Galen's Concept of Continuity

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In discussing the arrangement of the parts of the body, their internal cohesion and attachments to each other, the activities and powers that they possess or transmit, and the damage caused by destruction of their unity or union, Galen employs the concept of continuity, συνέχεια.[1] He gives special prominence to this concept in

[1] This paper is based on a fairly extensive, but by no means complete, search of Galenic texts. Works that survive only in Latin or Arabic translation were used only in those cases where the concept of continuity is clearly present. One such passage, *Anat.* 10 p.49.15–16 Simon, was identified by J. Kollesch, *CMG* Suppl. V p.79. The following abbreviations are used in references to Galen's works:
An in art.: An in arteriis natura sanguis contineatur: Kühn IV
Anat.: De anatomicis administrationibus: Kühn II, Simon II
CC: De causis contentivis: CMG Suppl.Orient. II
CMG: Corpus Medicorum Graecorum
Const. AM: De constitutione artis medicae: Kühn I
CP: De causis pulsuum: Kühn IX
DF: De differentiis febrium: Kühn VII
Helmreich: G. Helmreich, ed. *De usu partium*, 2 vols. (*BT*, Leipzig 1907–09)
II: De inaequali intemperie: Kühn VII
In Epid. I comm.: In Hippocratis Epidemiarum librum primum commentarii: CMG V 10.1
In Epid. III comm.: In Hipp. Epid. librum tertium commentarii: CMG V 10.2.1
In Epid. VI comm.: In Hipp. Epid. librum sextum commentarii: CMG V 10.2.2
In Fract. comm.: In Hippocratis librum de fracturis commentarii: Kühn XVIII B
In NH comm.: In Hippocratis de natura hominis librum commentarii: CMG V 9.1
In OM comm.: In Hippocratis librum de officina medici commentarii: Kühn XVIII B
In Progn. comm.: In Hippocratis Prognosticum commentarii: CMG V 9.2
In Prorrhet. comm.: In Hippocratis Prorrheticum commentarii: CMG V 9.2
In VA comm.: In Hippocratis de victu acutorum librum commentarii: CMG V 9.1
IO: De instrumento odoratus: CMG Suppl. V
Iul.: Adversus ea quae Iuliano in Hippocratis Aphorismos enuntiata sunt: CMG V 10.3
K: Kühn, *Claudii Galeni Opera Omnia.*
LA: De locis affectis: Kühn VIII
MC: De morborum causis: Kühn VII
MD: De morborum differentiis: Kühn VI
MM: Methodus medendi: Kühn X
Mot.musc.: De motu musculorum: Kühn IV
NF: De naturalibus facultatibus: Kühn II
Part.hom.diff.: De partium homoeomerium differentia: CMG Suppl.Orient. III
PD: De pulsuum differentia: Kühn VIII
PHP: De placitis Hippocratis et Platonis: CMG V 4.1.2, Kühn V

his classification of diseases. The two most comprehensive classes are δυσκρασία, faulty mixture of the active qualities (hot, cold, wet, dry), and συνεχείας λύσις, dissolution of continuity.[2] The latter is his own designation for a class that includes wounds, ulcers, fractures, corrosion of tissues, and the like, for which his predecessors had no common name.[3] He sometimes varies the phrase, substituting ἑνώσεως for συνεχείας, and διαίρεσις or διαφθορά for λύσις;[4] and sometimes he uses several of these terms in combination.[5] Yet συνεχείας

Plenit.: De plenitudine: Kühn VII
Ptis.: De ptisana: CMG V 4.2
SC: De symptomatum causis: Kühn VII
Sem.: De semine: Kühn IV
SIMON: M. Simon, *Anatomie des Galen* (Leipzig 1906) vol. II
SM: De simplicium medicamentorum temperamentis ac facultatibus: Kühn XI–XII
ST: De sanitate tuenda: CMG V 4.2
Tum.: De tumoribus praeter naturam: Kühn VII
UPart.: De usu partium: Kühn III–IV, Helmreich
UPuls.: De usu pulsuum: Kühn V
References are to *CMG* wherever possible. For the rest, Kühn's pagination is used for the works that are in Kühn, as it is always entered in the margins of subsequent editions.

[2] See for example *MM* 13.1, X 874.1–4 K. These two classes overlap. A faulty mixture of qualities, especially immoderate heat or cold, can destroy continuity. A chill in one part, for example, may cause a contraction which pulls that part away from those with which it is continuous: *SM* 4.2, XI 622.3–5, 623.1,5–6,7–8, 625.1–6, 626.1–2; *II* 6, VII 744.17–745.6 K. The classification of diseases that Galen gives in *MM* 2.6, X 125.13–126.5 K, is more elaborate: (1) faulty mixture, a disease of homoeomerous parts; (2) four kinds of diseases of organs; (3) dissolution of continuity, a form of disease common to homoeomerous parts and to organs. There is a somewhat similar scheme in *Const. AM* 5, I 237.15–238.11 K. The closest pre-Galenic approach that I have found to a generalized concept of interruption or blockage as a cause of disease is Philistion's view that when the flow of pneuma throughout the body is unimpeded, the body is healthy, and when the pneuma does not flow freely, diseases arise. See Anon.Lond. col. xx 43–50.

[3] See *MC* 11, VII 37–40 K. Lists of disorders that fall under this general heading are given also in *CC* 9, p.140.29–37; *Const. AM* 5, I 238–39 K; *II* 3, VII 739.17–18 K; *LA* 2.5, VIII 80–81 K; *MD* 11, VI 872 K; *MM* 3.1, 4.1, 6.1, X 160, 232–33, 385 K.

