



# THE BRIDGE

## Linking Practitioners of German Biological Medicine

Volume 9, Issue #3, March 2013

Monday, 18 March 2013

Dear Colleagues and Friends of OIRF,

👉 Welcome to Issue #3 of "The Bridge" newsletter for 2013! In this Issue I am pleased to begin a seven part series of articles by the esteemed Prof. Dr. Hartmut Heine on The Ground Regulation System. Here are the titles of all seven articles. Part 1 appears in this Issue and the remaining articles will follow in the next Issues:

**Part 1** – The Ground Regulation [A History and Background]

**Part 2** – GRS as a non-linear system – structure, function and determined chaos

**Part 3** – GRS as a non-linear system – structural components of the extracellular matrix (ECM)

**Part 4** – Spatial structure of the ECM and material transport within the system

**Part 5** – Contact, limitation and clogging up: Cell adhesion, basal membrane and glycosylation

**Part 6** – Functional relations of the ground regulation with the central nervous system

**Part 7** – The Ground Regulation and the Circadian Rhythm

– The Ground Regulation and Alzheimer Dementia

This first article of the series (I know "history" eww!! – and I suppose you "know all about" Ground Regulation) already has me amazed. I am confident that translation of these articles into English for the first time will once again take us to the heights of recent research and development in this field.

As I worked my way through translation of this particular article, the background of knowledge and understanding imparted in even this introductory article left me scrambling for dictionaries, research documents and way beyond "Google searches" to make sure that I was doing justice to the information Prof. Dr. Heine is presenting.

I was really curious about all the names of doctors, researchers and ancient philosophers that he kept mentioning. As I put together my own notes on who each of these 'guys' were, I decided to just maintain the document with the listings (mostly just short paragraphs on each one) and will publish it in the PDF format of this newsletter online – rather than clog up your email version.

So, here then is Part 1 of Prof. Dr. Heine's articles on the **Ground Regulation System**. As well, see the "Updates, Reminders and Announcements" for a quick reference to conferences and Institute activities.

Reminder: All Volume 9 Issues of "The Bridge" will also be published on our website and available to download in pdf/print format. Follow this link to download your copy of [Issue #3](#) and get all my alphabetical footnotes mentioned above.

➡ Here then are your newsletter items for this Issue #3:

*An **exclusive article** published March 2013  
by Occidental Institute Research Foundation . . .*

## **The Ground Regulation System (GRS)**

### **Part 1 – The Ground Regulation**

By o. Univ.Prof. Dr.rer.nat. med.habil. Hartmut Heine

**From an article in Naturheilkunde 2009; 6: 22-24. Reprinted in  
Der Weg zur Grundregulation, Zaen Plus GmbH 2011, 256-261**

**Machine Translation by SYSTRAN, Lernout & Hauspie, LogoMedia & Prompt  
Translation & redaction by: Carolyn L. Winsor, OIRF**

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The ancient theory of the [*bodily*] humors has been lively established for more than 2500 years. It has changed into the Ground Regulation System (GRS). The oldest and most effective theory of the history of medicine has thereby further developed into a theory of holistic medicine; in school [*orthodox*] medicine and complementary medicine we find a common denominator. Part 1 of this series [*of articles*] on the Ground Regulation System deals with the historical backgrounds of the ancient theories of the humors through to the present.

#### **Historical Background**

With the formation of advanced civilizations in the "axis" period (500 BC) (8), the question of development progresses from the possibility to the reality, the central philosophical reference point. An understanding of nature was then derived in Greek philosophy from the behavior of natural contrasts like "warm-cold", "dry-moist", "hard-soft", etc. Chinese thinking refers for example to the complementary processes of the

contrast yin-yang pairs which are constantly complementary in unceasing processes of change and finally lead to harmony of the whole. However ancient Greek thinking derived on the Epikrateias Interpretation of competition established: In the confrontation between two antagonists the advantage absolutely goes to the stronger more effective (4).

In Chinese philosophy the real religious foundation of yin-yang polarity originates from the creative elemental force, the Tao. Analogously in ionic natural philosophy, Thales of Milet<sup>a</sup> (about 600 BC) understood matter [*and form*] as an ark, as a creative chaos. In his immense dynamism Heraclitus<sup>b</sup> (about 440 BC) realized the Logos, which confers its measure on all events, a restless source of the always new. It is that elementary “maternal” basis that the late Paracelsus<sup>c</sup> called the Matrix, which develops into the fullness of forms. The thinking of contrasts (polar thinking) is also present in Indian and Native American medicine (4, 5).

