

Galen as Neuroscientist and Neurophilosopher

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Summary

Galen of Pergamum (130-200 A.D.) was one of the greatest authorities in Medicine. Hippocrates first and Galen later traced the scientific approach in Medicine and were the founders of the modern Medicine. Galen by his extensive scientific work contributed greatly in the fields of anatomy, correlative anatomy, experimental research, topographic diagnostics and neurosciences. In addition, his scientific orientation was influenced by philosophy, given that he was educated under the special philosophical atmosphere of the Hellenistic era. Galen was one of the most productive authors. He composed, more than five hundred dissertations on medicine, psychology, philosophy, medical ethics, logic and grammar. His work exercised great influence in Medieval medicine and contributed substantially in shaping the profile of the modern medicine. In the field of neurosciences Galen's contribution was much valuable. He was an expert anatomist of the nervous system. Galen, Herophilus and Erasistratus may be characterized as the founders of the Neuroanatomy. Galen's theory on the function of the human body was encephalocentric. He considered that the brain is the center of the human existence, the ruler of the human body, the "hegemonicon" of the psychosomatic entity of the human being. In the field of neurosciences and clinical neurology he contributed substantially, describing the function of the spinal cord and emphasizing its importance in motion and sensation. Galen described also the syndromes of the transverse section and hemi section of the spinal cord and many vascular syndromes of the brain. Galen improved the technique of trepanation and applied it for drainage of intracranial hematomas and relief of intracranial pressure. Galen described the sympathetic chain, defined the roots of the spinal nerves and concluded that the spinal nerves are mostly mixed, motor and sensory. In case of damage of the nerves sensation and movement disappear in the field of their distribution. Galen described a considerable number of mental disorders such

as phrenitis, paraphrenia, delirium, mania, melancholy, coma, carus, lethargy, catalepsy, epilepsy, which are serious disorders of the "hegemonicon". Galen insisted that, in addition to mental diseases, there are other conditions, which are the consequences of human errors and passions. Galen claimed that the liberation of the man from the anger, the fear and the desires is a milestone on his way to peace of soul and is also the basis of a free and noble personality. Ambition and envy are main causes of interior troubles. A free man should liberate himself from desires and fear. The efficacious treatment of the passions is their total and complete eradication, which demands continuous fight and persistence. Galen was pioneer in the field of psychosomatic medicine. He is also one of the first Neurophilosophers, who attempted to associate neurosciences with philosophy in a harmonious unity.

Keywords: Galen, Medicine, Philosophy, Neurosciences, Neurophilosophy

Introduction

After the great contribution of Hippocrates in the development of the scientific medicine, in classic Greek era, Galen contributed substantially in shaping the profile of modern medicine six centuries later, in Hellenistic era.

Galen by his extensive scientific work introduced in medicine (a) the anatomical observation, (b) the topographic diagnostic approaching of the diseases and (c) the experimental investigation. Galen was more analytic than Hippocrates in his dissertations, concerning the description of the diseases and attempted to associate the clinical medicine with the experimental investigation.

In the field of Neurosciences Galen was an eminent authority, who radiated through centuries. He opened new paths in brain anatomy and described numerous neurological disorders.

It was expectable that science and philosophy were amalgamated in Galen's work, since he lived and studied inside the special philosophical atmosphere of the

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Hellenistic times, where philosophy played a dominant role in scientific conceptualism.

A substantial number of Galen's observations and description of the structure and function of the nervous system may be characterized as original. Some of the clinical observations by Galen, have been described many centuries later by other authors.

On Galen's life

Galen¹ was born in Pergamos (Pergamum), a Greek city in Asia Minor, which flourished during the Hellenistic period and became a principal medical center, which had one of the best Aesculapia in that times. Galen's father, Aelius Nicon was architect and philosopher and according to his son he was well versed in mathematics and grammar and in addition he was a very peaceful, just, kind and merciful man, a gifted man².

Nicon wished to give his son an excellent education, including studies in Philosophy and Medicine. Thus, Galen begun to study philosophy at the age of fourteen³ and medicine at the age of sixteen, at Pergamum initially by the Hippocratians Stratonius and Satyrus. He went later to Corinth and then to Alexandria in Egypt, in search for the best professors, where he studied Medicine for four years by Heraclianus, who was the son of Numisianus, a very expert physician of Alexandria, a city which was characterized by the very high level of the medical education in Hellenistic Era.

¹Important sources of Galen's life are his works "The Order of My Own Books" (Ord. Lib. Prop.) (XIX. 49 – 61 Kühn), and On My Own Books (Lib. Prop.) (XIX. 8 – 48 Kühn) and also in XIV. 599 – 673 Kühn and V. 1 – 103 Kühn.