[4] ἕνωσις replaces συνέχεια at *Const. AM* 13, I 269.12 K; *In Fract. comm.* 2.16, XVIII B 446.8 K; *MD* 4, 11, VI 847.15, 871.4–5 K; *SC* 1.2.3, VII 94.5–7, 103.12 K; and restoration of ἕνωσις is given as the aim of treatment at *In Fract. comm.* 1.1, XVIII B 330.3–4 K, and *MM* 3.1,10, X 160.3–4,7–8, 228.12 K. λύσις or λύω may be replaced by ἀπόλλυμι (*MD* 12, VI 874.3–4 K), βλάπτω (*Const. AM* 5, I 239.17 K), διαίρεσις or διαιρεῖν (*MC* 1,11, VII 2.2–3, 37.16, 39.2–5 K; *MD* 12, VI 873.11 K; *MM* 6.1, X 385.9 K; *SC* 1.6, VII 117.2 K), διαφθορά or διαφθείρω (*In Fract. comm.* 1.1, XVIII B 330.2 K; *In VA comm.* 2.1, p.164.2). συνεχείας λύσις is replaced by ὄγκος in the classification given in *LA* 5.7, VIII 345.12–18 K.

[5] There is a piling up of terms at *Const. AM* 5, I 238.9–11 K; *MC* 11, VII 37.10–16 K; *MM* 5.2, 6.1,5, 7.2, X 309.12–13, 384.8, 423.16–17, 459.7 K; *SC* 1.6, VII 117.13–14 K.

λύcιc emerges as the name peculiar to this class of disorders, and as such it survives in Nemesius.[6]

Under this general heading are many different kinds of continuity. Here again Galen's division is dyadic: continuity is a property both of homoeomerous parts, such as bone and membrane,[7] and of the organs formed from homoeomerous parts.[8] Galen sometimes speaks of a homoeomerous part as being "continuous with itself," cυνεχὲc ἑαυτῷ.[9] Indeed, being continuous with itself appears to be a criterion of such a part; in one place Galen says that no compound body is homoeomerous, since the whole of it is not continuous with itself.[10] Homoeomerous parts can be divided into segments that differ in

[6] For further examples of *cυνεχείαc λύcιc* see *In OM comm.* 3.1, XVIII B 820.13 K; *MM* 3.2, X 162.7 K; and for *c. λύεcθαι*, *II* 3, VII 739.12 K; *In VA comm.* 2.1, p.163.22; *MD* 11, VI 871.11 K; *MM* 6.5, 14.16, X 426.10–11, 1002.2 K; *Sem.* 1.4, IV 527.8 K. The passage in Nemesius is *De natura hominis* 1, p.51.5–6 Matthaei.

[7] Galen gives a short list of homoeomerous structures subject to dissolution of continuity in *Const. AM* 5, I 238.12–239.6 K. He mentions the continuity of certain homoeomerous structures in other passages also, of arteries in *An in art.* 4, IV 717.2 K, and *MM* 13.22, X 941.15 K; of bone in *UPart.* 3.9, III 214.1–3 K, *MM* 6.5, X 426.10–11 K, and *In Fract. comm.* 1.1, XVIII B 330.2 K; of the mesenterion in *In Epid. VI comm.* 4.7, p.197.6–8, 12–13; of the membrane around the fetus in *Sem.* 1.6, IV 534.14–15 K; of the inner sheath that extends from the oral cavity through the esophagus to the stomach in *UPart.* 4.8, 7.3, III 282.11–13, 520.6–8 K, *In Prorrhet. comm.* 1.30, p.43.11, and *IO* 2.6 and 3.2, pp.38.5 and 40.13. See also the passages cited *infra* n.9; and for continuity in the substance of the tongue see n.12. Galen gives lists of homoeomerous structures in *II* 2, VII 735.6–12 K and in *Part.hom.diff.* 3.7, p.59.6–17 and 9.6, pp.83.22–85.1; but the lists show discrepancies. In his use of the term homoeomerous Galen follows Aristotle (with modifications) rather than Anaxagoras, except possibly in such passages as *SM* 3.16, XI 584.4–10 K, where he speaks of perhaps a thousand invisible homoeomerous bodies in a ladle of juice, and *SM* 4.3, XI 628.4–5 K, where he says that it is impossible, or at least very difficult, to find a substance (*e.g.* wine) that is completely homoeomerous.

[8] This dyadic division of continuity is mentioned in *Const. AM* 5, I 238.11–239.11 K; *MD* 11, VI 871.4–14 K; *MM* 2.6, X 125.19–126.1 K; *SC* 1.2, VII 87.3–6, 94.5–6 K.

[9] Clear examples are the inner sheath of the esophagus (*In Progn. comm.* 3.35, p.361.4–5), the semen in the uterus and the membrane that forms around it (*Sem.* 1.4, IV 523.4, 526.10 K), and the skin (*LA* 3.11, VIII 196.15–16 K). Muscles (*LA* 5.7, VIII 350.5–6 K) are also "continuous with themselves," though according to *Part.hom.diff.* 3.7, p.59.9–10, it is the fibres in the muscles that are homoeomerous.

[10] *PHP* 6.2, p.372.11–13, V 519.3–5 K. The text has been emended by the transposition of a negative. Writers other than Galen did not use the phrase in so restricted a sense. Erasistratus apparently used it of the pneuma in the arteries, with the meaning that if part of the pneuma escapes the rest will follow; *cf. An in art.* 2,3,4, IV 708.9–13, 710.5–12, 716.15 K. Galen reports also that for Aristotle and the Stoics water is continuous with itself in that it contains no void: *In Epid. VI comm.* 4.11, p.215.11. This appears to be a Parmenidean use of the term *cυνεχές*; see *infra* n.106. Plutarch describes the body as continuous with itself when it is awake: *Quaest.conviv.* 4.2.4, *Mor.* 666A.

size but not in kind, and the divisions cannot be numbered.[11] The continuity of a homoeomerous part may be destroyed by the cutting of a nerve or blood vessel, the breaking of a bone, the growth of a tumor, or any of the disorders that Galen includes under the name ἕλκος (hereafter translated 'sore' for lack of a better term).

