuria, dysuria, colic, bladder lithiasis and gout. These were the Lithoi (stones): Haematite, Gagates (Fossil Bitumen), loudaikos (Fossil Spines of Sea-Urchins), Lithos Spongion (Sponge-Stones),</p>

	Terra Samia, Geodes, Asios, Korallion (Isis Nobiblis), Alkyonion, Ales (Salt), Theion (Sulphur) and Burned Bricks.
Technical	Dioscurides accurately describes all the procedures for producing the drugs named in <i>Materia Medica</i> . These included the drying, boiling, solidifying, mixing with wine, water, milk, honey or other substances the various therapeutic agents.
General Comments	<p>The oldest known copy of his work is the <i>Juliana Anicia Codex</i> (ca. 512 A.D.), housed in the Austrian National Library in Vienna. Listed as <i>Codex Vindobonensis Medicus Graecus 1.</i>, it is better known as "Vienna Dioscurides," the oldest and most valuable work in the history of botany and pharmacology. It is certain that a Byzantine artist illustrated Dioscurides' codex for presentation to Juliana Anicia, the daughter of Emperor Anicius Olybrius, on the inauguration of a temple she had erected in Constantinople. The choice of the gift was probably compatible with Anicia's perception of herself as heiress of king Solomon. The artist seems to have based his work on illustrations from the <i>Rhizotomicon</i> of Crateuas of Pergamon (1st century B.C.), as well as other artists. It had been extensively copied in both the East and the West, to such an extent that many of the illustrations were eventually distorted and the plants are not recognizable in nature.</p> <p>Although the work is usually called an herbal, in reality it contains pharmaceutical information for all types of drugs. Thus, the first volume deals with aromatics (e.g. oils, gums); the second, with living creatures, fats, cereals, and herbs; the third, with roots; the fourth, with "other herbs and roots"; and the fifth, with wines and vines. In total, Dioscurides described about 1,000 remedies, with almost 5,000 uses, using approximately 600 plants and plant products, as well as a few animal products and minerals. His work remained in use until about CE 1600. Unlike many classical authors, his books were not "rediscovered" in the Renaissance, because they never left circulation. The <i>Materia Medica</i> was often reproduced in manuscript form through the centuries, often with commentary on Dioscurides' work and with minor additions from Arabic and Persian and other sources. Some editions were alphabetized for quick reference, which made his works a type of early medical dictionary.</p>
Biography	Pedanius Dioscurides (c. 40 in Anazarbus, Cilicia - c. 90) was an ancient Greek physician, pharmacologist and botanist who practiced in Rome during the rule of Nero. He was from Anazarbus, a small town near Tarsus in what is now south-central Turkey. Reputably, he was a surgeon with the army of the emperor so he had the opportunity to travel extensively seeking medicinal substances from all over the Roman and Greek world. Dioscurides is famous for writing a five-volume book ' <i>Peri Yles Iatrikes</i> ' which was later translated into Latin as <i>De Materia Medica</i> that is a precursor to all modern pharmacopeias.
Further reading	Gunther R., <i>The Greek Herbal of Dioscurides, Illustrated by a Byzantine</i> A.D. 512 - Englished by John Goodyer A.D. 1655 - Edited and first printed A.D. 1933, University Press, Oxford, Book I, recipe: 34, 35, 36.

Author	Rufus Ephesius, 1 st – 2 nd cent. AD
Images	 <p>The image shows a detailed anatomical diagram of a chick embryo at three and one-half days of development. The diagram is labeled with various parts: Brachial cleft 2, Ant. cardinal vein, Common cardinal vein, Post. cardinal vein, Brachial vein, Venous sinus, Upper limb bud, Mandibular segment, Lower limb bud, Tail, Allantois, Vitelline artery, Vitelline vein, Olfactory pit, Cerebral hemisphere, Retina, Lens, Iris, Choroid, Vitelline vein, Mesencephalon, Metencephalon, Myelomeres, Somites, and Ganglia N. 9, 8, 7, 6, 5, 4, 3, 2, 1. Below the main diagram, there are two smaller diagrams labeled 'CHICK EMBRYOS: At three and one-half days' and 'At four and one-half days'. To the right of the diagram is a bust of Rufus Ephesius, a bearded man with a prominent nose and a serious expression.</p>
Anatomy Pathology	He describes the location of the kidneys, the ureters and the urethra, insisting that we should use the word ureters exclusively for the tubes that connect the kidney with the bladder and not for the urethra also, as was reputedly done by others.
Physiology	
Chemistry	
Disease	He wrote the most extensive treatise on Renal Diseases in Antiquity. From the very beginning, he differentiated between the acute and spectacular symptoms of the lower genitourinary tract afflictions, which occur more frequently in younger patients, and the chronic, salient upper tract diseases that afflict older people. He elaborated on infective diseases of the tract, describing their symptoms and - occasionally fatal - outcome. In a very interesting case, he describes a renal abscess evacuating itself spontaneously in the bowel. In parallel, he also describes renal stones and their symptoms in detail, standing upon the impact of age, the season of the year, diet, and way of living. He described a disease (apparently chronic renal failure) with renal sclerosis, stating that it is chronic, without noisy symptoms, resulting in cachexia, lethargus, and generalized oedema. He suggests (with foresight) that haematouria is due to a widening of the renal tissue, hence the kidneys cannot filter urine efficiently, and blood passes with it. Usually, other substances that either precipitate or float in the urine pass out simultaneously with blood. He also described salient recurring haematouria. There is a description of an entity reminiscent of mellitus or insidious diabetes, characterized by heavy polyuria, thirst, emacipation, and death caused by oedema.
Therapy	In his works, Rufus mentions the same cathartic methods with other physicians; namely venesection, enemas, diuretic drugs, embrocations, cupping, baths and a careful diet. He adds though an interesting method for perspiration provocation in his work " <i>On the renal diseases</i> " and in the paragraph "on increased polyuria [urine diarrhoea]": " <i>because it is good for them to be able to perspire if diuresis stops. The best of all is a steam bath in a small vat with the head coming out from the top, so that, while the rest of the body is being heated, one can breathe cool air</i> ". He also makes an interesting report in another paragraph

	titled "on renal sclerosis": "One should relieve such people by rubbing and with embrocations and thermal baths and by prescribing them diuretics and enemas. Thus there is hope for the movement of the limbs to recover and for them not to fill with liquids".
Technical	
General Comments	
Biography	
Further reading	clendening.kumc.edu/ dc/pc/a.html