²V. 40,15 – 41,8 Kühn. "I did enjoy the good fortune of having the least irascible, the most just, the most devoted, and kindest of fathers" XIX, p. 39 (De libris propriis, ch. 21)

³«ὑποπληρώσας δὲ τετταρεσκαιδέκατον ἔτος ἤκουον φιλοσόφων πολιτῶν, ἐπὶ πλείστον μὲν Στωϊκοῦ, Φιλοπάτορος μαθητοῦ, βραχὺν δὲ τινα <χρόνον> καὶ Πλατωνικοῦ, μαθητοῦ Γαίου, διὰ τὸ μὴ σχολάζειν αὐτὸν, εἰς πολιτικὰς ἀσχολίας ἐλκόμενον ὑπὸ τῶν πολιτῶν, ὅτι μόνος αὐτοῖς ἐδόκει δίκαιός τε καὶ χρημάτων εἶναι κρείττων, εὐπρόσιτος τε καὶ πρᾶος. ἐν τούτῳ δὲ τις καὶ ἄλλος ἦλθε πολίτης ἡμέτερος ἐξ ἀποδημίας μακρᾶς, Ἀσπασίου τοῦ Περιπατητικοῦ μαθητῆς, καὶ μετὰ τούτου ἀπὸ τῶν Ἀθηνῶν ἄλλος Ἐπικούρειος...» (V. 41,11 – 42,8 Kühn). Galen endeavored to study and incorporate philosophy deeply and wished to seek continuously throughout his life, after truth, virtue, justice, temperance, fortitude, prudence interior peace, serenity, simplicity, self-control, self-respect and tranquility. Galen wished to hold only the truth in esteem, liberating himself from pain and grief. According to

In 157 A.D Galen returned to Pergamum, where he was appointed as official physician of gladiators, been distinguished for the very successful treatment of traumatic lesions.

In 162 A.D Galen went to Rome, supported by Glaucon, a philosopher who recognized his exceptional medical efficiency and his pious character. Galen in Rome remained for short time⁴, and started travelling later in Syria, Cyprus, Palestine Phenicia, returning in Pergamum finally. Galen was invited to Rome by the Emperor Marcus Aurelius, who wished Galen as imperial physician, to accompany him against the Germanic tribes. However Galen did not accompany Marcus and he stayed in Rome, in order to confront the epidemic diseases and to look after his son Commodus.

After Marcus' death Galen supported as physician Commodus⁵ and later after Commodus tragic end in 192 A.D. he stayed in Rome with the emperor Pertinax (193 A. D) and then he served as personal physician to Septimius Severus (193-213 A.D.). Galen gained great reputation in Rome, although he faced many difficulties due to contradictions and jealousy of his fellow physicians and philosophers. Flavius Boethus, whose wife was treated by Galen from a serious health problem supported Galen and encouraged him in teaching medicine and releasing lectures in the cycles of physicians, philosophers and intellectuals in Rome. Galen stayed in Rome for the rest of his life, until his death at the age of seventy in 199 or 200 A.D. According to Arabian sources Galen died aged 87 in Sicily⁶.

Galen's scientific work

Galen was very productive author⁷. He begun to write articles in the age of thirteen. As medical student

Galen the aim of philosophy is to help the man to become peaceful, self-controlled, free and noble.

⁴« ἔτεσι δὲ τρισὶν ἄλλοις ἐν Ῥώμῃ διατρίψας ἀρξαμένου τοῦ μεγάλου λοιμοῦ παραχρημα τῆς πόλεως ἐξήλθον ἐπειγόμενος εἰς τὴν πατριδα μηδεὶν (XIX. 15,16 – 18 Kühn).

⁵«... αὐτὸς μὲν ἐξήλθε, καταλιπὼν δὲ τὸν υἱὸν Κόμοδον, παιδίον ἔτ' ὄντα κομιδῇ νέον, ἐνετείλατο τοῖς τρέφουσιν αὐτὸ πειρᾶσθαι μὲν ὑγιάνον φυλάττειν, εἰ δὲ ποτε νοσήσειε, καλεῖν ἐπὶ τὴν θεραπείαν ἐμέ» (XIX. 18,9 – 18,19 Kühn).

⁶Nutton V. Galen in the eyes of his contemporaries Bull Hist. Med, 1984, 58,315 - 324.

⁷Galen is a gifted writer. His language is elegant, eloquent, clear, concrete, explicit, pleasing and poetic. See also De Lacy, P. 1966. "Galen and the Greek Poets". In: Greek, Roman and Byzantine Studies 7, 259–266.

he composed a treatise on the anatomy of uterus, based on personal observations in apes. Galen wrote on almost every scientific field. In total, he composed more than five hundred dissertations on anatomy, medicine, philosophy, medical ethics, logic and grammar. In his extensive work, Galen tried to incorporate all the theories in Medicine and Philosophy, describing also his personal observations, theories, ideas and doctrines. He tried also to reduce the distance between theory and practice, knowledge and experience, proving the value of the existent harmony between the theoretical education and the practical application in Medicine. He criticized frequently Aristotle and the eminent physician Erasistratus and his disciple Martialis, whereas he expressed his admiration and high respect for Hippocratic works.

Unfortunately large number of Galen's dissertations on Philosophy have been lost during the years and only few have survived in the original Greek text. The conflagration in Rome in 191 A.D. destroyed large number of Galen's manuscripts, and as a result we know only a small part of the extensive Galen's contribution in Philosophy.

Galen exercised a great influence in western and Arabic Medicine. His manuscripts remained textbooks of reference in medieval Medicine. In contrast to Hippocratic writings, which are mostly synthetic and observational, Galen's ones are analytical, based extensively on experimental investigation.