Continuity in the organs takes several forms. The tongue as organ of taste has the continuity of its homoeomerous substance. This continuity may be dissolved, with resultant pain, by a sharp or bitter taste.[12] (The dissolution of continuity, though not always painful, is nevertheless one of the two principal causes of pain.)[13] The arteries are continuous with each other and with the heart.[14] When an artery is severed, the continuity extends only as far as the cut.[15] The veins are similarly continuous with the liver,[16] and the nerves and spinal cord with the brain.[17] The forearm is a continuous whole before its unity is destroyed by a fracture.[18] A muscle that divides into fingers, as it were, is not continuous at the divided end;[19] and similarly the lungs, being divided into lobes, are not wholly continuous.[20]

Continuous parts may be contiguous or may be joined by an intermediary. Muscle is continuous with bone.[21] An outer muscle in the leg is continuous with an inner muscle.[22] The three bones of the tarsus are continuous with the scaphoid bone.[23] The tendon at the

[11] See *MD* 8, VI 867.14–868.2 K; *PHP* 6.2, p.372.13–14, V 519.6–7 K; and on the infinite divisibility of continuous magnitudes, *infra* n.121.

[12] *SC* 1.6, VII 116.18–117.2 K. The tongue appears in the list of homoeomerous structures in *Part.hom.diff.* 7.11, p.77.20–23, even though it is a sense organ (*cf. Const. AM* 2, I 232.4 K). Presumably as an organ it is non-homoeomerous, yet its flesh is homoeomerous. There are examples of other such organs in *Part.hom.diff.* 7.1–3, pp.73.21–75.7. Similarly, the skin is called homoeomerous (see *supra* n.9) yet is an organ of touch.

[13] *Const. AM* 7, I 249.8–11 K; *II* 3, VII 739.9–18 K; *In Fract. comm.* 3.34, XVIII B 586.5–8 K; *In VA comm.* 2.1, p.163.22; *LA* 2.5, VIII 80.12–17 K.

[14] *UPuls.* 5, V 164.18–165.1 K; *UPart.* 6.7, III 436.10–12 K; *cf.* 6.14, III 479.16 K.

[15] *PHP* 2.6.10, p.150.9–11; 6.3.3, p.372.25–27, V 520.4–6 K.

[16] *Cf. UPart.* 4.13, III 301.8 (as corrected by Helmreich, vol. I p.221) and 10 K. See also p.360 *infra.*

[17] *Const. AM* 3, I 234.11–12 K; *UPart.* 8.12, III 671.14–15, 672.1–2 K; *Mot.musc.* 1.1, IV 369.13–14; 371.6–7 K; *MM* 6.3, X 403.7–8 K; *PHP* 7.5.9, p.454.21–23, V 620.1–3 K.

[18] *In Fract. comm.* 1.51, XVIII B 410.10–13 K.

[19] *Anat.* 5.3, II 493.14–15 K.

[20] *UPart.* 7.10, III 550.13–14 K.

[21] *Mot.musc.* 1.9, IV 414.11, 417.15–16 K.

[22] *UPart.* 3.16, III 258.9 K.

[23] *UPart.* 3.8, III 201.5–6 K.

sternum is continuous with the rectus muscle at the epigastrium.[24] The upper part of the stomach is continuous with the esophagus, and the lower part is continuous with the upper part.[25] The penis is continuous with the neck of the bladder.[26] Continuity implies closeness also in Galen's refutation of the Stoic argument that speech does not come from the brain. Galen says that one of the Stoic premises should have been: "All that is sent through a thing is sent out of the parts continuous with that thing"; and another premise should have been: "The brain is not continuous with the windpipe."[27]

But continuous parts are not always contiguous. The brain is continuous with the heart through the carotid arteries.[28] The kidneys are continuous with the colon through the peritoneum.[29] The uterus is continuous with the breasts through the blood vessels;[30] and there are bonds that fasten a bronchial tube to the parts continuous with it.[31] Nor does contiguity entail continuity. The arteries that ascend from the groin lie close to the arteries that descend from the sternum, but their continuity is through the great artery, just as leaves on different branches of a tree may be spatially close but remote in their continuity, which is through the trunk.[32]

The use of *cυνεχές* to characterize closely related parts of the body is not original with Galen. It appears in a passage that Galen quotes from Diocles,[33] and it may even go back to Diogenes of Apollonia.[34] Artistotle in his biological works uses *cυνεχές*, much as Galen does, of parts of the body that combine to form systems. He says in one passage that the continuity of bones with the spine and of blood

[24] *Anat.* 5.3, II 496.17–18 K.

[25] *LA* 6.2, VIII 381.5–7 K.

[26] *Sem.* 1.5, IV 566.15 K.

[27] *Cf. PHP* 2.5, pp.142.22–24; 142.34–144.1; 144.10–11, 25–28; 146.10–13, 16–17. Galen does not always name the continuous parts to which he refers. He speaks, for example, of "injuries to the heel and the continuous parts," *In Fract. comm.* 2.18, XVIII B 449.6–7 K, and the violent passage of a humor through continuous parts as it is evacuated, *LA* 1.2, VIII 24.7–8 K. The arteries on expanding draw in *τὸ cυνεχές*, *An in art.* 7, IV 730.17–18 K. A pair of nerves spreads through the mouth of the stomach and the parts continuous with it, *UPart.* 4.7, III 277.8 K. *Cf.* also *MC* 7, VII 30.15 K.