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Author	Galen, 1 st – 2 nd cent. AD
Images	<p>Galen and Hippocrates</p> <p>This image represents the split in the classical Greek medical lineage. The Tree of Life represents the Healing Arts. On the right is Hippocrates holding in his right hand a flowering branch symbolizing the vitalist schools. In the patriarch's left hand is the text of the Hippocratic Cannon. To his left is Galen holding the withered branch of reductionist, mechanistic medicine. The blooming flower is De Medicina Futura, Homoeopathy.</p> 
Anatomy Pathology	<p>He made a differential diagnosis between the veins (which do not pulsate and do not have a double wall) and the arteries (which contain air, referred to as <i>pneuma</i>). This is a point of his teachings that had been repeatedly condemned and scorned upon by later doctors.</p> <p>However, from the careful reading of his works it can safely be assumed that when speaking about <i>pneuma</i>, Galen meant air-containing blood, i.e. oxygenized air. He also described the ureters (which do not contain blood and have different wall structure). He suggested that there is an ureteropelvic sphincter prohibiting the ureteric reflux and experimentally proved its existence. However, he repeated the ancient writers' wrong notion about the higher position of the right kidney. The blood supply to the kidneys was described in detail. He also suggested, based on anatomical observations, that the nerves of the kidneys are outgrowths of the third cerebral vertebra. Galen was the father of the experimental method in medical investigation, and throughout his life dissected animals in his quest to understand how the body functions. He also recommended that other doctors practice dissection as a means of discovery as well as to improve surgical skills. However, because his knowledge was derived for the most part from animal (principally the Barbary ape), rather than human</p>

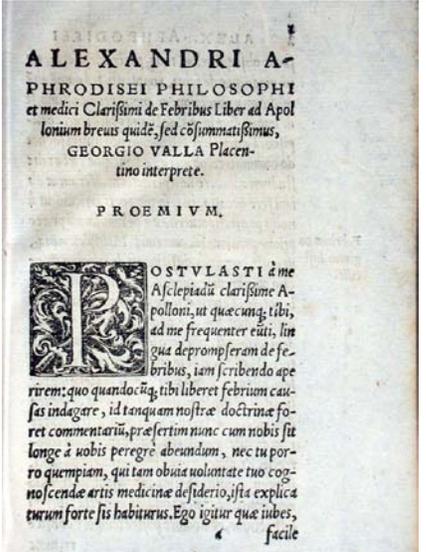
	<p>dissection, Galen made many mistakes, especially concerning the internal organs. For example, he incorrectly assumed that the <i>rete mirabile</i>, a plexus of blood vessels at the base of the brain in ungulate animals, was also present in humans. In spite of Galen's mistakes and misconceptions, his writings reveal an astonishing wealth of accurate detail.</p>
Physiology	<p>Galen held that the kidney is one of the organs used for clearing away body waste, like the intestines, the skin, the nose, the mouth. He indisputably showed that urine is produced in the kidneys and not in the bladder, by tightening the ureters of an animal and observing that they became so extended as ready to burst. When he untied them, urine started to pour in the bladder, a proof that it is formed in kidneys. This simple statement did not satisfy him, so he tried to explain why this happened. In his usual polemic manner he refuted other writers, mainly Erasistratus, who albeit accepting the basic thesis that urine was formed in the kidneys, failed to explain why. Using a complicated series of arguments he hypothesized that it was not seer gravity that caused the drawing of blood to the kidneys and the separation of urine from it, but some intrinsic power or property of the kidneys themselves. For this reason, the arteries supplying the kidneys were very large compared to the organ's weight, in order to purify as much blood as possible. However, the blood that enters the kidney is not solely used for purification, but also as nutrient for the kidney itself. Hence, the thinner compound of the blood containing the waste toxins (yellow bile) is excreted, while the thicker one remains in the renal blood steam.</p> <p>Moreover, to avoid formed urine mixing with blood, the kidneys have a thickly woven consistency. Worth mentioning are his comments in a polemic against other doctors on possible blood purification. He said that although we would be able to treat any disease if it was possible to take all blood out of the body and clean it extra-corporally and then transfer it back to the body, in reality we could not achieve much, because it was not the blood that suffered but an internal organ, which would continue to generate impurities and pollute the blood again. This thesis can rightly be considered as the first theoretical proposal for the possibility of dialysis and the latter's inferiority to transplantation. Still, it would have no practical appliance for another eighteen centuries.</p> <p>Many of Galen's anatomical and physiological observations were accurate. He proved that urine was formed in the kidney (as opposed to the bladder which was the common belief). He correctly identified seven of the 12 cranial nerves, discovered the heart valves, recognized the contagiousness of tuberculosis, and the possible spread of rabies via dogs. People such as Vesalius and Harvey finally refuted many of Galen's notions.</p>
Chemistry	
Disease	<p>He commented extensively on Hippocrates' works. He reported kidney damage after strenuous exercise e.g. horse ridding. The exacerbation of "nephritis" and gout after over-indulging in food and drink was noted. He commented with insight on the filtrating capacity of the kidneys, by saying that it is based on the secretion of a serous matter, different from blood, in the area where minute vessels merge together. While, if this failed, the serous matter with the waste products is diffused in the whole body, causing oedema. He differentiates between anuria and retention of the urines, adding that obstruction of the urinary tract may be caused by stones and also by thrombi created in haemorrhagic and infective situations. The radiation to neighbouring organs of a pain due to renal disease was</p>

	<p>noted, as well as the differentiating signs between a renal and an intestinal colic. He also differentiated between pus coming from the kidneys (mixed with urine) and that coming from the bladder (pure pus). Extremely interesting is the statement that the hair-like sediment of the urines (casts) is not formed in the renal pelvis but in the renal capillaries (!). Equally interesting is the statement that haematuria may be due to weakness of the kidneys themselves to prevent blood from escaping in the urine, or to the blood vessels while the kidneys remain intact. He hypothesized that the same cause that produces excess of water - drinking in diabetes - also produces polyuria, which is explained by some "weakness" of the kidneys. A very rare case of a renal abscess evacuated through coughing was reported, and explained by free discharge of the pus from the kidney to the venous circulation, then to the heart and thence to the pneumonic vessels.</p>
<p>Therapy</p>	<p>Galen performed many audacious operations that were not again used for almost two millennia, including brain and eye surgery. He reputedly performed an emergency pericardiectomy to a woman with cardiac tamponate who frequently fainted because of it. After the operation the patient recovered His favourite subject was the Barbary ape, on who also performed experimental pericardiectomy.</p>
<p>Technical</p>	<p><i>Galen's contribution to the evolution of medical statistics is usually ignored. We present here only one example: "I assert that experience has shown that what has produced a similar result in three cases can produce the reverse in three others. I say that a thing seen may be seen exactly as before, and yet belong to those things, which are of both kinds, or to those things that happen often or to those things that take place but rarely. [...] What is to prevent the medicament that is being tested for having a given effect on two hundred people and the reverse effect on twenty others; and to prevent that of the first six people who were seen at first and on whom the remedy took effect, three belong to the two hundred and three to the twenty without you being able to know which three belong to the two hundred and which to the twenty, even if you were a soothsayer? ... Therefore I say of what has been seen but once, that is not technical, just as the single grain of wheat is not a perfect heap; but if it is a thing that is seen many times in the same way, then I call it technical. ..."(20)</i></p>
<p>General Comments</p>	<p>Reportedly, he employed twenty scribes to write down his words. In 191, a fire in the Temple of Peace destroyed some of his records. ("Nature" - Greek <i>physis</i>) - a major reason why later Christian and Muslim scholars could accept his views. His fundamental principle of life was <i>pneuma</i> (air, breath) that later writers connected it with the soul. These writings on philosophy were a product of Galen's well-rounded education, and throughout his life Galen was keen to emphasise the philosophical element of medicine. <i>Pneuma physicon</i> (animal spirit) in the brain took care of movement, perception, and senses. <i>Pneuma zoticon</i> (vital spirit) in the heart controlled blood and body temperature. "Natural spirit" in the liver handled nutrition and metabolism. Although he was not a Christian, Galen's writings reflect a belief in only one god, and he declared that the body was an instrument of the soul. This made him acceptable both to the fathers of the church and to Arab and Hebrew scholars.</p> <p>Galen's works in many ways came to symbolize Greek medicine to the medical scholars of Europe and the Middle East for the next fifteen centuries. His message of observation and experimentation were largely lost, however, and his theories became dogma throughout the West. In the mid-16th century, however, his message that observation and investigation were required for through medical research began to emerge, and modern methods of such research finally arose. If the work of Hippocrates represents the foundation of Greek</p>