Galen gave much emphasis on the structural and functional background of the diseases and the etiology of the pathological processes. However his medical theories are frequently amalgamated with philosophical doctrines. Galen in addition to clinical Medicine worked in the fields of descriptive anatomy⁸ physiology⁹, pathology, pharmacology, psychology and psychiatry. He endeavored to find the causative factors of the diseases and to localize the suffering viscera on the basis of the clinical symptoms and signs. Galen attempted to classify the diseases on the basis of the main symptoms and clinical signs and on the basis of the suffering part of the body.

Galen introduced many pharmaceutical plants, collected from many countries, for the treatment of the diseases. He tested the pharmaceutical properties of the

plants in large number of clinical cases in order to choose the most efficient of them. In addition, he invented many medical instruments for the anatomical dissections and the surgical operations and moreover he was a pioneer in the study, description and treatment of psychosomatic diseases¹⁰.

Unfortunately large number of Galen's manuscripts is lost. Between the years 1821-1832 K. G. Kühn published Galen's extant works in Leipzig, The edition in 22 volumes includes the Latin translation and about 10,000 pages of Greek text¹¹.

Galen's physiology

Galen had a perfect knowledge of the philosophical and medical tradition, that preceded his work. It is reasonable, therefore, that a fundamental concept in Galen's Physiology was the theory of the four "humors" of the human body, which was derived from Hippocratic similar theory¹². Whenever the yellow bile, the black bile, the blood and the phlegm are intermixed in right ratio and balance, under ideal conditions of temperature and humidity the human body is healthy, being in a state of homeostatic equilibrium¹³.

The preponderance of one of the four humors acts a great influence on the character and the personality of the man, resulting in the bloody, the choleric, the

¹⁰Erasistratus theories and concepts are incorporated in the works of Rufus of Ephesus and Marinus of Alexandria. See Rufus of Ephesus, ed. C. Daremberg and C. E. Ruelle, Paris, 1879.

¹¹Galen's works were studied by many authors. We mention among the others Fridolf Kudlien, Hans Diller, Karl Deichgräber, Ludwig Edelstein, Owsei Temkin, Luis García Ballester

¹²Hippocrates De natura hominis, IV, 13-15 "Τὸ δὲ σῶμα τοῦ ἀνθρώπου ἔχει ἐν ἐσωτῶ αἷμα καὶ φλέγμα καὶ χολὴν ξανθὴν καὶ μέλαιναν, καὶ ταῦτα ἐστὶν αὐτῷ ἡ φύσις τοῦ σώματος, καὶ διὰ ταῦτα ἀλγεῖ καὶ ὑγιαίνει. Ὑγιαίνει μὲν οὖν μάλιστα, ὅταν μετρίως ἔχη ταῦτα τῆς πρὸς ἀλλήλα κρήσιος καὶ δυνάμιος καὶ τοῦ πλήθους, καὶ μάλιστα μεμιγμένα ἢ ἀλγεῖ δὲ ὅταν τούτων τι ἔλασον ἢ πλέον ἢ ἢ χωρισθῇ ἐν τῷ σώματι καὶ μὴ κεκρημένον ἢ τοῖσι σύμπασιον»

¹³According to Galen the human body is divided into two different structures: the homogeneous (homoeomerous) and the organic ones. In the homoeomerous structures every part is like every other. Therefore the structure may be characterized as homogeneous if it is divisible into similar parts like the bones, the muscles, the veins, the arteries, the ligaments, the nerves, the membranes. Organic parts are the structures which are composed of various tissues like the lungs, the stomach, the heart, the liver the spleen, the kidneys and the brain.

⁸Ustun C (2004) Galen and his anatomic eponym: vein of Galen. Clin Anat 17:454-457 καὶ Kaplan EL, Salti GI, Roncella M, Fulton N, Kadowaki M (2009) History of the recurrent laryngeal nerve: from Galen to Lahey. World J Surg 33:386-393

⁹Dunn PM. Galen (AD 129-200) of Pergamun: anatomist and experimental physiologist, Arch Dis Child Fetal Neonatal Ed 2003; 88: 441 - 443.

melancholic and the phlegmatic character.

Therefore, the good or bad balance of the human humors is related with health or disease. In cases of imbalance (dyskrasias) the man suffers from disease, the severity of which is related to the severity of the imbalance and the deviation from the homeostatic equilibrium¹⁴.

Pain is the symptom of the dysfunction, dyskrasia or traumatic lesion of a part of the human body. Pain is a manifestation of the loss of the harmony of an area of the body, which is important for the topographic localization of the suffering tissue or organ¹⁵ and the detection of the causative factor of the disease.

Essential doctrine in Galen's physiology is the concept of spirit (pneuma πνεύμα) which from the respiration inserts in the lungs, then it is transmitted to heart, to liver, to brain and it is diffused in every part of the body. The spirit in the heart is transformed to vital spirit¹⁶, which is the source of the natural temperature of the body.