### **Bodily Humors**

It has its origin in Pythagorean thinking and refers to both polar contrast pairs “warm-cold” and “moist-dry”. The Pythagorean called Empedocles<sup>d</sup> from Agrigentum (500-430 BC) connected with it a formation of the world from the four basic materials (elements): Fire, Water, Air and Earth (this is also valid for other advanced civilizations). In different ratios they would be involved in the construction of all things. Both contrast pairs are thereby involved with the concept in the qualitative description of the four basic materials, so that every element is provided with two such primary qualities. Therefore water is moist and cold, air is warm and moist, fire is warm and dry and earth is cold and dry (2, 14). We recognize here already characteristics of that which is today called regulation or cybernetics in energetically open systems (1, 17). This cybernetic beginning shows a complexity reduction, i.e. a simplification of the perception of the world; how it came about again only through Copernican [*thinking*] at the turn of the 16th century. Such complexity reductions are connected in principle with drastic innovations (5, 15).

That polar thinking additionally led Hippocratic physicians to assign one bodily fluid to each element by which an explanation of the regulated material ratio became possible for the human being: Water corresponded with the “mucus” (phlegmatic), the air with the blood (sanguine), the fire with the “yellow bile” (choleric) and the earth with the “black bile” (melancholic). All these four “fluids” or humors are involved in the construction of the human body in different ways. On the whole, a well balanced harmonious ratio (temperament) should arise (cybernetically the “desired value” [*or set point*]).

Nevertheless this did not exclude that one of the four life humors can easily predominate (“actual or true value”). The ancient constitutional theory is still notable today with the four types based on it: If apathy/phlegm predominates he is spoken of as a phlegmatic; dominance of the blood characterizes the sanguine; the choleric is determined by the

yellow bile and the melancholic by the black bile. These constitutions express themselves in physical as well as psychic characteristic features. Still today we speak for example of the “dry humors” or the “hot blood”, and in the quality-determining adjectives like “hot” and “dry” the concept pairs of the primary qualities are still recognizable (2, 6, 14).

The universal character of the polar contrast pairs is familiar to us above all currently in molecular biology: Heterodimer cell receptors like the T-cell receptors determine the function of the adaptive immune systems; the relationship of the transcription to the translation of the genetic materials is determined by the respective relationship of the activated DNA to the RNA; for every protease there is an antiprotease (e.g. coagulation) etc. In general for modern medicine the pair of “activation-inhibition” has the greatest meaning.

The disease concept of Hippocratic medicine is oriented by the disturbance of harmony or the balance of the humors (eucrasia or syncrasia [*humoral harmony*]). Every disturbance continuing for a certain time results in a “dyscrasia” [*humoral imbalance*] disease. Hence the comprehensive view of the Hippocratic physician was “necessarily” directed to the whole lifestyle. Over and over the goal was always to reach symmetry in the lifestyle. This was subsumed under the concept of “diaita” (strengthening the vitality). The applied therapies (laxatives and emetics, sweating, urinary support, bleeding, nutritional conversion, climate change, among others) were seen completely according to the principle of counter control (*contraria contrariis*) under the primacy of the prognosis and only secondarily in the line of the diagnosis. These essentially consisted of pulse measurement and uroscopy (2, 14, 15). In the language of cybernetics counter control means the best possible matching of the actual and desired values (22). Hence the bodily humors refer to the continuous flow and change (pneuma<sup>e</sup>) in and outside the subjects, which already corresponds to the cybernetic principle of homeostasis (or rather homeodynamic). Also Prana<sup>f</sup> from Indian medicine and Qi from Chinese Medicine is classified here (7).

### **Humoral Pathology**

According to Hippocrates<sup>g</sup>, Galen<sup>h</sup> of Pergamon (c. 130-c. 200 BC) was the most important doctor of antiquity. On account of anatomical and experimental physiological investigations on animals he reached the conviction that the blood stream with its finest branches played a leading role for nutrition, but also for the illnesses of people and animals. With this the humoral theory changed to humoral pathology, without changing the traditional writings of Hippocratic medicine (Corpus Hippocraticum) (2, 14). Humoral pathology became the leading medical theory for more than 1500 years (6).