[28] *UPuls.* 2, V 156.8–9 (*cf.* 154.6–7) K.

[29] *In Epid. VI comm.* 1.6, p.24.20–21.

[30] *MM* 13.19, X 925.13–926.1 K.

[31] *LA* 1.1, VIII 3.1–2 K.

[32] *An in art.* 5, IV 719.2–4 K.

[33] *LA* 3.10, VIII 187.13 K.

[34] *Cf.* the use of *cυνέχω* in fr. B 6 Diels-Kranz=Arist. *Hist.An.* *Γ* 2, 512a27.

vessels with the heart is a necessary condition of their performing their proper functions.[35] Elsewhere Aristotle makes a sharper distinction than Galen does between continuity and attachment,[36] and he ties continuity more closely to oneness of movement. Thus he gives arm and leg as examples of continuous things that are spoken of as one, but then goes on to say that shin or thigh is a better example than leg.[37]

It is abundantly clear that there is for Galen, as for Aristotle, a close relation between the body's continuities and its activities and powers. The powers may proceed by identifiable routes or may pass through tissues. Galen uses the phrase κατὰ τὸ cυνεχές, 'step by step', to characterize the course of the air as it passes from nostrils to the trachea or the brain,[38] the stages in the distribution of nutriment to all parts of the body,[39] and the successive emptying and filling of parts in the dissipation of the body's substance from the inner organs through the skin into the surrounding air: the parts are emptied and refilled "one after another, as in a kind of dance" κατὰ τὸ cυνεχὲc ὡc ἐν χορῷ τινι.[40]

Especially important for Galen is the availability of continuous routes for the transmission of quality and power without an accompanying transmission of substance. The power of pulsation flows constantly into the tunics of the arteries from the body of the heart, with which the tunics are continuous.[41] The power "called natural and nutritive" flows from the liver to the veins,[42] and in the veins there is "continuity of transference."[43] A proof that the liver is the source of this power is that there is no other organ with which all veins are continuous.[44]

[35] Arist. *Part.An.* 2.9, 654a32–b17.

[36] *Metaph. I* 1, 1052a19–20; K 12, 1069a5–8.

[37] *Metaph. Δ* 6, 1016a2–3, 9–12. For other Aristotelian uses of the concept of continuity see *infra* nn.104 and 120.

[38] *IO* 3.11, 4.2, p.44.6, 27.

[39] *PHP* 6.8.19, p.410.36, V 568.10 K. *Cf.* [Arist.] *De spiritu* 3, 482a35, where it is denied that inspired breath is distributed κατὰ cυνέχειαν to the whole body.

[40] *SC* 1.7, VII 129.4 K. Bandaging, also, may be κατὰ τὸ cυνεχές (*cf. In Fract. comm.* 3.15, XVIII B 556.3 K); and the chain of pieces of iron hanging from a magnet is κατὰ τὸ cυνεχές (*NF* 1.14, II 48 K).

[41] *PHP* 7.5.12, p.456.3–4, V 620.18–621.2 K.

[42] *In Epid. VI comm.* 1.3, p.18.12–13.

[43] *UPuls.* 2, V 157.13–14 K. See also p.364 *infra*.

[44] *PHP* 6.8.5, p.408.17–20, V 564.15–565.1 K. See also 6.5.19,28, pp.390.35–392.1, 392.35–394.3, V 542.16–543.5, 545.10–16 K.

In the nerves the situation is more complex. The optic nerves are hollow and contain psychic pneuma.[45] This pneuma proceeds from the brain to and through the eyes.[46] When it strikes the outer air it assimilates the air to itself by means of a flow of qualitative change throughout the air, which is a continuum. Galen compares this flow to the flow of the sun's light and heat. The resultant continuum of pneuma and air becomes the instrument for vision.[47]

The majority of nerves, however, which transmit the power of sensation and motion from the brain to all parts of the body,[48] are not hollow. They carry these powers through their inner core, which consists of compressed brain tissue and is surrounded by protective coats similar to the meninges.[49] A proof that these nerves have in them a flow of power or qualitative change rather than of substance is the fact that transmission from brain to toe is instantaneous; no substance, not even pneuma, could make its way so quickly through such narrow, tortuous and fragile conduits.[50] The power carried by a nerve extends beyond the nerve itself to what is continuous with it. Thus the nerve to the liver, without penetrating the whole of that organ, makes it faintly sensitive.[51] Galen tells us, incidentally, that "flow of power" and "flow of qualitative change" are simply two ways of referring to the same phenomenon.[52]

The flow is initiated by action of the brain's pneuma on the continuum. This was the case with vision, when the pneuma struck the outside air. Galen asks why it is that the spinal cord also is hollow for some distance from the brain and suggests as an answer that this hollow permits the pneuma to strike the solid portion with a stronger blow than would be possible if the spinal cord were entirely solid.[53]

The dissolution of the body's continuities is, as was said, one of the two main classes of diseases. But these same continuities, when unbroken, may themselves contribute to the spread of disorders.

[45] *PHP* 7.4.4, p.448.25–29, V 612.14–613.2 K.

[46] *PHP* 7.4.11–13, p.450.10–22, V 614.4–18 K.

[47] *PHP* 7.5.5–10, p.454.8–27, V 619.2–620.8 K.

[48] *PHP* 7.1.4, p.428.19–21, V 587.13–16 K.

[49] *PHP* 7.3.5; 5.13, pp.440.15–19; 456.5–11, V 602.3–8; 621.2–11 K; *Anat.* 10, p.34 Simon.

[50] *PHP* 7.4.20–21, p.452.8–15, V 616.10–617.1 K. Matter mostly needs a wide road: *UPart.* 6.17, III 499.14–17 K.

[51] *UPart.* 4.13, III 310.15–311.4 K.