The vital spirit in the brain is transformed into psychic spirit (pneuma) by the choroid plexuses of the ventricles and the retiform plexus or rete mirabile in the base of the brain, around the hypophysis. The psychic spirit is the most perfect kind of spirit, which might be the substance of the soul¹⁷, although Galen admitted that he could not define the substance of the soul.

The psychic spirit is located inside the four ventricles¹⁸ of the brain, it moves in the interconnected ventricles and in any anatomical structure of the brain and then it is transmitted through the nerves in the whole body¹⁹ giving sensation and movement. Thus, the ven-

tricular system is the most precious part of the brain.

The physic spirit is responsible for the growth and the reproduction of the human being. The vital spirit controls the viability and the temperature of the human body, though the psychic spirit is responsible for the function of the brain and nerves, the sensation, the voluntary motion and the mental faculties²⁰.

Brain is the seat of intelligence, memory, fantasy, cognition, sensory perception and motor control. According to Galen the brain is the "hegemonicon", the principal organ which controls all the functions of the human body, directs the volition²¹ produces images, understands thoughts and adjust the behavior. Brain is the center of sensation. It perceives all the sensorial stimuli from the sensory organs via the nerves.

According to Erasistratus the spirit (pneuma) is distinguished in to vital and psychic spirit.

²⁰Paracelsus (1493-1541) criticized Galen on his humoral concept of disease. However he agreed with Galen that the brain is the source of the thoughts. Paracelsus said that Hippocrates shaped the genuine scientific face of Medicine, though Galen intermixed medicine with Philosophy. The same contradiction with Galen humoral concept has also JB van Helmont (1577-1644), though Guillaume de Baillou (1538-1616), in Paris tried to conciliate the difference. Rene Descartes (1596-1650) claimed that the blood passes from the brain to the pineal gland, where it is transformed to animal spirit, which is diffused in the whole body.

²¹Galen insisted, offering good evidence, that the brain was the 'ruling part' of the body, controlling sensory and motor activity and not the heart, as claimed Stoics and Aristotle, who considered the heart to be the seat of the soul. According to Zenon and Chrysippus heart is the seat of "hegemonicon". Thoughts and speech come from the heart, a view that was argued by Galen, who proved experimentally that cutting of the recurrent laryngeal nerve abolish speech, though the function of the heart remains intact. The cardio-centric aspect of Aristotle and Stoics was accepted by William Harvey (1578-1657), who in his memorable work «De motu cordis et sanguinis in animalibus» in 1628, claimed that the heart is the center of sensation, motion and vegetative functions. The contradiction between the cardiocentric and encephalocentric theories lasted for many centuries. Nemesius, Bishop of Emesa in Syria claimed that the soul permeates the whole of the body and the cognitive faculties are related with the brain. Among the first authors who introduced the encephalocentric theory were Alcmaeon from Croton and the Pythagoreans, Anaxagoras, Hippon from Samos, Philolaos and Hippocrates. In the Hellenistic period, in the third century B.C, Herophilus and Erasistratus were in favor of the encephalocentric theory. Andreas Vesalius (1514-1564), professor of anatomy at Padua, accepted Galen's theory that the brain is the center of sensation, motion and cognition, but he was unable to confirm that the ventricle of the brain are related with the mental faculties.

¹⁴I. 413 – 508 Kühn

¹⁵ἄλγημα δὲ, καθ' ὃν ἂν ἐρείδῃ τόπον, ἧτοι συνεχείας λύσιν, ἢ ἀλλοίωσιν ἀθρόαν ἐνδείκνυται. λύεται μὲν οὖν ἢ συνέχεια τομῆ, καὶ διαβρώσει, καὶ θλάσει, καὶ τάσει. ἀλλοιοῦται δὲ ἢ οὐσία θερμότητι, καὶ ψυχρότητι, καὶ ξηρότητι, καὶ ὑγρότητι (I. 357,6 – 10 Kühn).

¹⁶«ἐκ μὲν τῆς κεφαλῆς φησι τὸ ψυχικόν, ἐκ δὲ τῆς καρδίας τὸ ζωτικὸν ὀρμάσθαι πνεῦμα» (V. 281,5 – 6 Kühn)

¹⁷«πτότερον δ' οὖν τίς ἐστὶν ἢ χρεία τοῦ ψυχικοῦ τούτου πνεύματος καὶ πῶς ἀγνοεῖν ἔτι τὸ ἀκριβέστατον ὁμολογοῦντες οὐσίαν ψυχῆς ὁμῶς οὕτω τολμῶμεν ὀνομάζειν» (III. 542,2 – 4 Kühn).

¹⁸«τὸ δ' ἐκ τῶν τραχειῶν ἀρτηριῶν πνεῦμα τὸ ἐξωθεν ἐλθθὲν ἐν μὲν τῇ σαρκὶ τοῦ πνεύμονος τὴν πρώτην ἐργασίαν λαμβάνει, μετὰ ταῦτα δ' ἐν τῇ καρδίᾳ τε καὶ ταῖς ἀρτηρίαις καὶ μάλιστα ταῖς κατὰ τὸ δικτυοειδὲς πλέγμα τὴν δευτέραν, ἔπειτα τὴν τελεωτάτην ἐν ταῖς τοῦ ἐγκεφάλου κοιλίαις, ἔνθα δὴ καὶ ψυχικὸν ἀκριβῶς γίνεταί» (III. 541,16 – 542,1 Kühn).