### **Nova Scientia (Renaissance, Clarification)**

Galileo<sup>j</sup> (1564-1642) expanded the logical structure of Aristotle<sup>k</sup> (384-322 BC), after which only the conclusion from the general to the specific (the deduction) would be consistent and generally binding. Galileo overcame this hurdle through the absolutely new mental framework of the Nova Scientia<sup>i</sup>. Without violating the Aristotelian dictates of deduction, Galileo recognized that through observation, experiment and analysis false assumptions could be recognized and excluded. On the basis of the discovery of the moons of Jupiter with the microscope previously developed by Galileo, his student Benedetto Castelli<sup>l</sup> (1610) could exclude the 1000 year old geocentric world view of Ptolemaeus<sup>m</sup> as a false hypothesis and prove the heliocentric view (11). Copernicus<sup>n</sup> (1473-1543) produced crucial preliminary work for it with proof resulting through analysis that the earth turns around the sun (“Copernican turning point”) (11). In medicine the turning point succeeded through the exact analysis of the human body (Andreas Vesalius<sup>o</sup>, 1514-1564), the dissection of deceased patients and the investigation of their organs (Giovanni Battista Morgagni<sup>p</sup>, 1682-1771). Morgagni founded the main characteristics of “Solidar pathology<sup>q</sup>” valid up to today, i.e. illness symptoms are associated with certain organs. The Latin adjective *solidus* means hard and was chosen by Morgagni as a difference from humoral pathology. Previously Harvey<sup>r</sup> (1578-1657) had discovered the blood circulation and with it the new found physiology. The light microscopes built for the first time by Leeuwenhoek<sup>s</sup> (1632-1723) also made the description of the fine tissues and tissue structures possible. Through the microscopic examination of lung capillaries the anatomist Malpighi<sup>t</sup> (1628-1694) could confirm Harvey’s microscopic discovery (2, 14).

### **Departure into Modern Times**

In spite of all the scientific innovations humoral pathology was not also simply “brought down” in the course of clarification, since rather the discovery of the circulation has strengthened it. But also here these doubts were caused about the trustfulness of the newcomer experts compared to the traditional Hippocratic and Galenic theories (11).

Above all it was Paracelsus (Theophrast von Hohenheim 1493/94-1541) who rebelled and attracted a lot of attention in the German language. In his lecture announcement for the year 1527 he wrote: “For who does not know that most of the doctors of today’s time have been wide of the mark for the greatest damage to ill people in the worst manner, because they much too slavishly stuck to the words of Hippocrates, Galen, Avicenna<sup>u</sup> and others (quoted after 2).

The main effect of Paracelsus lay in the area of pharmaceutical chemistry (“iatrochemistry”). Here he broke with the Hippocratic/Galenic pharmacology. He is valid as the starting point of modern quantifying clinical pharmacology theory (15).

Morgagni's solidar pathology influenced all European medical faculties and is the pioneer for the development of the cellular pathology of Virchow<sup>v</sup> (1821-1902). Nevertheless humoral pathology was preserved and expanded by solidar pathology (2, 14) in the University of Vienna under the influence of Gerhard van Swieten<sup>w</sup> (1700-1772), the personal physician to the Austrian Empress Maria Theresa.

The medical faculty at the University of Vienna was leading in Europe at this time. There it was the pathologist Carl von Rokitansky<sup>x</sup> (1804-1878) who revived anew this tradition from humoral pathology. C. v. Rokitansky (13) concentrated particularly on the role of the blood as the locality of pathological events. As a contemporary of Virchow<sup>v</sup> (16) the same technical accessories were available to him such as efficient light microscopes, and tissue imbedding, coloring and slicing technologies. C. v. Rokitansky became a big opponent to Virchow, after the discovery of the cell (Schwann<sup>y</sup> and Schleiden<sup>z</sup>, 1850) as a "true organic unit" and the starting point of all described life and symptom phenomena (cellular pathology). Virchow is completely biased here in the causal-analytical objective thinking of the clarification, which applies nevertheless only for energetically closed systems. Here the reference would be permitted that in the Anglo-American area of clarification, above all under the influence of the philosophy of Bacon<sup>aa</sup> (1561-1626) and his main work Novum Organum Scientiarum, humoral pathology perished very quickly (2, 14).

The opinions of v. Rokitansky (Krasenlehre) are however classified as cybernetic. He recognized that the blood enters as a means of transportation in the capillary area in exchange with the cells, and that for tissue functions from there it would depend very much on the respective blood mixtures, and that an essential meaning in illness formation is due to the blood (2, 3). The cybernetic (17), the theory of living beings as energetically open systems (1, 9) and the fractal structure of the organisms ("chaos theory") (10) is still a long way off.

Certainly v. Rokitansky with his blood mixture theory devotion, was by no means "the last scientific attempt at a revival of the humoral pathology ideas", but rather was the first attempt to apply the principle of a disturbed homeostasis or flow balance to illness formation (6).

Virchow's cellular pathology (16) remained untouched by it, and entered a firm alliance with pharmacological medicine. Only recently, through investigation of the ground substance (extracellular matrix, ECM), cellular pathology finds a connection to that of v. Rokitansky founded thinking.