[52] *PHP* 7.4.2, p.448.14–16, V 612.2–4 K.

[53] *PHP* 7.4.23, p.452.17–22, V 617.4–11 K; *cf.* 7.4.3, p.448.22–24, V 612.12–14 K.

Galen found explanations of this kind in his predecessors. He quotes a passage from Erasistratus in which it is said of a gathering of pus that it constantly fills the continuous places: πληρουμένων δὲ ἀεὶ τῶν συνεχῶν τόπων;[54] and he reports that his teacher Pelops used the concept of continuity to explain how a diseased leg could affect the head: the cause is either a qualitative change or a substance of the nature of pneuma that spreads through the parts κατὰ τὸ συνεχές. If poison lodges in a nerve-like part, it could send its power κατὰ τὸ συνεχές to the beginning of the nerves. A scorpion's sting can penetrate the skin and strike a nerve or artery or vein; but even a shallow bite on the surface of the skin may be transmitted by the skin itself to the whole body, since the skin is continuous with itself and nerve-like.[55] Where Pelops ends and Galen begins in this passage is not clear. Galen apparently accepts Pelops' explanation. Elsewhere, however, he gives rather different explanations of the way in which poisons reach the heart.[56]

Galen utilizes in still other contexts the concept of continuity to explain the spread of pathological states in the body. Tension, for instance, can arise in a part from an affection either of the part itself or of parts continuous with it.[57] When veins containing menstrual blood become swollen, their tension may spread to the bonds adjoining them and from these κατὰ τὸ συνεχές to the uterus.[58] Gangrene attacks τὰ συνεχῆ, and herpes, the creeping disease, gets its name from the way it attacks τὸ συνεχὲς τοῦ δέρματος.[59] In one of Galen's cases the part of the pericardium that is continuous with the sternum mortified as a consequence of a wound in the sternum.[60] The body's reaction to a disorder may also involve continuity: vomiting is explained by the sheath within the esophagus that is continuous with itself from stomach to mouth.[61] The healing of a break is of course a restoration of continuity.[62]

Continuity also explains some forms, at least, of sympathetic dis-

[54] *LA* 5.3, VIII 318.12–13 K.
[55] *LA* 3.11, VIII 194.18–197.4 K. At 196.15–16 I would read συνεχές τε γὰρ αὐτῷ.
[56] *SM* 3.18, XI 596.7–598.5 K, and *infra* n.116.
[57] *In Epid. VI comm.* 1.30, p.58.2–7.
[58] *LA* 6.5, VIII 429.17–430.2 K.
[59] *Tum.* 8, 9, VII 720.17–18, 723.4–5 K.
[60] *PHP* 1.5.1, p.74.3–5.
[61] *In Progn. comm.* 3.35, p.361.4–10; see also *supra* n.7.
[62] *MM* 3.10, X 228.12 K; see also *supra* n.4.

orders. Though I have not found in Galen a generalized statement of the relation between the two, in certain specific cases he conjoins sympathy and continuity. Among the signs of an affection of the colon he lists deterioration of appetite and digestion, "since the stomach through the sharing of continuity suffers sympathetically with the part that is affected primarily."[63] Again, tension may arise by sympathy alone (that is, without an excess of blood) when the parts continuous with inflamed parts are drawn tight.[64] A third passage has to do with the ear and the brain: pain in the visible ear is not dangerous, as the visible ear has no sovereign power and is not continuous with any sovereign part; but pain in the depth of the ear arises from an affection of the auditory nerve, which is attached to the brain at no great distance. It is reasonable, then, that many who suffer pain in the depth of the ear die, since the brain comes into sympathy with it.[65]

It is not surprising to find Galen using his concept of continuity and his classification of diseases as aids in the interpretation of Hippocrates. Galen found the term συνεχής used in Hippocratic texts with reference to time, as in the phrase, πυρετὸς συνεχής, continuous fever,[66] and παλμὸς συνεχής, continuous throbbing.[67] Rain, also, may be continuous and soft.[68] Galen himself characterizes the sequence of signs and symptoms in a Hippocratic case history as occurring κατὰ τὸ συνεχές.[69] But Galen's sophisticated view of the manifold continuities in the body's structure and activity is, as far as I know, absent from the Hippocratic writings. Yet Galen assumes its presence. For example, a rather challenging problem for Galen was to make sense of the passage in Hipp. *De Fract.* 31 (vol. III p.526.9–10 Littré) which says, "... unless a person should say that other diseases too are sores (ἕλκεα). For this statement also has a

[63] *LA* 2.5, VIII 84.16–17 K.

[64] *In VA comm.* 2.10, p.169.16–18. There is another example of tension by continuity and without swelling in *In Epid. I comm.* 3.19, p.132.17–19, but in that passage there is no mention of sympathy.

[65] *In Progn. comm.* 3.18, p.346.11–16.

[66] Galen mentions continuous fever in many places. See for example *In Epid. I comm.* 1.24, pp.37.18–38.32; 3.2, 3, 10, pp.111.1–114.2; 120.23–121.29; *In Epid. III comm.* 3.66, pp.147–48.

[67] See Gal. *In Epid. I comm.* 3.19, pp.131.12, 132.10.

[68] See Gal. *In Epid. I comm.* 1.2, p.24.1,10,19.