¹⁹Herophilus was one of the first authors who claimed that the seat of the psychic spirit is the ventricles of the brain. Ac-

The brain, the spinal cord and the nerves are of the same substance. The nerves are originated either from the brain or from the spinal cord²².

Galen as Neuroscientist

Galen's contribution in the field of Neurosciences is very important. Galen described ten of the cranial nerves, the corpus callosum, the tectum, the formix, the epiphysis or pineal body, the sympathetic chain, he also distinguished the roots of the spinal nerves²³. He described the recurrent laryngeal nerve, characterizing it as vocal nerve or nerve of the speech. He described the ventricular system of the brain as the seat of the psychic spirit. In addition, Galen described the blood vessels of the brain and studied extensively the function of the spinal cord, emphasizing its importance for the movements of the body and limbs.

Galen was an excellent orator and tutor. He described his scientific methods as proving "αποδεικτικὰς"²⁴, given that they are based on objective observation and experimental verification. He insisted that every problem might be solved by the right observation and experimental investigation, based on the best methodology. The scientific work needs intelligence, knowledge and experience.

Any problem should be analyzed thoroughly with clarity. A plan should be made for the application of the proper methodology for the faster approach to the right

²²«ὄτι μὲν γὰρ ἀρχὴ νεύρων ἀπάντων ἐγκέφαλος τε κὼν νωτιαῖος καὶ ὡς αὐτοῦ τοῦ νωτιαίου πάλιν ἐγκέφαλος, ἀρτηριῶν δ' ἀπασῶν καρδία, φλεβῶν δ' ἦπαρ, καὶ ὡς τὰ μὲν νεῦρα παρ' ἐγκέφαλου τὴν ψυχικὴν δύναμιν, αἱ δ' ἀρτηρίαὶ παρὰ καρδίας τὴν σφυγμικὴν, αἱ φλέβες δ' ἐξ ἥπατος τὴν φυτικὴν λαμβάνουσιν, ἐν τοῖς Περὶ τῶν Ἱπποκράτους καὶ Πλάτωνος δογμάτων ἀποδέδεικται» (III. 45,9 – 15 Kühn). The role of the spinal cord in the reflexive responses of the limbs was described by Julien Lagellois (1749-1814).

²³In 1811, Sir Charles Bell concluded, after experimentation in animals, that the function of the anterior roots was motor and in 1822 Francois Magendie in Paris verified that the anterior root are concerned with motion and the posterior with sensation

²⁴« ἀρχὴ δ' εἰς τὴν εὐρεσιν ἡ φύσις ἔσται τοῦ πράγματος ὑπὲρ οὗ σκοπούμεθα·καὶ γὰρ καὶ τοῦτο ἐμάθομεν ἐν ταῖς ἀποδεικτικαῖς μεθόδοις...»·καὶ «Ὡς γὰρ κἂν τῷ περὶ τῆς ἀποδεικτικῆς εὐρέσεως εἴρηται γράμματι, περιαντληθεὶς ὑπὸ τοῦ πλήθους τῆς τῶν ἰατρῶν διαφωνίας, εἴτ' ἐπὶ τὸ κρίνειν αὐτὴν τραπιόμενος, ἔγγων χρῆται πρότερον ἐν ἀποδεικτικαῖς μεθόδοις γυμνάσασθαι. καὶ τοῦτο πράξας ἔτεσιν ἐφεξῆς πολλοῖς ὑπέβαλλον οὕτως ἕκαστον τῶν δογμάτων αὐ-

solution²⁵.

Many problems analyzed by Galen were subjects of discussions and controversies in Medicine and Philosophy for many years.

In addition to the main question, concerning the dominant role of the brain or the heart in the human psychosomatic entity, Galen posed also the problem of the fetus as existence, which raised many disputes with Asclipiades.

Although Galen was very analytic in his descriptions and discussed all the possible views and explanations on every matter, he endeavored to come in concrete conclusions, avoiding extreme skepticism and void «ανεπίκριτον»²⁶ argumentation, which might only cover the ignorance. All the problems necessitate right investigation, evaluation and verification of the right solution²⁷, by the best scientific methodology.

Experience and good medical education are essential factors for the solution of medical problems. Many years of clinical practice are needed for the best beneficial contribution of a physician. The theoretical knowledge is also important for the choice of the right methodology in approaching and solving scientific problems.

According to Galen the thinker should avoid dogmatism, since everything is flexible and changeable. There is a continuous motion «κίνησις» of thoughts and knowledge that does not permit any dogmatic fixation. In the biologic world everything is changeable and there are two main principles, the birth (γένεσις) and the decay (φθορά), which control and modulate all the biological phenomena²⁸.

According to Galen the physician must be philosopher, intellectual, with good knowledge of logic and with high moral standards in order to be much beneficial to his patients, respecting, protecting and healing their psychosomatic entity²⁹.

τῆ...» (x, 469,14–18 K.)