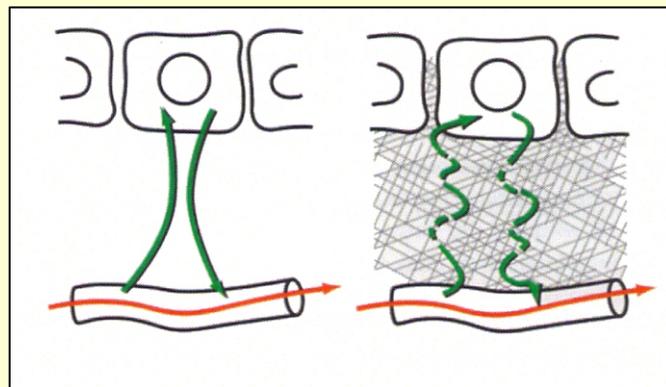
In the medical faculty of the University of Vienna the meaning of the ideas of v. Rokitansky were modernized by the full Professor Hans Eppinger<sup>bb</sup> (1875-1948) (3). In the introduction to his work published in 1949, Permeabilitätspathologie als die Lehre vom Krankheitsbeginn [*Permeability Pathology as the Theory of the Illness Beginning*],

Eppinger writes: "... indifferently, whether you refer to normal or pathologically changed tissues for study, you always come across the same structure, namely the big operating consortium 'blood-capillary wall-interstice-tissue cells-lymph vessel'. Yes you can even go one step further and ascertain that the disturbance of the capillary permeability often corresponds to the first scene in the first act of the "illness" drama. [...] A lot which turned out as new territory for me was already seen coming more or less correctly from humoral pathology. In any case there is quite a lot of the correct core in these old teachings, which is why I welcome it, if now a permanent connection between cellular and humoral pathology is allowed to develop, however under the only possible condition that the new humoral theory also finds out about a healthy scientific foundation like it was already established successfully for a long time for cellular pathology, [...]".

Permeability pathology founded by Eppinger reached the next and determining step in the union with cell pathology in the 1950's to 1970's by full Professor for Histology and Embryology Alfred Pischinger<sup>cc</sup> (1899-1982) from Vienna (12). Pischinger developed, supported by a study group of highly gifted young doctors and researchers (the "Viennese Team") the "System of the Ground Regulation" (GRS). In this respect this fact that today appears trivial is dedicated for the first time called:

"Strictly speaking the cell concept is only one morphological abstraction. Biologically seen it cannot be taken without the living environment [*or milieu*] of the cell" (12) (Fig. 1).

This living milieu as well as the connective tissue, the ground substance and the recently called extracellular matrix (ECM), serve as a molecular sieve in the transit route between capillaries and cells and vice versa (Fig. 1). Pischinger and his coworkers recognized that the ECM was "the common active field of the cyto-humoral, the axo-(neuro-) humoral and the angio-(hemo-) humoral control functions" (12). In other words, the molecular sieve of the ECM is connected with its cells both in the terminal vascular bed as well as in the hormone and nervous systems.



**Figure 1:** Cell supply. Left: Conventional representation (Virchow). Right: Ground substance (extracellular matrix, ECM). Each cell is connected in series in the ECM as a molecular sieve (from (6), Heine).

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Follow this link to our website to see [Issue #3](#) with the alphabetical footnotes.



### The MORA Nova:

Did you attend the **Pleo-Sanum Conference** in Tempe, Arizona early this month? What a great lineup of speakers that included **Dr. Thomas Rau**, **Dr. Dietrich Klinghardt** and **Dr. Karim Dhanani**. This was a great conference and I was very pleased to be able to show off our new MORA-Nova.

Basic operation of this phenomenal new BioResonance device is very straightforward. After only a few hours Elaine and I are easily able to move through the computer menus quickly, give basic therapy and access the newly developed EAV assessment module. It is really fantastic! Our application for Health Canada is being prepared and we expect to be able to achieve "pending" status on that registration soon.



Dates for the planned **MORA Nova training session in St. Louis, MO are June 7, 8 & 9, 2013**. Your guest instructor and lecturer is **Nuno Ruivo, DO** from Med-Tronik, who is a long time MORA user and one of the technology and software developers of the Nova device. Friday, June 7 will be basic introductory information to help you get the device setup and do your first treatment and assessment. The following 1½ days will be more intermediate work with an emphasis on practical application in your practice. Sessions are jointly sponsored by OIRF, Med-Tronik and **Dr. Simon Yu** at Prevention and Healing. See registration details on our website at [Nova Workshop](#), and call Kate at Prevention and Healing at (314) 432-7802 to reserve your place. Attendance is limited.