	<p>medicine, then the work of Galen, who lived six centuries later, is the apex of that tradition. Galen crystallised the best work of the Greek medical schools, which had preceded his time. It is essentially in the form of Galenism that Greek medicine was transmitted to the Renaissance scholars.</p>
Biography	<p>The most famous doctor in the Roman Empire was a Greek, named Galen (1st – 2nd century AD) (<u>Greek</u>: Γαληνός, <i>Galēnos</i>, born in Pergamum. Because in several epigrams a C followed his name, i.e. Galen C., it was wrongly thought that the famous Roman family of Claudii adopted him and the C stands for Claudius. In reality, the C. stands for 'Clarissimus' meaning 'Glorious' in Latin.</p> <p>His parents gave to Galen an education that prepared him to be a philosopher, but at the age of 16, he changed his mind and decided to become a doctor. He studied in Greece, in Alexandria and other parts of Asia Minor and returned home to become chief physician to the gladiator school in Pergamum. During this time he gained much experience of trauma and wound treatment. He later regarded wounds as "windows into the body". Galen was very ambitious and set his sights on Rome. A combination of self-promotion, skill with otherwise 'incurable' patients, vast knowledge and, as is often the case, good connections made him well known around town.</p> <p>An outbreak of plague in Rome forced him back to Pergamum, but in 168-9 he returned to Italy to serve as physician to Lucius Verus and Marcus Aurelius during a military campaign in Northern Italy. Galen then went back to Rome with Aurelius to serve as his personal physician. He would later serve as physician to Aurelius's successors, Commodus and Septimius Severus.</p>
Further reading	<p><u>Hahnemann on Constitution and Temperament, Chapter One: Constitution, Temperament & Diathesis</u></p> <p>Scarborough J. Galen's investigations of the kidney, <i>Clio Med.</i> 1976,Oct;11(3):171-7 Crombie AC, editor. Galen in: <i>Styles of scientific thinking in the European tradition</i>. London: Duckworth, 1994:224-225 pp.</p>

Author	Areteus Cappadociensis, 2 nd century AD
Images	
Anatomy Pathology	
Physiology	Special attention should be given to Areteus's remark that, in what we call now a day diabetic nephropathy, the disease may be located in the kidneys (correct) but it may also be explained

	by some melting of muscles which are then excreted via the kidneys (equally correct).
Chemistry	
Disease	<p>He repeats earlier writers' description of renal colics and renal infections. He states that renal colics, although very painful and spectacular, do not jeopardize a patient's life. There is a detailed classification of renal stones according to their size, shape, opacity, location in the urinary tract etc. However, if they cause urine retention with or without infection, the outcome is always very serious and, if left untreated, fatal. Again there are detailed descriptions of different renal abscesses and a very interesting description of diabetic nephropathy with emphasis on polyuria and polydipsia. He likened the symptoms with those appearing after a biting by the poisonous snake "<i>dipsas</i>" so called because it causes thirst (dipsa).</p> <p>He defined gout as a disease appearing in crisis, reinvented the word "diabetes", described the urinary tract dilatation secondary to obstruction of the bladder and supported the idea of physical removal of a renal calculus through exercise.</p>
Therapy	He repeats the usual recommendation for various herbal remedies and/or venesection for renal diseases. An interesting comment of his is the statement that it is very difficult to cure chronic lithiasis, especially in the old age. Afflicted patients will eventually die carrying their problem. Hence only alleviating treatment is recommended. Because, if a body has the fertile ability to deliver stones, it is easier to turn a sterile woman to a mother than to stop the formation of stones.
Technical	
General Comments	<p>As a general comment, some fractions of Areteus's treatise on diabetes and its affliction on kidneys are presented. However, it must be kept in mind that although Areteus is considered the first describer of diabetes, Dimitrius of Apammia had briefly reported the disease in the second century BC. "<i>Diabetes is a strange affection, not very frequent among men, being a melting down of the flesh and limbs into urine. Its cause is of a cold and humid nature as in dropsy. The course is a common one, namely the kidneys and bladder, for the patients never stop making water, but the flow is incessant, as if from the opening of aqueducts. Hence the disease appears to me to have got the name diabetes, as if from the Greek word which signifies a siphon, because the fluid does not remain in the body, but uses the man's body as a bladder whereby to leave it. They stand out for a certain time, though not for very long for they pass urine with pain, and the emaciation is dreadful; nor does any great portion of the drink get into the system, and many parts of the flesh pass out along with the urine. The nature of the disease then is chronic, and it takes a long period to form, but the patient is short-lived if the constitution of the disease be completely established; for the melting is rapid, the death speedy</i>".</p> <p>Moreover, life is disgusting and painful; thirst unquenchable; excessive drinking, which however is disproportionate to the large quantity of urine for more urine is passed; and one cannot stop them either from drinking or making water. Or if for a time they abstain from drinking, their mouth becomes parched and their body dry; the viscera seem scorched up; they are affected with nausea, restlessness, and a burning thirst; and at no distant term they expire, thirst as if scorched by fire. The cause of this may be that some of the acute diseases may have terminated in this; and during the crisis of the disease may have left some malignity lurking in the part.</p> <p>But if anyone is bit by the dipsas [a species of viper] the affection induced by the wound is of this nature; for when the reptile dipsas bites one, it causes an unquenchable thirst. Others do no</p>

Images	
Anatomy Pathology	
Physiology	He emphasizes the fact that kidney function influences the whole body, while that of other organs, e.g. bones, muscles, veins affects a particular part of it. He states that blood has four varieties. The thicker that is captured in the spleen, the even thicker that is excreted with the faeces and the clear blood that is used as a nutrient for the body
Chemistry	
Disease	He repeated the reasons for the different location of stones in younger and older patients.
Therapy	
Technical	
General Comments	Two treatises have come down to us, which have been ascribed to <i>Alexander Aphrodisiensis</i> , of Aphrodisias, in Caria, and the most celebrated of the commentators on Aristotle.
Biography	
Further reading	