²⁵Jonathan Barnes, "Galen on Logic and Therapy," in Fridolf Kudlien and Richard J. Durling, eds., Galen's Method of Healing (Leiden, 1991), 50–102

²⁶DL IX 92–93

²⁷«τῆς ἐννοίας πρότερον ὁμολογηθείσης, ἥς χωρὶς οὐχ οἶόν τε ἐστινεύρεθῆναι τὴν οὐσίαν τοῦ προκειμένου πράγματος· αὐτὴν δὲ τὴν ἐννοιαν ὁμολογουμένην ἀπασιν ἐλέγμενον χρῆται λαμβάνειν, ἢ οὐδ' ἂν ἀρχὴν δεόντως ὀνομάζεσθαι. ... τὰς δὲ τῆς οὐσίας αὐτῆς τοῦ πράγματος εὐρέσεις τε καὶ ζητήσεις καὶ ἀποδείξεις οὐκέτ' ἐκ τῶν τοῖς πολλοῖς δοκούντων, ἀλλ' ἐκ τῶν ἐπιστημονικῶν λημμάτων» (x,40–42 K.)

²⁸K.II,3

²⁹Galenic medical ethics are based mostly on Hippocratic

Galen's contribution in the study of the nervous system and the role that the brain plays in the homeostatic equilibrium of the soul and body is of substantial importance. Galen studied the structure of the brain extensively and it is reasonable that he is considered with Herophilus and Erasistratus as the founder of Neuroanatomy³⁰. He dissected the brain by various types of sections and various visual angles in order to get a detailed three dimensional view of its anatomy and obtain a precise knowledge of the topographic relationships. In his manuscripts on the brain Galen described the anatomical methods that he applied in dissecting the brain for the best visualization of its interior morphology. Galen introduced large number of terms in the field of Neuroanatomy, which survived and are in use until now³¹.

Galen was the first physician who proceeded to experimental research. He might be considered as the founder of experimental physiology and experimental neurosurgery³². He proceeded to experimental investigation on pigs, horses, apes and other animals, since the autopsies on corpses were not allowed in his era and on the other hand he wished to combine investigation on physiology and anatomy at the same time. His anatomical studies on various animals enabled him to describe the anatomical variations between species, becoming therefor the pioneer in correlative anatomy³³.

In the field of neurophysiology Galen studied the function of the spinal cord and the structure of spinal column³⁴. He made remarkable observations on the

lesions of the spinal cord. He noticed that on transverse sectioning of the spinal cord all the movements are abolished below the level of the section and total anesthesia is induced. He proceeded to transverse sectioning of the spinal cord at various levels in animals and described the distribution of the motor and sensory loss in the body under the level of the lesion. On sectioning the spinal cord at the level of the fifth cervical vertebra, Galen described the motor and sensory loss in the upper and lower limbs, whereas the diaphragmatic respiration remained intact. On transverse semisection of the spinal cord the voluntary motion is abolished under the level of the section ipsilaterally and the perception of the pain and temperature is lost in the body and limbs contralaterally³⁵.

Galen noticed that in cases of hemiplegia, associated with ipsilateral facial palsy the lesion is located in the brain. In the contrary in cases of hemiplegia without involvement of the cranial nerves the lesion is in the spinal cord. He underlined that disorders of cognition and psychiatric phenomena are due to brain's dysfunction.

In cases of traumatic lesions of the brain Galen applied trepanation for draining the intracranial hematomas³⁶ and decreasing the intracranial pressure. For the trepanation Galen used the "crown trephine" (φοινικίδα) for removing bone and the "drill trepan" (τρύπανον) for making perforations in the skull. He applied also trepanation for the treatment of hydrocephalus in childhood³⁷. Galen studied hydrocephalus extensively and described three kinds of it, one between the brain and the meninges, one between the meninges and the skull and one between the skull and the skin.

Galen thought that the anterior part of the brain is the seat of perception, volition, memory and reason,

ethical principles and on Platonic and stoic philosophy and they were profoundly respected in Middle Ages, Renaissance and in Arabic World.

³⁰Rajkumari Ajita. "Galen and his Contribution to Anatomy: A Review". *Journal of Evolution of Medical and Dental Sciences* 2015; 4 (26): 4509-4516.

³¹Durling, R. (1993). *A Dictionary of Medical Terms in Galen*. Leiden: Brill.

³²Besser M. Galen and the origins of Experimental Neurosurgery. *Austin J Surg.* 2014; 1 (2):1009

³³Galen did his studied on correlative anatomy on apes. He studied the morphology of the skull correlating it in various types of apes.

³⁴Marketos SG, Skiadas PK. Galen: a pioneer of spine research. *Spine.* 1999; 24 (22): 2358-2362. The spinal cord was also studied by Oribasius (325-404), Paul of Aegina (625-690), Andrea Vesalius (1414-1564), Berard Blasius (1666), who distinguished the white from the grey matter of the spinal cord, Domenico Mistichelli (1709), Johann Jacob Huber (1707-1778), Felix Vinq d' Azyr (1748-1794), Luigi Rolando (1809), Ludwig Türk (1810-1868), Jacon Augustus Lockhard (1817-1880), von Kölliker (1857-1905) and many other

neuroscientists, who after the application and use of microtome in histology by Benedict Stilling (1810-1879), contributed greatly in the study of the structure of the spinal cord.