## Design meets Technology

### MORA<sup>®</sup> Nova

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- Graphic menu navigation

➤ **Special “factory” offer for the MORA Nova has been extended:**  
“With every MORA-Nova sold **between now and March 30th, 2013**, the customer will receive the Nova-Elements software group containing the test-sets: 5-Elements, Allergy, Bach flowers, Trace elements, Geopathy, Mycosis, Nosodes, Schüssler Salts, Horvi and the Meridian test-set [Morell] which has a retail value of \$4,450, **free of charge.**” Contact Elaine or Carolyn today to get order and delivery information.

And so I repeat – again – my friends, **the MORA-Nova is the future of BioResonance Therapy**. This is the medicine that works to bring about healing from within the smallest quanta of biophoton light in our bodies, but which is capable of taking us to the stars. The MORA Nova is true BioResonance Therapy with the latest and most sophisticated technology available. Contact Carolyn or Elaine today toll free at 1-800-663-8342 for order, delivery and trade-in details. Orders placed in the next few weeks will have delivery well before the workshop.

### 🔄 Updates, Reminders and Announcements:

➤ Watch for the fourth 2013 issue of the “The Bridge” newsletter to arrive in your Inbox around mid-April with an article from our newest OIRF Medical Advisor, **Dr. Uwe Uellendahl** from Germany. Part II of Prof. Dr. Heine’s article to follow in the May Issue.



➤ **LEASING IS NOW AVAILABLE:** All arrangements have been finalized to make leasing available to purchasers of the larger (more expensive) OIRF recommended instrumentation. Contact Elaine at 1-800-663-8342 to obtain applicable forms and instructions for your current or future instrumentation purchases.

➤ You will be able to see (and touch – no grubby fingerprints allowed!) the MORA Nova at the forthcoming **NorthWest Naturopathic Physicians Convention** in Portland, Oregon on April 12-14, 2013. Speakers include Rick Kirschner, ND, Mariane Marchese, ND, Paul Anderson, ND, Gonzalo Flores, DC LAc, and David Cohen, PhD. You can get more information on this important convention at [www.nwnpc.com/2013](http://www.nwnpc.com/2013). Visit Elaine and Carolyn at Booth #22.



➤ Here are the dates for our very special **Anniversary Biological Medicine Group Tour #40(!) to Germany**. Please note that participants can attend any or all portions of this program. Arrangements for speakers, itinerary and related details are already underway and initial information has been posted online and is available at the NWNPC Convention in Portland:

**Part I: Oct. 25 to 29, 2013 Tools.** Visit various instrumentation companies for an opportunity to see, play with and hear about the “tools of our trade”

**Part II: Oct. 29 to Nov. 4, 2013 Techniques.** Hear private lectures from renowned scientists, researchers and practitioners about the latest methods and techniques in Europe. Plenty of time to peruse the exhibit stands at Medicine Week and participate in their scheduled English language lectures.

**NOTE: Dr. Thomas Rau** of the Paracelsus Clinic, Switzerland will be one of our keynote speakers.

**Part II: Nov. 4 to 7, 2013 Applications.** Visit several clinics and private practices to see these “Tools and Techniques” in practical everyday application. Dr. Rau has invited us to visit and tour the **Paracelsus Clinic** in Lustmühl, Switzerland.

Talk to Elaine or Carolyn at the NWNPC Convention or by phone for a personal invitation to join us for this exceptional anniversary program.

➤ **Updates, Reminders and Announcements** (continued):

➤ Be sure to order your set of 12 DVDs with the manual from the [Biological Medicine Symposium 2012](#).



➤ Visit our **Facebook** page – will you be our friend?

➤ For a complete [listing of resource materials](#), including publications, reports, books and videos please follow this link to our website. There are full descriptions of all printed and recorded materials online.

➤ For a complete [listing of recommended instrumentation](#), including diagnostic, therapeutic and BioResonance devices please follow this link to our website. There are full descriptions of all instrumentation online. More details concerning the new Optical Hand Electrodes and the Integrated Laser System from Medical Electronics will be posted shortly.

I trust you will find much of interest in these pages. We look forward to meeting you during our 2013 activities and programs. As always your comments are welcome. Remember that this is your newsletter – your suggestions, article contributions, critiques, FAQ's and compliments – are gratefully accepted. See you in Portland . . .