Author	Oribasius Pergamenus, 4 th cent. AD
Images	(SEE ATTACHED FILES)
Anatomy Pathology	Oribasius in the 4 th century was the first to recommend a truss for hernia, to describe the function of prostate and the rectal muscles and lastly, to treat hypospadias.
Physiology	He repeated Galen's thesis about the shape and role of the kidney in separating urine from blood and he added the precise statement that the whole amount that is secreted from the renal granules is then excreted as urine, while the remaining clear blood feeds the whole body.
Chemistry	
Disease	He commented widely on other writers' works, mainly Rufus's. He accurately epitomized the thesis that generalized oedema may be caused either by an excess of whole body fluid, or by ailments of the liver (cirrhosis?). Equally successful was the explanation that thick substances in the urine appear when the pores of the renal sieve (finistrae?) are damaged and become wider, allowing thicker than normal material to pass through.

Therapy	He devotes a large part of his works to the dietary importance of many foods in facilitating or obstructing the normal function of the kidneys. Moreover he repeats the usual methods of the past, like venesection.
Technical	
General Comments	
Biography	<p>Oribasius (c. 320-400) was a Greek medical writer and the personal physician to the Roman emperor Julian the Apostate. He was born in Pergamum of Mysia and established Byzantine nephrology. He studied at Alexandria under Zeno of Cyprus before joining Julian's retinue. He was involved in Julian's coronation in 361, and history has it that in 362, on behalf of his emperor Julian the Apostate, Oribasius visited the Delphic oracle, now in a rather desolate state, offering his emperor's services to the temple and, in return, receiving the very last prophecy by the Delphic Pythia, announcing the final death of the Olympic pagan religion. He remained with the emperor until Julian's death in 363 AD. In the wake of this event, Oribasius was banished to foreign courts for a time, but was later recalled by the emperor Valens.</p> <p>Oribasius's major works, written at the behest of Julian, are two collections of excerpts from the writings of earlier medical scholars, a collection of excerpts from Galen and the <i>Collectiones</i>, a massive compilation of excerpts from other medical writers of the ancient world. The first of these works is entirely lost, and only 25 of the 70 (or 72) books of the <i>Collectiones</i> survive. This work preserves a number of excerpts from older writers whose writings have otherwise been lost, and has thus been valuable to modern scholars.</p>
Further reading	<p>Renal and Glomerular Circulation according to Oribasius (4th Century) <u>Eftychiadis, A.C.</u> Am J Nephrol 2002; 22:136-138 (DOI: 10.1159/000063751) <u>Article (PDF 105 KB)</u> http://www.ub.unibas.ch/kadmos/gg/pic/gg0350_007_txt.htm</p>

Author	Nemesius of Emesa, 4 th cent. AD
Images	
Anatomy Pathology	
Physiology	He repeated Alexander's theories about the four elements of blood
Chemistry	
Disease	
Therapy	
Technical	
General Comments	A Christian philosopher, apologist, and bishop of Emesa (now Hims, Syria) who was the author of the treatise: "On the Nature of Man" (<i>Peri physeos anthropou</i> , in Greek:), the first known compendium of theological anthropology with a Christian orientation. The treatise considerably influenced later Byzantine and medieval Latin philosophical theology.

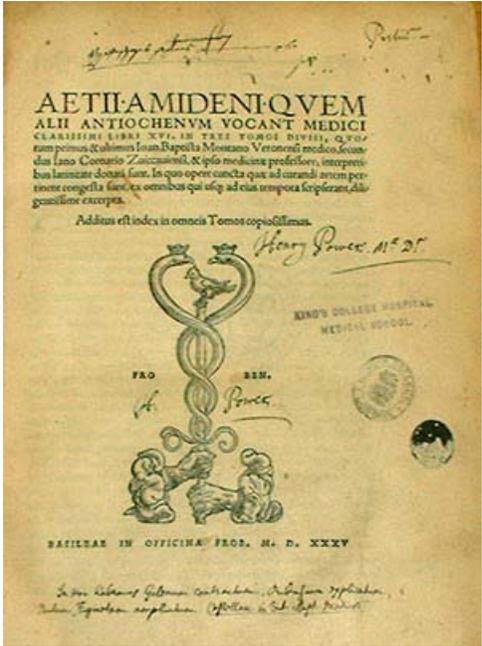
Biography	A man of extensive culture, Nemesius integrated elements from various sources of Hellenistic philosophical and medical literature. He used the experimental physiology of the 2nd-century Greek physician Galen and the observations of other men of science, the philosophy of Neoplatonic Idealism (Alexandrian influence), and Aristotelian Realism (Antiochene influence). The result is a Christian synthesis that cannot be characterized as representing any specific philosophical school. "On the Nature of Man" lacks logical unity in its arrangement of material, and its abrupt ending indicates that the work was unfinished or was intended for revision. The opening chapter criticizes the concepts of man advanced by the Greeks from Plato to the 3rd-century Christian sectarians; it then emphasizes the place of man in the plan of creation as delineated in the Mosaic literature of the Old Testament and in the letters of St. Paul. Because man bridges the spiritual and material worlds, Nemesius maintains, he requires a unique intelligent principle of life, or soul, proportionate to his dignity and responsibility. He submits that the soul must be an incorporeal, intellectual entity, subsistent in itself, immortal, and yet designed to be one with the body.
Further reading	Nemesius Of Emesa. <u>Encyclopædia Britannica</u> . 2006. Encyclopædia Britannica Premium Service. 13 July 2006 < http://www.britannica.com/eb/article-9055234 >. De Natura Hominis. Liber Unus, Denovo Recognitvs et Manuscriptorum Codicum Collatio

12

Author	Palladius Alexandrinus, 5th cent. AD
Images	
Anatomy Pathology	He states that the kidneys lack nerves, and thus do not feel pain. They may only feel a heaviness and discomfort, if there is stone in their flesh. If the pain is excruciating, it means that the stone has moved from inside the kidney to neighbouring areas.
Physiology	
Chemistry	
Disease	He greatly elaborates on Hippocrates' description and pathology of renal lithiasis. He differentiates the causes of renal stones in children and adults and he clearly states that by the term "nephritis" we usually mean renal lithiasis.
Therapy	Apart of the usual to Byzantine doctors' recommendations, he elaborates on Hippocrates' instruction to use gymnastics and running to prevent and/or treat renal lithiasis and to combine them with a light diet.
Technical	
General Comments	
Biography	Palladius, Greek doctor and sophist (iatrosophista) of the 5 th century A.D. who lived and worked in Alexandria. Writer of small medical treatises (synopses) and comments on Hippocrates works (scholia).
Further reading	