³⁵The syndrome of the semisection of the spinal cord is named after Charles-Édouard Brown-Séquard, who described it in workers with traumatic lesions of the spinal cord in 1850. C.-É. Brown-Séquard: *De la transmission croisée des impressions sensitives par la moelle épinière. Comptes rendus de la Société de biologie,* (1850)1851, 2: 33-44.

³⁶Rocca J: Galen and the uses of trepanation, in Arnott R, Finger S, Smith C (eds): *Trepanation: History—Discovery—Theory.* Lisse, The Netherlands: Swets and Zeitlinger Publishers, 2003, pp 253–271. See also Gross CG: *Trepanation from the Palaeolithic to the internet,* in Arnott R, Finger S, Smith C (eds): *Trepanation: History—Discovery—Theory.* Lisse, The Netherlands: Swets & Zeitlinger Publishers, 2003, pp 307–322

³⁷Mariani-Constantini R, Catalano P, di Gennaro F, di Tota

though the posterior part, which is more solid than the anterior, plays an important role in the life and the vegetative functions of the man. He claimed also that defective perception and reasoning may provoke delusions and hallucinations.

Health is the result of the homeostatic equilibrium of the psychosomatic entity of the human being. Disease is the opposite of health. Health is based on the harmonious natural balance of hot, cold, wet and dry, the physical qualities, which are associated with the blood, the yellow bile, the black bile and the phlegm. Small deviations from the homeostatic equilibrium may not be diseases³⁸. There is an individual disposition (diathesis, διάθεσις) that is responsible for the health or illness of a person, which may play an important role in the morbidity.

A central concept of Galen's psychology is the tripartite³⁹ division of the soul, each of the parts been located in a different part of the body. The rational faculty of the soul is located in the brain⁴⁰, the spiritual in the heart and the desiderative one in the liver. The psychic spirit (pneuma) according to Galen resides in the ventricles of the brain. The brain is responsible for the perception, the cognition and the memory. The mental and physical health of the human being is based on the equilibrium and the harmonious relationship between the three parts of the soul. Any disarrangement of that balance may provoke mental disorder or any other psychological

disturbance with various phenomenology⁴¹.

The treatment is based on the restoration of the harmony between soul's parts. The soul should become again according to the nature (kata physin, κατά φύσιν). The clinical phenomena of the disease are of substantial importance for the choice of the proper therapeutic method.

From the mental disorder of particular importance are phrenitis⁴², delirium (παραφροσύνη) paraphrenia, mania, melancholy, coma, carus (κάρος), lethargus, catalepsis, epilepsy, which are conditions affecting the "hegemonikon" and disturbing the soul-body relationship.

Dementia according to Galen consist of decline in memory, judgment and learning, and it is a disorder of the "hegemonikon". Dementia may exist in melancholy, which in that case is reversible. Memory disturbances may coexist with affections of reason. Loss of memory and reason appears in lethargy and karos. Loss of memory and reason and loss of understanding (σύνεσις) appear in a disease that Galen calls morosis (μώρωσις). In cases of morosis the physician cannot find any special clinical sign in the affected place..

Phrenitis is a psychic disorder accompanied by an acute fever⁴³, affecting the hegemonikon. A diagnostic feature of phrenitis is that the delirium persists after the fever declines. Other symptoms of phrenitis are insomnia, visual hallucinations, crocydismus and carphologia, rapid breathing, weak pulse, drying of the eyes.

The high fever differentiates phrenitis from mania and agitated melancholy, which may have also a continuous delirium⁴⁴.

G, Angeletti LR: New light on cranial surgery in ancient Rome. *Lancet* 355:305–307, 2000

³⁸«τὰ δὲ ἐφ' ἐκάτερα τῆς ἀκριβοῦς συμμετρίας βραχείας ἐκτροπὰς οὐδέπω μὲν εἶναι νόσους, ἔστ' ἂν μηδέπω βλάβην αἰσθητὴν ἐνεργείας τινὸς ἀπεργάζωνται» (VI. 842K).

³⁹«πρόκειται δὲ δεικνύειν ὡς οὔτε καθ' ἓν μόριον τῆς ψυχῆς οὔτε κατὰ μίαν αὐτῆς δύναμιν αἴ τε κρίσεις γίνονται καὶ τὰ πάθη συνίσταται, καθάπερ ὁ Χρῦσιππος ἔφασκεν, ἀλλὰ καὶ δυνάμεις πλείους αὐτῆς εἰσιν ἑτερογενεῖς καὶ μόρια πλείω. τὸ μὲν δὴ τὰς δυνάμεις τῆς ψυχῆς τρεῖς εἶναι τὸν ἀριθμὸν, αἷς ἐπιθυμοῦμέν τε καὶ θυμούμεθα καὶ λογίζομεθα, καὶ Ποσειδώνιος ὁμολογεῖ καὶ Ἀριστοτέλης. τὸ δὲ καὶ τοῖς τόποις αὐτὰς ἀλλήλων κεχωρίσθαι καὶ τὴν ψυχὴν ἡμῶν μὴ μόνον ἔχειν ἐν ἑαυτῇ δυνάμεις πολλὰς, ἀλλὰ καὶ σύνθετον ἐκ μορίων ὑπάρχειν ἑτερογενῶν τε καὶ διαφερόντων ταῖς οὐσίαις Ἰπποκράτους ἐστὶ καὶ Πλάτωνος δόγμα» (PHP, V, 4, 2-3).