*Carolyn*

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**Alphabetical Footnotes for Prof. Dr. Heine's Part 1 article:**

- a) **Thales of Milet** (634-546 BC). Greek philosopher who is considered the founder of Greek science, mathematics, and philosophy.
- b) **Heraclitus** (c.434-c.475 BC), a pre-Socratic Greek philosopher of Ephesus (near modern Kuşadası, Turkey) criticizes his predecessors and contemporaries for their failure to see the unity in experience. He claims to announce an everlasting Word (*Logos*) according to which all things are one, in some sense. Opposites are necessary for life, but they are unified in a system of balanced exchanges. The world itself consists of a law-like interchange of elements, symbolized by fire. Thus the world is not to be identified with any particular substance, but rather with an ongoing process governed by a law of change. The underlying law of nature also manifests itself as a moral law for human beings. Heraclitus is the first Western philosopher to go beyond physical theory in search of metaphysical foundations and moral applications.

Continued . . .

- c) **Paracelsus** (born Philippus Aureolus Theophrastus Bombastus von Hohenheim, 1493-1541) was a German-Swiss Renaissance physician, botanist, alchemist, astrologer, and general occultist. He is also credited for giving zinc its name, calling it *zincum*. "Paracelsus", meaning "equal to or greater than Celsus", refers to the Roman encyclopedist Aulus Cornelius Celsus from the 1st century, known for his tract on medicine.
- d) **Empedocles** (c. 490-430 BC) was a Greek pre-Socratic philosopher and a citizen of Agrigentum, a Greek city in Sicily. Empedocles is generally considered the last Greek philosopher to record his ideas in verse. He has been regarded variously as a materialist physicist, a shamanic magician, a mystical theologian, a healer, a democratic politician, a living god, and a fraud. To him is attributed the invention of the four-element theory of matter (earth, air, fire, and water), one of the earliest theories of particle physics, put forward seemingly to rescue the phenomenal world from the static monism of Parmenides. Empedocles' world-view is of a cosmic cycle of eternal change, growth and decay, in which two personified cosmic forces, Love and Strife, engage in an eternal battle for supremacy.
- e) **Pneuma**, in Stoic philosophy is the concept of the "breath of life," a mixture of the elements air (in motion) and fire (as warmth). Originating among Greek medical writers who locate human vitality in the breath, *pneuma* for the Stoics is the active, generative principle that organizes both the individual and the cosmos. In its highest form, the *pneuma* constitutes the human soul (*psychê*), which is a fragment of the *pneuma* that is the soul of God (Zeus). As a force that structures matter, it exists even in inanimate objects.
- f) **Prana** is the Sanskrit word for "life" (from the root *prā* "to fill", cognate to Latin: *plenus* "full"). A simple and anatomically connected meaning of Prana is derived from its 2 prefixes, "pra" = "prime" and "A" = "all round"; and the root, "an" "to move". Thus, this word indicates "the primary and all round motion of Life Energy". This life Energy has been vividly invoked and described in Vedas.
- g) **Hippocrates of Cos** (c. 460 BC-c. 370 BC) was an ancient Greek physician of the Age of Pericles (Classical Greece), and is considered one of the most outstanding figures in the history of medicine. He is referred to as the father of western medicine in recognition of his lasting contributions to the field as the founder of the Hippocratic School of Medicine. This intellectual school revolutionized medicine in ancient Greece, establishing it as a discipline distinct from other fields that it had traditionally been associated with (notably theurgy and philosophy), thus establishing medicine as a profession.
- h) **Aelius Galenus or Claudius Galenus** (129-c. 200/c. 216 AD), better known as **Galen of Pergamon** (modern-day Bergama, Turkey), was a prominent Roman (of Greek ethnicity) physician, surgeon and philosopher. Arguably the most accomplished of all medical researchers of antiquity, Galen contributed greatly to the understanding of numerous scientific disciplines, including anatomy, physiology, pathology, pharmacology, and neurology, as well as philosophy and logic.
- i) **Niccolò Fontana Tartaglia** (1499/1500-1557) was an Italian mathematician, engineer (designing fortifications), a surveyor (of topography, seeking the best means of defense or offense) and a bookkeeper from the then-Republic of Venice (now part of Italy). He published an important pioneering treatise, **Nova Scientia** (A New Science) as well as many books, including the first Italian translations of Archimedes and Euclid, and an acclaimed compilation of mathematics. Tartaglia was the first to apply mathematics to the investigation of the paths of cannonballs; his work was later validated by Galileo's studies on falling bodies. He also published a treatise on retrieving sunken ships.
- j) **Galileo Galilei** (1564-1642), was an Italian physicist, mathematician, astronomer, and philosopher who played a major role in the Scientific Revolution. His achievements include improvements to the telescope and consequent astronomical observations and support for Copernicanism. Galileo has been called the "father of modern observational astronomy", the "father of modern physics", the "father of science", and "the Father of Modern Science".
- k) **Aristotle** (384 BC-322 BC) was a Greek philosopher and polymath, a student of Plato and teacher of Alexander the Great. His writings cover many subjects, including physics, metaphysics, poetry, theater, music, logic, rhetoric, linguistics, politics, government, ethics, biology, and zoology. Together with Plato and Socrates (Plato's teacher), Aristotle is one of the most important founding figures in Western philosophy. Aristotle's writings were the first to create a comprehensive system of Western philosophy, encompassing morality, aesthetics, logic, science, politics, and metaphysics.
- l) **Benedetto Castelli** (1578-1643), born **Antonio Castelli**, was an Italian mathematician. Benedetto was his name in religion on entering the Benedictine Order in 1595. He was a long-time friend and supporter of his teacher, Galileo Galilei, and in turn teacher to Galileo's son. He assisted Galileo's study of sunspots and participated in the examination of the theories of Nicolaus Copernicus. Castelli was interested in mathematics and hydraulics. He was appointed as a mathematician to the University of Pisa, replacing Galileo, and later at the University of Rome La Sapienza