13

Author	Alexander Trallianus, 6 th cent. AD
Images	
Anatomy Pathology	
Physiology	
Chemistry	
Disease	<p>There is again a treatise on differentiating renal from intestinal colics. He describes in detail the clinical findings of generalized oedema and, interestingly, the persistence of the mark of the finger after the pressure on the flesh is lifted. He discusses the pathogenetic mechanism of an infection which he identifies with excessive blood accumulation, but he also emphasizes that it is not only the amount of the accumulated blood but also its foul quality to be blamed. Generally, he is a compiler.</p> <p>Alexander put forward the hypothesis that renal stones are formed in cases of "thick humours accumulated in the kidneys."</p>
Therapy	He presents many compound medicaments as painkillers in renal lithiasis, describing the exact dose of their ingredients. He also strongly recommends baths for the same infliction.
Technical	
General Comments	
Biography	Alexander Trallianus, (c. 525 – c.605) was a Greek physician born in Tralles in Lydia (now Turkey). He lived probably about the middle of the 6th century and practised medicine with success at Rome. The Greek text of one of his works was printed in Paris in 1548 and his <i>De Lumbricis</i> at Venice in 1570.
Further reading	

<p>Author</p>	<p>Aetius Amidanus, 6th cent. AD</p>
<p>Images</p>	 <p>The image shows the title page of a manuscript. At the top, there is a handwritten signature and the word 'Probat'. Below that, the title 'AETII AMIDENI QVEM ALII ANTIQVORVM VOCANT MEDICI' is printed in a bold, serif font. Underneath the title is a block of Latin text in a smaller font, followed by a line that reads 'Additas est index in omnia Tomos copiosissimus.' In the center of the page is a large, ornate caduceus (a staff with two snakes entwined around it and wings at the top). To the right of the caduceus, there is a circular stamp that reads 'HENRY POWELL M.D. 25' and 'KING'S COLLEGE HOSPITAL MEDICAL SCHOOL'. At the bottom of the page, there is another line of Latin text: 'BASILIAE IN OFFICINA PROB. M. D. XXXV'. There are also some handwritten notes at the very bottom of the page.</p>
<p>Anatomy Pathology</p>	
<p>Physiology</p>	
<p>Chemistry</p>	
<p>Disease</p>	<p>He differentiates between intestinal and renal pain, repeats what already has been written about diabetic nephropathy, describes some symptoms that may be assigned to chronic renal failure, like lack of pain, occasional fever, emaciation, recurrent haematuria, faintness and paroxysmal blindness. If nephrosclerosis coexists, anasarca oedema would appear. The aetiology of lithiasis and haematuria after stress is discussed as also that of stone formation. He described orchitis and testicular carcinoma, classified renal stones, classified three different types of hydrocele and advocated the surgical drainage of renal abscesses.</p>
<p>Therapy</p>	<p>He describes the mode of action of several herbal drugs used in renal ailments. He refers to the venesection and various purgative measures, emphasizing the beneficial role of vomiting. He recommends diuretics for the treatment of diabetes. A pleasant instruction was the moderate use of wine by the elders.</p>
<p>Technical</p>	
<p>General Comments</p>	<p>Aetius Amidanus, in the 6th century AD, returns to the old belief in the healing power of the humidity of statues in gyms – Christianity has in parallel promoted the collection of hallowed moisture (agiasma) from relics, buildings and various objects associated with certain saints. The same author repeats Orivasius' opinions on the right colour of urine before training and on the freedom of athletes to consume larger quantities and more nutritious food than common mortals. However, his reference of the blindness due to nephropathy may be linked with the current knowledge of several oculorenal syndromes, or the sudden blindness due to intraocular pressure because of anasarca oedema and/or hypocalcaemia.</p>
<p>Biography</p>	

Further reading	
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15

Author	Stephanus Alexandriensis, 7 th cent. AD
Images	
Anatomy Pathology	
Physiology	
Chemistry	
Disease	
Therapy	
Technical	
General Comments	
Biography	Greek mathematician and philosopher of the 7 th c. A.D., who taught in the university of Constantinople (established by the Byzantine Emperor Theodosius II, 401-450 A.D.) during the era of Emperor Heraklius. Reputably, he was a pupil and co-worker of the renowned doctor Theophilus. It's very likely that Stephanus did not practice medicine himself. He wrote many treatises however, 'memoranda' on Hippocrates, Galen and Aristotle's works as well as various works on philosophy and astronomy.
Further reading	

16

Author	Paulus Aegineta, 7 th cent. AD
Images	
Anatomy Pathology	
Physiology	
Chemistry	
Disease	Another compiler. However, he tries in an apologetic fashion to explain why Hippocrates did not write a whole disease on the renal problems but left only scattered fragments on them. He brilliantly puts forward some etymological explanations about the identical terms used for different renal problems and their causes, like phlegm, nephritis, colic, nutrient and heaviness. These explanations are not always correct but underline the ancient Greek writers' feeling of inaccuracy in their descriptions of kidney diseases.
Therapy	He presents a long list of herbal remedies for kidney diseases, used either internally or externally. Some of his drugs are quite exotic, like the blood of a male goat or the dried decapitated bodies of cicadas.
Technical	
General	

Comments	
Biography	<p>Paul of Aegina or Paulus Aegineta (625? –690?) was an Aegina-born 7th-century ancient Greek physician best known for writing the medical encyclopaedia <i>Medical Compendium in Seven Books</i> (in Greek: <i>Epitomes iatrikes biblia hepta</i>). For many years in the Byzantine Empire, this work contained the sum of all medical knowledge of the then known world and was unrivalled in its accuracy and completeness.</p> <p>The sixth book on surgery in particular was referenced in the European and the Arab worlds throughout the Middle Ages and is of special interest for surgical history. The whole work in the original Greek was published in Venice in 1528, and another edition appeared in Basel in 1538. Several Latin translations have been published and it was first translated into English, with commentary by Dr. Francis Adams sometime between 1844 and 1848.</p> <p>He remained in Alexandria after the Arabic invasions. He was called by the Arabs Al Qawabily, which means the Gynaecologist, because he described in detail the male and female genitalia. He also performed exclusively therapeutic orchiectomy and surgically treated hydrocele and vericocele. His writings and his works particularly influenced the Arabians who <u>studied</u> and translated them. He studied and practiced at Alexandria and also at Rome.</p> <p>The whole work in the original Greek was published in Venice in 1528, and another edition appeared in Basel in 1538. Several Latin translations have been published and it was first translated into English, with commentary by Dr. Francis Adams sometime between 1844 and 1848.</p>
Further reading	For his medical writings as they were known in Arabic, see <u>Ullmann, <i>Medizin</i></u> , pp. 86-87; <u>Sezgin <i>GAS III</i></u> , p. 168-170. For an English translation of the medical encyclopaedia by Paul of Aegina, see, <i>The Seven Books of Paulus Aegineta</i> , trns. by Francis Adams (London: Sydenham Society, 1844-1847).