[69] *In Epid. I comm.* 3.19, p.131.14–16; *cf.* also *In VA comm.* 4.110, p.358.9–10.

certain reasonableness." In Galenic terms the question raised here is whether diseases of the class marked by faulty mixture of the qualities may also be said to be diseases of the class marked by dissolution of continuity, since sores belong to the latter class. Galen argues that although such a statement would be false, it is nevertheless plausible. (He takes ἐπιείκεια to be equivalent to πιθανότης; he is rather fond of the antithesis "plausible, but not true."[70]) He explains its plausibility by pointing out that a sudden change to faulty mixture, when caused by excessive heating or chilling, is accompanied by a painful dissolution of continuity, or, in other words, a sore. But from this it does not follow that all instances of faulty mixture are instances of sores.[71]

Galen uses the concept of continuity also in interpreting the Hippocratic statement that "the whole body breathes together and flows together with itself."[72] The context in Galen is that if the arteries are ligated so that the blood cannot transmit heat, the heat will nevertheless be transmitted by the walls of the arteries, and if even these cannot transmit it, other parts will, especially the veins, "through the continuity of transference."[73]

I shall not attempt to list and classify all the other uses, in Galen and elsewhere, of συνεχής, συνέχεια and related terms. A few, however, deserve to be mentioned, as possibly relevant to Galen's concept of the continuities that unify the body and underlie its activities. In Galen himself one finds συνεχής used of the unifying theme of a treatise or the unifying thread of an argument. Sometimes, to be sure, the term refers only to what comes next, with no necessary implication of coherence. In his commentaries, for instance, Galen may make a transition by announcing that he will now proceed to τὸ συνεχές.[74] At other times, however, the emphasis is on the unity or coherence of a verbal sequence, whether a sentence, a discussion or a whole treatise. In one place Galen obtains the continuity of a

[70] See for example *UPart.* 6.20, III 505.15–16 K; *SM* 2.5, XI 471.13–14 K; *PHP* 1.10.10, p.98.12.

[71] *In Fract. comm.* 3.34, XVIII B 585.15–587.12 K; *II* 6, VII 744.17–745.6 K.

[72] *UPuls.* 2, V 157.10–12 K. I do not know the Hippocratic source.

[73] See *supra* n.43.

[74] *In VA comm.* 4.40, p.311.16; *In NH comm.* 3.16, p.101.23; *In Progn. comm.* 2.63, p.315.17; *In Epid. III comm.* 3.33, p.131.7; *In Epid. VI comm.* 3.32, p.174.1. Compare Pl. *Soph.* 261E1, 262C1, where it is pointed out that not every sequence (συνέχεια) of words has a meaning or forms a sentence.

Hippocratic text by transposing a clause;[75] in another he rearranges a Hippocratean passage to produce an order in which one sentence is *cυνεχὴc καὶ ἀκόλουθοc*, continuous with and consequent on, the preceding sentence;[76] and in still another he gives the continuity of a Hippocratic passage through paraphrase.[77] He reports that Dioscurides gave continuity to a Hippocratic sentence by recasting it;[78] and of yet another passage he says that some commentators linked it to the passage immediately preceding, while others "split it off from continuity with the preceding statement."[79] Within his own treatises he sometimes postpones the discussion of an item in order not to interrupt *τοῦ λόγου τὸ cυνεχέc*.[80]

The participle *cυνέχον* is also used of the unifying element in treatises. In his commentary on *Epidemics VI* Galen speaks of "that which most of all holds the entire account together."[81] In *De locis affectis* he uses a very similar phrase with reference to a work of Erasistratus.[82] His own early work, *De elementis secundum Hippocratem*, presented *τὰ cυνέχοντα πάντα* of the Hippocratic *De natura hominis* but did not include a sentence-by-sentence commentary.[83] Chrysippus' treatises *De anima* and *De affectibus* both failed to give adequate attention to *τὸ cυνέχον*, that which holds (or should hold) a treatise together.[84]

Even tighter, one would assume, is the continuity in the sequence of propositions that comprise a demonstration. In one of his commentaries Galen recasts a Hippocratean sentence into a demonstration (*ἀπόδειξιc*) consisting of three propositions, which he introduces

[75] *In Epid. I comm.* 1.19, p.36.2–3.

[76] *In VA comm.* 2.32, p.190.28–29.

[77] *In Epid. VI comm.* 2.20, pp.82.27–83.6.

[78] *In Epid. VI comm.* 3.13, p.142.11.

[79] *ἀποcχίcαντεc ἀπὸ τῆc τῶν προειρημένων cυνεχείαc*, *In Epid. VI comm.* 4.11, p.211.11. *Cf.* also *In Prorrhet. comm.* 3.6, p.113.16, where Galen gives *τὸ cυνεχὲc τῆc λέξεωc* that results from changing a word.

[80] *Sem.* 1.7, IV 536.5 K; *cf. MM* 5.7; 10.5, X 335.17; 685.2 K; *LA* 1.1, VIII 13.11–12 K; *UPart.* 4.17, III 329.2–3 K. To this usage may be compared Epicurus' reference to the continuous circuit of the whole of his philosophy, *τῆc cυνεχοῦc τῶν ὅλων περιοδείαc*, *Epist. ad Herod.* 36.

[81] *τὸ cυνέχον μάλιcτα τὸν ὅλον λόγον*, *In Epid. VI comm.* 2.46, p.118.23–24.

[82] *LA* 5.3, VIII 320.10 K: *αὐτὸ μάλιcτα τὸ cυνέχον ὅλον αὐτοῦ τὸν λόγον.*

[83] *Cf. In NH comm.* 1 proem, p.3.12–14; *PHP* 8.2.13, p.492.28–29, V 664.17 K. There is a similar use of *cυνέχον* in Philod. *De pietate* p.86.33 Gomperz.