- m) **Ptolemaeus** (lived between the 3rd century BC and 2nd century BC, and became the first King of Commagene. He was of Orontid Armenian descent, being related to the king of Sophene Arsames I. His father was King Orontes IV of Armenia, son of Arsames I.
- n) **Nicolaus Copernicus** (1473-1543) was a Renaissance mathematician and astronomer who formulated a heliocentric model of the universe which placed the Sun, rather than the Earth, at the center. The publication of Copernicus' book, De revolutionibus orbium coelestium (*On the Revolutions of the Celestial Spheres*), just before his death in 1543, is considered a major event in the history of science. It began the Copernican Revolution and contributed importantly to the rise of the ensuing Scientific Revolution. One of the great polymaths of the Renaissance, Copernicus was also a jurist with a doctorate in law, a physician, quadrilingual polyglot, classics scholar, translator, artist, governor, diplomat and economist who formulated Gresham's Law in the year (1519) of Thomas Gresham's birth.
- o) **Andreas Vesalius** (1514-1564) was a Flemish anatomist, physician, and author of one of the most influential books on human anatomy, De humani corporis fabrica (*On the Structure of the Human Body*). Vesalius is often referred to as the founder of modern human anatomy. He was professor at the University of Padua and later became Imperial physician at the court of Emperor Charles V.
- p) **Giovanni Battista Morgagni** (1682-1771) was an Italian anatomist, celebrated as the father of modern anatomical pathology.
- q) **Solidar Pathology** is the view that every disease process can be explained by a change or disturbance of solids ("solida") and structures of the body, in contrast to the humoral (four humors of Hippocratic), after referring to the "fluids".  
**Giorgio Baglivi** (1668-1707) is often described as the founder and "prophet" of Solidarpathology. He argued that "the importance of solidarity was greater for the development of disease than that of fluids." In **Giovanni Battista Morgagni** (1682-1771) Pathology of Solidarity that causes certain symptoms were in individual organs relocated. Basis of this theory were accurate pathological autopsy reports. The French anatomist and physiologist **Marie François Xavier Bichat** developed (1771-1802), finally a first Morphopathology in which he said tissue and no longer put the whole institution at the heart of physiology. Thereby fueling the development was cellular pathology paved
- r) **William Harvey** (1578-1657) was an English physician. He was the first to describe completely and in detail the systemic circulation and properties of blood being pumped to the body by the heart, though earlier writers had provided precursors of the theory.<sup>4</sup>
- s) **Antonie Philips van Leeuwenhoek** (1632-1723) was a Dutch tradesman and scientist from Delft, Netherlands. He is commonly known as "the Father of Microbiology", and considered to be the first microbiologist. He is best known for his work on the improvement of the microscope and for his contributions towards the establishment of microbiology. Using his handcrafted microscopes, he was the first to observe and describe single-celled organisms, which he originally referred to as *animalcules*, and which are now referred to as microorganisms. He was also the first to record microscopic observations of muscle fibers, bacteria, spermatozoa, and blood flow in capillaries (small blood vessels). Van Leeuwenhoek did not author any books, although he did write many letters.
- t) **Marcello Malpighi**, (1628-1694), Italian physician and biologist who, in developing experimental methods to study living things, founded the science of microscopic anatomy. After Malpighi's researches, microscopic anatomy became a prerequisite for advances in the fields of physiology, embryology, and practical medicine.
- u) **Abū 'Alī al-Ḥusayn ibn 'Abd Allāh ibn Sīnā** (c. 980-1037), commonly known as **Ibn Sīnā** or by his Latinized name **Avicenna**, was a Persian polymath, who wrote almost 450 treatises on a wide range of subjects, of which around 240 have survived. In particular, 150 of his surviving treatises concentrate on philosophy and 40 of them concentrate on medicine. His most famous works are The Book of Healing, a vast philosophical and scientific encyclopaedia, and The Canon of Medicine, which was a standard medical text at many medieval universities. The Canon of Medicine was used as a text-book in the universities of Montpellier and Leuven as late as 1650. Ibn Sīnā's Canon of Medicine provides a complete system of medicine according to the principles of Galen (and Hippocrates). His corpus also includes writing on philosophy, astronomy, alchemy, geology, psychology, Islamic theology, logic, mathematics, physics, as well as poetry. He is regarded as the most famous and influential polymath of the Islamic Golden Age.
- v) **Rudolph Carl Virchow** (1821-1902) was a German doctor, anthropologist, pathologist, prehistorian, biologist and politician, known for his advancement of public health. Referred to as "the father of modern pathology", he is considered one of the founders of social medicine.