Author	Theophilus Protospatharios, 7th cent. AD
Images	A manuscript illustration in MS 3632, FOL. 512, Un. Bologna, depicts him sitting, while his assistant Plossos fetches him a uroscopy bottle in a special canister. An array of vials with several urine colours is lying at the bottom of the illustration.
Anatomy Pathology	He repeats the ideas on the subject by previous writers.
Physiology	
Chemistry	
Disease	He described the various findings from uroscopy according to the patient's particular tissue damage. He elaborates on Hippocrates' comment that if the perirenal fat is melting away, the urines will have an oily appearance. He presents - in between other comments - a list of the various renal problems of the elderly, in an imaginary dialogue between himself, Stephanus Atheniensis and Damascius.
Therapy	

Technical	A similar report with Actuarius comments on the heating of urines can be found in the writings of Theophilus Protospatharius (7 th c. AD): <i>"So what must be learned is that in all kind of urines we inspect four qualities, the composition of the urines, its colour, the substance and the solutes; [...] And the ones that become thick not from the inside [of the body] but because of the cold air, will become thin again when warmed in warm water [...]"</i>
General Comments	He was the most important uroscopist of Byzantium until Johannes Actuarius, four centuries later.
Biography	He lived between the 6 th and 7 th centuries A.D. in Constantinople. Doctor in the court of Emperor Heraklios, he was given the title of Protospatharios (leader of the imperial guard but also a honorary title). He wrote, among other works, the treatise "de urinis" ("peri ouron") one of the most influential works on uroscopy.
Further reading	Theophilus Protospatharius and Damascius. Commentarii in Hippocratis aphorismos. In: Dietz FR, editor. Scholia in Hippocratem et Galenum. Amsterdam: Hakkert, 1966: Volume 2, page 446, lines 6-17.

Author	Stephanus Atheniensis, 9th-10th cent. AD
Images	
Anatomy Pathology	
Physiology	
Chemistry	
Disease	
Therapy	Again the usual recipes and also the eating of beetles as diuretics.
Technical	An important test found in Byzantine texts is that of the warming of urines. Byzantine doctors had noticed that the external temperature was very important for the proper inspection of urines. The cooling of the urines had a corrupting result on the diagnostic and prognostic value of uroscopy; therefore they had invented a method of partially reversing the effects of cooling. They would reheat urine in the amis and record the occurring changes. This technique was thought to be introduced during the 19 th century AD (19) by Richard Bright but, as the following passages show, it seems that it was a rather common procedure found in several texts from different centuries. Stephanus (7 th -9 th c. AD?) recalls the use of this technique in order to differentiate the "thickening" of the urines that is due to the cooling from the environment from that attributed to the existence of thick substances in the urines: <i>"[...] if it [the urine] came like this from the body then it will remain like this, or else [if the condition is reversed] it will become thin again. For if it was not created thick inside, but it was urinated thin and became thick because of the cooling of the air, like the crystals, if put either in fire or in warm water becomes thin again, or else it will also show bubbles on the surface and that means that it is thick due to its composition [...]"</i>
General Comments	
Biography	

Further reading	
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19

Author	Damascius, 9 th -10 th cent. AD
Images	
Anatomy Pathology	
Physiology	
Chemistry	
Disease	He is involved in an imaginary dialogue with Protospatharius and Stephanus Atheniensis. In it, he mainly describes symptoms of lithiasis and elaborates on the causes of strangury.
Therapy	
Technical	
General Comments	
Biography	We know very few things about him. He is known as a commentator of Hippocrates and Galen. No other works are attributed to him. He lived before the 11 th c. A.D. He is a different person from Damascius the philosopher and neo-Platonist of the 6 th c. A.D.
Further reading	

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Author	Pseudo-Galen
Images	<p><i>Pictures of workers from the Book of Antidotes of pseudo-Galen. Probably Northern Iraq 1199, The Red Kaganate, Turko-Mongol Trousers</i></p> <p>By Steven Baker, http://www.geocities.com/kaganate/pants2.html http://www.mcah.columbia.edu/cgi-bin/dbcourses/item?skip=10500, Item ID:10686</p> 

Anatomy Pathology	He describes the direction of the renal arteries from the abdominal artery to the kidney. He rightly comments that the reason for the many minute vessels in the kidneys is the delay of the blood inside them, thus to permit for the separation of the blood from urine.
Chemistry	
Disease	He comments in detail on Hippocrates' Aphorism that tuberculosis may inflict the kidneys. He hypothesized that because of their narrow urethral passage, children are prone to develop bladder-stones, while old people with a wider urethral passage form kidney stones, having enough space in there for stones to be formed. He reported an earlier observation by Diocles that a lung abscess may be drained via the kidney to the urines. And he also correctly states that an enclosed renal infection (abscess) may cause a lot of pain but doesn't present any sign form the urines. On the contrary, when it drains there are obvious uroscopical findings.
Therapy	
Technical	
General Comments	
Biography	
Further reading	

Author	Michael Psellus, 11 th cent. AD
Images	
Anatomy Pathology	
Physiology	
Chemistry	
Disease	He wrote an extensive poem on medical problems with more than one thousand verses, which he titled himself without excessive modesty, as " <i>An excellent medical work in the iambic manner, by the wisest Michael Psellus</i> " Many of its verses are devoted to a brief presentation of symptoms and findings of renal ailments, as well as their therapy.
Therapy	
Technical	This knowledge isn't delivered to some specialized physicians, but to any cultured man: "...Because the varieties of the [urines'] mixtures are many, and my judgment and the purpose of the verses is not to contain all of everything of the art, but to provoke the appetite of my fellow men, scholars, rhetoricians and philosophers, on the accurate art of medicine, because as their are pursuing the (metrical) graces of the rhymes, in metrical (doses) they will conceive the (medical) art. So these are enough about the urines...". However, Psellus' likening of the method of uroscopy with the oracles spelled by the Delphian priestess Pythia was repeated, albeit scornfully, six centuries later. James Hart, writing in 1623, states: "Hence, it comes to pass that any idle old trot cobbler, or costard-monger, will seem to pronounce some Delphian oracle by the urine."
General Comments	There are poems on uroscopy and extracts from correspondence, not by medical doctors but by literati from various disciplines, give many details about urines in health and disease. Because the prognosis of disease, as Michael Psellus suggests in such a poem, does not

	depend on physical examination alone: "...for one can guess the future of the disease not by the beat of the pulse but by the stools and the multicoloured qualities of the sputum, and the observation of the urines is often adequate to show the future like the Pythian Tripod"
Biography	Michael Psellus (11 th c. AD) the politician, diplomat, poet, with an extended medical knowledge
Further reading	Diamandopoulos AA, Diamandopoulou AH and Marketos S. Two Late Byzantine songs on Uroscopy and Phlebotomy. Rivista di Storia della Medicina, Societa Italiana di Storia della Medicina, 1996