[84] *PHP* 3.8.26–28, pp.228.30–32, 230.1,6; 4.6.13–14, 7.20–21, pp.272.25–30, 284.24–28.

with the words ὥcτε εἶναι τὸ cυνεχὲc τῆc ἀποδείξεωc ὧδέ πωc περαινόμενον, "so that the continuity of the demonstration arrives at its conclusion pretty much in the following way."[85]

Galen employs also the Stoic concept of a continuing cause, αἴτιον cυνεκτικόν or αἰτία cυνεκτική, modifying it to conform to his own view of being and becoming. A continuing cause is coeval with its effect; while it is present, the effect remains, and when it ceases, the effect ceases.[86] As Galen states it, the Stoics held that everything that exists must have a continuing cause; but this, Galen argues, leads to an infinite regress.[87] His own view is that only those things that have their being in becoming require continuing causes.[88] The continuity here is not only in the persistence in time of a condition capable of producing a given effect but also the persistence of the power of that condition to produce that effect. Galen employs a continuing cause from time to time in his treatises;[89] he uses it in his exegesis of Hippocrates;[90] and he accuses Julianus of misusing it.[91]

A distinction should be made, I think, between temporal continuity and spatial continuity. In its temporal aspect cυνεχήc may be used either of uninterrupted happenings or of frequently repeated happenings. Examples of the latter include continual sexual indulgence, which drains the semen more continuously from the body,[92] the continuous eliminations that characterize some pathological states,[93] the continuous movement of the organs of respiration[94] and the heart,[95] continuous use of a medicament,[96] continuous moistening of a bandage,[97] continuous visits of the physician,[98] and indeed the

[85] *In Progn. comm.* 1.2, p.198.11–12.

[86] *Cf.* Chrysippus, fr.phys. 351, *SVF* II, p.121.25–28.

[87] Cf. *Plenit.* 3, VII 525.10–528.17 K, where criticism of the Stoics is incidental to criticism of the Herophileans.

[88] *CC* 8.2, p.138.19–25; *Synopsis librorum suorum de pulsibus* 9, IX 458.15–459.5 K.

[89] *E.g. SC* 1.2,5,7, VII 93.2–4, 109.7–9, 132.7 K; *CP* 1.1; 4.1,7, IX 2.1–3.20; 156.3, 165.7 K.

[90] *Cf. In NH comm.* 2.1, p.58.16–21.

[91] *Iul.* 6.1–13, 8.19–22, pp.52.17–58.6, 69.4–70.10.

[92] *Sem.* 1.16, IV 586.7, 587.5 K.

[93] *SC* 3.5, VII 238.7, 239.2 K; *cf. UPart.* 4.18; 5.16, III 332.12–15, 333.3–4, 334.3; 405.9 K.

[94] *In VA comm.* 1.31, p.149.27; *cf. UPuls.* 1, V 152.17–153.1 K.

[95] *PHP* 6.8.33, p.414.20, V 572.2–3 K; *UPart.* 6.8, III 438.5 K.

[96] *MM* 5.10, X 357.6 K.

[97] *In Fract. comm.* 1.21, XVIII B 366.13–15 K.

[98] *In Fract. comm.* 1.21, XVIII B 367.9–10 K.

continuous dripping of water that wears away the rock.[99] All these happenings are interrupted by short pauses. It is less clear whether Galen would permit pauses in such temporal events as the continuous growth of a plant[100] or an embryo[101] or the continuous flow from kidney to bladder[102] or the continuous nourishment of psychic pneuma.[103] A clear example of uninterrupted continuity in time would be for Galen the circular movement of the heavens; but I have not yet found in him that application of the term.[104] Nor have I found the statement that time itself is continuous.

Spatial continuity, however, is uninterrupted.[105] It is possible that this was what Parmenides meant, or at least part of what he meant, when he said that the all that is one is *cυνεχές*.[106] Gorgias, in seeming disagreement, argued that if what is is one, and the one is a continuous magnitude, then it is not one, for it can be cut.[107] For the atomists, on the other hand, bodies are not continuous because they contain void;[108] and Galen reports that Aristotle and the Stoics,

[99] SM 3.18, XI 597.13–14 K.

[100] *PHP* 6.3.12, p.376.6, V 523.8–9 K.

[101] *Sem.* 1.6, IV 535.8 K. The phrase *cυνεχὴc αὔξηcιc* was used by Aristotle, *Gen.An.* 2.6, 745a35, in a counterfactual about the teeth: "Even if they had continual growth (for 10,000 years) ..."

[102] *SC* 3.8, VII 251.11 K.

[103] *UPuls.* 2, V 154.14–15 K.

[104] *Cf.* Arist. *Phys.* 8.8, 264b9. On the importance of the concept of continuity in Aristotle's doctrine of movement see especially the discussion in F. Solmsen, *Aristotle's System of the Physical World* (Ithaca [N.Y.] 1960) 187–204. In the *Nicomachean Ethics* Aristotle describes as continuous the activity in accordance with virtue and the accompanying pleasure, pointing out that continuity of activity cannot be achieved in human affairs, but that this activity is more continuous than any other; see *Eth.Nic.* 1.10, 1100b16; 10.4, 1175a3–5; 10.7, 1177a19–22. For Epicurus time has minimal continuous spans (*Ad Herod.* 62); and Epicurus speaks of the temporal continuity of a life (*Main Tenets*, 16), the continuous movement of atoms (*Ad Herod.* 43), the continuous flow of atoms from the surface of bodies (*Ad Herod.* 48), and the continuous motion of small bits of earth that cause earthquakes (*Ad Pyth.* 105). Echoing Aristotle, he says that the philosophic life is *cυνεχὲc ἐνέργημα ἐν φυcιολογίᾳ* (*Ad Herod.* 37) and speaks of continuous pleasures, *ἡδονὰc cυνεχεῖc* (fr.116 Usener).

[105] An exception is Democritus' view that the Milky Way is made up of many small continuous (*cυνεχῶν*) stars: fr. A 91 D–K. Leucippus also, according to Diog.Laer. 9.32, spoke of continuous bodies flowing together.