- w) **Gerard van Swieten** (1700-1772) was a Dutch-Austrian physician. In 1745 he became the personal physician of the Austrian Empress Maria Theresa. In this position he implemented a transformation of the Austrian health service and medical university education. He founded a botanical garden, a chemical laboratory and introduced clinical instruction. Since 1745 he was also librarian for Maria Theresa in what was then the Imperial Library.
- x) **Baron Carl von Rokitansky** (1804-1878), was a Bohemian physician, pathologist, humanist philosopher and liberal politician.
- y) **Theodor Schwann** (1810-1882) was a German physiologist. His many contributions to biology include the development of cell theory, the discovery of Schwann cells in the peripheral nervous system, the discovery and study of pepsin, the discovery of the organic nature of yeast, and the invention of the term metabolism.
- z) **Matthias Jakob Schleiden** (1804-1881) was a German botanist and co-founder of the cell theory, along with Theodor Schwann and Rudolf Virchow. Schleiden and Schwann became the first to formulate what was then an informal belief as a principle of biology equal in importance to the atomic theory of chemistry. He also recognized the importance of the cell nucleus, discovered in 1831 by the Scottish botanist Robert Brown, and sensed its connection with cell division. Schleiden was one of the first German biologists to accept Charles Darwin's theory of evolution. He concluded that all plant parts are made of cells and that an embryonic plant organism arises from the one cell.
- aa) **Francis Bacon, 1st Viscount St. Alban**, (1561-1626) was an English philosopher, statesman, scientist, jurist, and author. He served both as Attorney General and Lord Chancellor of England. Although his political career ended in disgrace, he remained extremely influential through his works, especially as philosophical advocate and practitioner of the scientific method during the scientific revolution. Bacon has been called the creator of empiricism. His works established and popularised inductive methodologies for scientific inquiry, often called the *Baconian method*, or simply the scientific method. His demand for a planned procedure of investigating all things natural marked a new turn in the rhetorical and theoretical framework for science, much of which still surrounds conceptions of proper methodology today
- bb) **Hans Eppinger Jr.** (1879-1946) was an Austrian physician who gained an infamous reputation due to experiments on prisoners. During World War II he gained an infamous reputation due to his experiments on prisoners at the Dachau concentration camp. Along with **Professor Wilhelm Beigelbock**, he performed tests on 90 Gypsy prisoners by providing them sea water as their only source of fluids. (In some cases the taste of the water was disguised to hide the saline content.) The prisoners suffered from severe dehydration, and witnesses reported that they had been seen licking the floors they had mopped in an attempt to get some water. The goal of the experiment was to determine if the prisoners would suffer severe physical symptoms or death within a period of 6–12 days. Following the war he committed suicide, reportedly using poison. This occurred a month before he was to be called to testify at the Nuremberg Trials. Much later it was discovered that he had an unclaimed Swiss bank account.
- cc) **Alfred Pischinger** (1899-1982) Work in Germany over the last half-century by Prof. Dr. Alfred Pischinger, Prof. Dr. Hartmut Heine and Dr. Helmut Schimmel has also focused on the internal communication system, in particular as it relates to the ground system. This work has led to their characterization of the ground system or extracellular matrix interaction with the cellular system as a 'ground regulatory system', seeing therein the key to homeostasis, a body-wide communication and support system, vital to all functions. **Note:** Please refer to the textbook The Extracellular Matrix and Ground Regulation for more details.
- dd) **Of interest: Claude Bernard** used the phrase "Milieu intérieur" in several works from 1854 until his death in 1878. He most likely adopted it from the histologist Charles Robin, who had employed the phrase "milieu de l'intérieur" as a synonym for the ancient Hippocratic idea of humors. Bernard was initially only concerned with the role of the blood but he later included that of the whole body in ensuring this internal stability.