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Author	Symeon Seth, 11 th cent. AD
Images	
Anatomy Pathology	
Physiology	
Chemistry	
Disease	
Therapy	Symeon Seth, recommended exotic drugs for the treatment of urological problems.
Technical	
General Comments	
Biography	He was active in the 10 th century. His treatise on drugs exemplifies the Byzantine doctors' of the period trend to introduce new therapeutic substances from foreign lands.
Further reading	

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Author	Johannes Apokaukos, 13 th cent. AD
Images	
Anatomy Pathology	
Physiology	
Chemistry	In a passage of one of his letters to a fellow bishop Apocaukos describes in the year 1219 AD the stones that he painfully urinates: "... and I also suffer chronic disease from my kidneys for there are stones that come through the glands of my penis, sometimes big like grams, only heavier, and have many shapes. And they are polygonal and like pyramids or cubes. And because of the different shapes they hurt the lumen of the urethra and cause extreme pains and sufferings. And some other times when they are big enough they completely block my urethra and I'm completely filled with liquids. And by tearing the lumen it causes such pain, bringing death before my eyes...". The description was so accurate that we observe its repetition, almost verbatim, by Van Swieten, an elaborated scientist of the 18 th century (i.e. after the invention of the microscope), when he described a deposit in the urine "of crystals having a figure of rhombus".

Disease	
Therapy	
Technical	
General Comments	
Biography	He was Archbishop of Naupaktos and Arta, in Southwest Greece during the era of the partition of the Byzantine Empire after the 4 th Crusade. The Crusaders occupied the main part of the Empire, while three minor Greek States had been established in the periphery. Two in Asia Minor (the Empires of Nicaea and Trabizond) and one in Northwest Greece (the Principality of Arta). Apocaucos, scion of a celebrated Byzantine family, became Archbishop of Naupaktos and thus Prelate of the Principality of Arta. He developed a remarkable activity both in the administration of the Church and the State. He was an accomplished epistolographer and more than a hundred of his letters survive.

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Author	Nicolaus Myrepsus, 13 th cent. AD
Images	The 14 th century frontispiece of the Dynameron manuscript. On the upper zone Christ is depicted enthroned, flanked by Virgin Mary, St. John the Baptist and the Archangels. On the lower zone the Chief-Physician is examining a uroscopy bottle, here in Athens, while his patients are waiting for an answer.
Anatomy Pathology	
Physiology	
Chemistry	
Disease	
Therapy	Nicolaus Myrepsus was the author of the celebrated pharmacological book "Dynameron" that contains many drugs with nephrological action.
Technical	
General Comments	
Biography	
Further reading	

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Author	Johannes (Ioannis) Zacharias Actuarius, 14 th cent. AD
Images	
Anatomy Pathology	
Physiology	Similarly to the method of his predecessors in uroscopy, Johannes explained all the changes of the colour, sediment, transparency and general appearance of the urine to the

	<p>imbalance of the four humours. He added many interesting arguments about the role of the waste products of metabolism during the various phases of the disease. Thus, he came to observe correctly signs and symptoms that may be correlated to day with an array of ailments, while he himself did not really know the exact nature of the disease. As examples may be presented his description of what we now call secondary hyperparathyroidism, adipose tissue wasting, acute nephritis and many others. A pitfall of his theories was considered his remarks about the findings of the urines in ailments of a particular organ, e.g. the brain or the bones. This can be explained by the general tendency of medieval uroscopists to explain everything via their method, in spite the fact that Johannes was very careful to avoid the overestimation of uroscopy. It is tempting to speculate today, with the current knowledge of proteomics, that the link between laboratory findings of the urines and diseases of particular organs isn't just a medieval doctor's fancy.</p>
Chemistry	
Disease	<p>He recommends eating fruits and mainly of figs and grapes as purgatives for the kidneys. For the same purpose he also suggests almond-oil.</p>
Therapy	
Technical	<p>Actuarius is acclaimed for his introduction in uroscopy of a vial with specific characteristics. These were the flat basis, the high quality of translucent uncoloured glass with a smooth unadorned surface and grid marks. He also elaborated further on the importance of the urine's temperature when this were examined, suggesting the heating of them by immersing the container in a bath of boiling water, a kind of <i>bain marie</i>. This was an astonishing observation more than half millennium before Richard Bright's description of the urine's coagulation by heating in the case of proteinuria.</p> <p>The following passages from his treatise on urines show his meticulous scientific thinking: <i>“Chapter a. [...] But first of all we must investigate the amis and the place and the time in which the inspection of the urines is proper to be done; [...] So those amides that are made of transparent and thin glass can show the exact colours. Some that are slightly green, and being so, they are not exactly transparent – because the transparency is the result of the absence of colour – deprive some of the colour and maybe of the composition. And through them the contents cannot be seen exactly because of the impurities. And since they [the impurities] have various shapes, they corrupt the diagnosis. And if it also happens that they [the amides] are very wide and the urine sample is minimum and is spread on the bottom and is only slightly deep, there is no way to distinguish the impurities. And as for those amides that are made asymmetrically, having thinner tops and wider bottoms, and having the bottom protruding, since they have large volumes they can collect all the urine and thus seem useful for carrying. But as their usefulness for inspection of the urines is concerned, they are notably at disadvantage compared to the other amides, which have the shape of the drinking glasses and are very useful and the most useful of the shapes you must learn [...]. Now we shall talk on the inspection of the urines.</i> <i>Chapter b. On the proper place in which the inspection of the urines must be done. Because the more shadowy places remove a part of the colour making it darker and the more sunny and luminous make the colours seem softer, one has to inspect in both conditions and by eliminating the colour effect and trying to find the median condition, so that he will not misjudge any of the colours. And if he can see the contents clearly this is good enough. But if they are still very dim and not obvious, then he must look at them against the sun to see them clearly. And it is also useful to know the time at which it is better to inspect the urines</i></p>