⁴⁰ἡ ἐν ἐγκεφάλῳ καθιδρυμένη λογιστικὴ ψυχὴ δύναται μὲν αἰσθάνεσθαι διὰ τῶν αἰσθητηρίων, δύναται δὲ καὶ μεμνησθαι [διὰ] τῶν αἰσθητῶν αὐτῆ καθ' ἑαυτήν, ἀκολουθίαν τε καὶ μάχην ἐν τοῖς πράγμασιν ὄραν, ἀνάλυσιν τε καὶ σύνθεσιν, οὐκ ἄλλο τι δηλοῦμεν ἢ εἰ περιλαβόντες εἰποίμεν. ἡ λογιστικὴ ψυχὴ δυνάμεις ἔχει πλείους, αἰσθησιν καὶ μνήμη καὶ σύνεσιν ἐκάστην τε τῶν ἄλλων (IV. 770-71 K)

⁴¹ὅτι γὰρ οἱ τε χυμοὶ καὶ ὅλως ἡ τοῦ σώματος κρᾶσις ἀλλοιοῖ τὰς ἐνεργείας τῆς ψυχῆς, ὡμολόγηται τοῖς ἀρίστοις ἰατροῖς τε καὶ φιλοσόφοις (VIII K. 191).

⁴²Phrenitis is also described in Hippocratic corpus (2.232; 3.116-118; 5.460; 5.514; 5.516; 5.598; 6.216-218; 6.200; 6.204; 2.650-652 7.128 Littré).

⁴³ταῖς φρενίσι δ' ἴδιον ἐξαιρετὸν ὑπάρχει τὸ μὴδ' ἐν ταῖς παρακαμῖσι τῶν πυρετῶν παύεσθαι τὴν παραφροσύνην. οὐ γὰρ ἐπὶ συμπαθείᾳ κατ' ἐκείνην τὴν νόσον ὁ ἐγκέφαλος πάσχει, ἀλλὰ κατ' ἴδιοπάθειάν τε καὶ πρωτοπάθειαν κάμνει, καὶ διὰ τοῦτο κατὰ βραχὺ τε συνίσταται τοῦτο τὸ πάθος καὶ οὐκ ἐξαίφνης παρακόπτουσιν ἢ ἀθρόως, ὡς ἐπὶ τοῖς ἄλλοις μορίοις, ὅσα προεῖπον ἀρτίως. (VIII K. 329)

⁴⁴VIII 166 K.

On the passions of the soul

Galen claimed that in addition to mental diseases there are other conditions, which are the consequences of passions and errors of the man. He said that errors arise from a false opinion, and passions from the irrational power. The man by the spiritual culture and wisdom may recognize the special value of the self-knowledge and self-control and may also recognize his errors and passions. If a man wishes to have a knowledge of his inner self, he must work very hard to obtain it.

It is very important for the man to free himself from his passions. For the liberation of man from passions and errors is indispensable to recognize them sincerely and to eradicate them. A man must remind himself of his passions and his decision to fight against them each day. A man must also liberate himself of carnal desires, excessive curiosity, and envy. The man must learn how to judge himself and to lead a life of better self-discipline every day. The road to temperance is through self-discipline. Any disease of the soul and any passion must be eradicated promptly before it would become strong and incurable. It is essential to remove the roots of the passions from the souls completely. A young man must ask the help and support of an expert and responsible person, who would direct him to the truth.

Among the first and greatest errors is the one which derives from self-love or ambition. A man who loves himself with a true love and wishes to become a good, honest and noble person must recognize and treat that errors promptly.

According to Galen the path to the truth is not long and laborious, but is a rather short and strait. Intense emotional involvement may cause deviation from the truth. In order to follow the way of the truth, the man has to keep the interior peace, which is the result of wisdom and spiritual culture. The man should liberate himself from fear and desires in order to be able to approach the truth.

The domination over the passions is possible through reason and continuous training. For each human being needs almost a lifetime of continuous training to become a perfect man. The man should become just, temperate, courageous, psychologically strong, hopeful and merciful in order to be able to eradicate his passions completely. Galen claims that the culture of the soul starts from the forgiveness of the errors of others, the fight against anger and fear and the rational thinking, since reason is the most precious gift to human being.

The psychopathologic analysis of the passions by Galen has many similarities with the approaches of the modern psychopathology. However Galen's psychothe-

rapeutic technique associates philosophy and medicine harmoniously. Galen combined Platonic, Aristotelian, Pythagorean and Stoic methods in order to approach the etiopathology of the passions and analyze the main causative factors and motivations. He attempted by his methodology to uncover any concealed passion in order to help the man to eradicate it completely and to obtain his interior peace and psychological stability.

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