[106] Parmenides, fr. B 8, line 6 D–K; *cf.* line 25. For a discussion see M. C. Stokes, *One and Many in Presocratic Philosophy* (Cambridge [Mass.] 1971) 134–35. The view that the cosmos is one and continuous is attributed to Philolaus by Stobaeus; see Philolaus, fr. B 21 D–K.

[107] Gorgias, fr. B 3 D–K=Sext.Empir. *Adv.Math.* 7.73.

[108] Leucippus, fr. A 19 D–K=Arist. *Phys.* 4.6, 213a31–b1.

rejecting the atomists' view, held that water, at least, does not contain void and is continuous.[109]

Galen himself avoids these theoretical controversies, but he finds continuity on the visual level in such substances as air,[110] vapor,[111] a black cloud,[112] resinous frankincense,[113] honey,[114] even barley gruel. Continuous barley gruel was already in Hippocrates' repertory of medicaments.[115]

Another feature of spatial continuity, as compared to temporal, is that it is not necessarily linear. In his physiology Galen for the most part thought of continuity as linear. He had trouble explaining the spread through the body of secondary sexual characteristics, poisons and their antidotes, and the powers of strong foods; and here he had to resort to some kind of general diffusion.[116] In his theory of vision, where the surrounding air is the medium, he needed an indefinitely large number of straight lines reaching from eye to visual objects.[117] But in general he made the continuities as specific as possible. This brought him into conflict with the Stoics. For Chrysippus the soul is a continuous pneuma that pervades the whole body.[118] Being in direct communication with every part, it doesn't need to send messages through passageways.[119] Galen thought that his experiments refuted this view, but he had great difficulty persuading the Stoics that he was right.

It remains a question whether Galen recognized the spread between opposite poles as a continuum. Aristotle in the *Nicomachean Ethics* had used the term συνεχής of the range between the vices of

[109] *Cf.* Gal. *In Epid. VI comm.* 4.11, p.215.3–11. In the same vein Galen, *SM* 4.2, XI 623.5–6 K, remarks that empty space is not permissible in continuous bodies so long as their continuity is preserved.

[110] *Cf. In Epid. VI comm.* 4.11, p.215.3; *PD* 3.6, VIII 673.2 K; *PHP* 7.5.7, p.454.15, V 619.11 K. Air was συνεχής also for the Stoics: Diels, *Dox.Graec.* p.409.9.

[111] *DF* 2.12, VII 378.16 K.

[112] *In Epid. VI comm.* 4.20, p.230.1; *cf.* also 230.5 and Arist. *Mete.* 2.9, 3.1,3, 369b1–3, 370b30–31, 372b22–24.

[113] *MM* 5.4, X 322.10 K.

[114] *ST* 4.5, p.119.18,20.

[115] *Cf.* Gal. *Ptis.* 5, pp. 458.14; 459.7,18; 460.21.

[116] *Cf. Sem.* 1.16, IV 584.1–585.5 K.

[117] *Cf. PHP* 7.5.40, p.460.25–26, V 627.1 K. Galen recognized also that sound spreads by waves; *UPart.* 8.6, III 644.13 K.

[118] Chrysippus, fr.phys. 885, *SVF* II p.238.32–33=Gal. *PHP* 3.1.10, p.170.9–10.

[119] *Cf.* Chrysippus, fr.phys. 898, *SVF* II pp.246.39–247.2=Gal. *PHP* 2.5, p.140.28–32.

excess and defect, with virtue somewhere in between.[120] It is a property of such a continuum that it can be cut at any of an infinitely large number of points[121] and that any two points on it will be opposites, the one closer to one extreme, the other closer to the other. In Galen's physiology there are some basic polarities, especially hot and cold, wet and dry, that present spreads of this kind;[122] and in a discussion of the Hippocratic "opposites are remedies for opposites" Galen points out that the things furthest apart in any genus are opposites, that there is between the extremes a μέσον of due measure, and that between the extremes there is also an infinite number of opposites, differing from each other as being more or less. The physician's problem, he says, is to find in any instance of more or less the opposite that will restore due measure.[123] In another passage, where Galen is discussing movements of the arm, he gives a range of positions of the arm, with a mean between two opposite poles.[124] That the spread in these cases is a continuum in Aristotle's sense seems clear, but I have not found the term συνεχές in the Galenic passages.

However that may be, it is evident that Galen's continuities are on the whole concrete: events in time or extensions in space. It is his use of a generalized concept of continuity to explain many of the structures, activities and malfunctions of the body that gives this concept an important place in his thought.

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[120] Arist. *Eth.Nic.* 2.6, 1106a26. *Cf.* in Aristotelian biology the continuum of differences within a genus; *Hist.An.* 8.1, 588b5; *Part.An.* 1.3, 643b33.

[121] The view that continuous magnitudes are infinitely divisible is assigned by Stobaeus to Aristotle and the Stoics; see Diels, *Dox.Graec.* pp.449.5, 461.30. Galen says that the infinite divisibility of magnitudes was established by the geometers: *PHP* 8.2.8, p.492.5–7, V 663.5–8 K; *cf. PHP* 8.2.4, p.490.19–20, V 662.2–3 K.

[122] See for example *De temperamentis* 1.8, I 558.4–14 K. Galen even refers (558.13) to a mean that is ἄκρως εὔκρατος; *cf.* Aristotle's description of the mean as an ἀκρότης, *Eth.Nic.* 2.6, 1107a8.

[123] *MM* 11.12, X 767–773 K; *cf.* also *MM* 9.15, X 650.7–651.16 K.

[124] *Mot.musc.* 2.1, IV 422–426 K. A possible, but not really probable, reference to such continua appears in Galen's list of the meanings of διαίρεσις in *PHP* 9.9, V 803.17–804.1 K. One item on the list is the division of a continuum into its parts.