	<p>[...] <i>Chapter c. On the timing that is more proper to inspect the urines.</i> <i>So, when the urines that are micturated in the amides are still felt lukewarm they give the exact colour to our sight, but the contents and their composition and the bubbles that are attributed to them, naturally, are not yet clearly seen. Because some of the bubbles will disappear, following the loss of temperature, while some others will remain as the urines get cooler. And the suspending particles at the beginning will not be seen well, but as the urine get cooler then these also start to appear more clearly, as they might be cloudy or, as time passes, either remain as they were or start to move to the middle of the amis and then to the bottom. And as for the compositions, those that are distributed equally are recognized by the colour, those that are thick are demonstrated after the suspending particles deposit, and later these deposit as well. Therefore it is useful to observe the urines not after they are already cold or you will make great mistakes in your diagnosis, but also be careful not to shake them much before you inspect them for you will move the particles and destroy the bubbles and dilute the deposits and confuse the situation. And these are about the timing that are necessary to know for the exact inspection of urines, in accordance to the exact art of those who know [...]" (17).</i></p> <p>Actuarius, in the same book, "De urinis", often refers, some times scornfully, to the specialists who inspect the urines. He does not refer to them as "doctors". He uses the terms "urine inspector" and "nature inspector", terms, which imply the existence of a separate specialty of the "inspector", sort of a laboratory technician: "[...] <i>But it is not so when one sees thin urine during the winter and is unable to overcome the cold weather, and during the summer, thick [urine] and is unable to stop the dilution due to the heat. So what do the respectable urine inspectors think when they see thin urines that become thick the next day, and the opposite, despite the climate? How can they tell when the change took place and for what reason? It seems to me that they mistake, being far from the truth [...]"</i></p> <p>And in another passage concerning the effect of the food consumed on the qualities of the urines, we read: " [...] <i>so that the nature's inspector will see all these by the norms of colours and compositions and particles, and by examining the proportions in each one of them and decide what to do, maybe this way he will not make a mistake [...]"</i></p>
<p>General Comments</p>	<p>Actuarius had been initially enrolled to be an orator, but later decided to become a medical doctor, as he found medicine a practical way to help people, while rhetoric was just an exhibition of haute eloquence, without any benefit to humanity apart of self-admiration. In spite of his contempt for flowery speaking, he sometimes went astray to the fields of a rather poetic way of writing medial text, as he himself sincerely admitted. Although his writings reveal him as pragmatic scientist without the usual medieval assumptions, he unashamedly stated at the beginning of his treatise on urines that he aimed to complement Galen, Hippocrates and the rest of ancient medical writers, as they have left only uncompleted works on the subject. He tried successfully towards this end.</p> <p>His main contribution is that not only did he describe the various differences of the colours and other characteristics of the urines according to various increases, but also tried to explain the pathological mechanisms via which these differences did occur. Although he must have had knowledge of Avicenna's Canon on Urines, he elaborated much further. This interaction between Byzantine and Arabic, Syrian and Iranian medicine is well documented, especially during the era of Late Byzantium.</p>
<p>Biography</p>	<p>Johannes Zacharias Actuarius (c. 1275-c. 1328) was a Byzantine physician in</p>

Constantinople. He wrote several books on medicinal subjects, particularly, an extensive treatise about the urines and uroscopy. Around 1299, he considered moving to Thessalonica, Northern Greece, but decided to stay in Constantinople; later, he was appointed chief physician to the Emperor. Actuarius was a title at the court of Constantinople, given apparently only to physicians, and quite distinct from the use of the word found in the earlier Latin authors, but has come to be associated with Johannes. The name Zacharias, meaning 'sugary' was also a nickname given because of his sweet speaking. Thus, the only solid information we have about his name is Ioannes. He sided himself with the party of the Emperor Andronicus Paleologos and the Great Duke Alexius Apocaukos during the Byzantine internal conflicts of that period. He made a number of important contributions to clinical medicine and generally followed the teachings and tenets of Hippocrates and Galen. The first portion of this work was translated from the Greek by Corneille Henri Mathys (d. 1565) and is a systematic textbook of medical practice.

In "*On the functions and disturbances of the soul-spirit*," Actuarius discussed a number of different mental illnesses that could be attributed to dietary errors, bodily causes, fatigue, and intemperance. For patients so afflicted he prescribed diets, baths, and exercise. He considered the origin of the soul to be in the pneuma, which was formed in the liver and united with the vital spirit in the heart for distribution throughout the body. He recognized five mental functions that distinguish man from animals: reason, understanding, judgment, perception, and imagination. "*On the urines*" was an influential book and had a significant impact on medicine of the Middle Ages.

However, in contrast to later physicians, Actuarius placed great emphasis on the fact that uroscopy was only one method to be used in determining a diagnosis. He thought that urine was a filtrate of the blood and, as such, could be analyzed to provide reliable information in pathological conditions. He recommended that the physician employ a graduated glass vessel as an aid in examining the urine. Actuarius also made one of the earliest reports of haemoglobinuria in this work. Volume II contains the six books of his *Methodi medendi* here translated by Mathys. It is in this general treatise on medical practice that Actuarius reveals his active practice of Hippocratic principles. He believed in treating each case on its individual merits and spoke out against the polypharmacy of his day. Although an adherent of Galen, he did not always agree with him and he was successful in making Galen's teachings on the pulse clearer and easier to follow. He felt that venesection was of great therapeutic value and provided specific guidance for the best areas to let blood for various disease states. He was perhaps the first to detect and describe the pinworm and also wrote on colic and lead poisoning. Volume III contains his *Composition of medicines* here translated into Latin by Jean Ruel (1479-1537). In this comprehensive treatise, Actuarius discusses a wide variety of therapeutic agents, their uses, actions, and directions for preparation. In addition to this treatise, there are three works by Sylvius in the volume: *Commentarius in Claudii Galeni duos libros De differentiis februm* (see No. 182), *De febris commentarius* (see No. 178) and *De mensibus mulierum et hominis generatione* (see No. 184).

Further reading

Author	Nicephorus Vlemmydes, 14h cent. AD
Images	
Anatomy Pathology	
Physiology	
Chemistry	
Disease	
Therapy	
Technical	<p>His most well known nephrological writing is a huge poem on the colours of urine, which was supposed to be sung by the medical students in Constantinople. It is now presented only a small passage in a translation by the author: The Canon which distinguishes between the thirteen uroscopy vials that are examined for human diseases, and also includes the most necessary instructions for both their diagnoses and treatments.</p> <p>Prelude: Three linear hymns (sound A') to be chanted to the rhythm of the canticle "of the celestial battalions" Be aware that there are thirteen vials in different diseases, first comes the white, second the blond and third the pinkish; the fourth is reddish and the fifth is like blood, the sixth is identical to saffron.</p> <p>After the latter be aware that the seventh is similar to citron, and the next is black and the ninth is white just like water; the tenth is off-white with sediment and is totally turbid as is the eleventh.</p> <p>The appearance of the twelfth is not stable; neither turbid nor clear, but seems to be just as a stirred mixture and is therefore muddy; the last one is saffron-like. Well, try then and learn herein their proper diagnoses [...]</p> <p>In his popularized poem, Nicephorus Blemmydes describes a test (that reminds us of a similar modern test of the three sequential urinations) for diagnosing the seriousness of the illness: <i>"[...] and if it derives from the stomach [the disease], because of indigestion, go and collect two and three bottles in a row and learn their interpretation. And if they remain the same then this means death. But if they change to clear or yellow then the patient will become healthy again..."</i></p>
General Comments	
Biography	<p>He was born in 1197 A.D. at Constantinople, died in 1272 at Ephesus. Theologist and philosopher, studied at Prusa and at Nysse of Bithynia. He wrote several works on alchemy, geography and an epitome on logic and physics. He also wrote two autobiographies, which are considered major historical sources for his era. His main contribution in nephrology is his poem "On Urines" (In Greek: "Peri uron")</p>

Further reading