Bloodletting, the Humours, and Other Medical Beliefs (*humour* is the British spelling)

Early science in the Western world viewed all things as a compound of four basic elements: fire, air, earth, and water. In the human body four humours—blood, yellow bile, black bile, and phlegm, respectively—corresponded directly to the elements. Emotion and temperament were determined by the balance of humors, resulting in sanguine, choleric, melancholic, and phlegmatic characters. The Theory of the Four Humours originated in ancient Greece.

Hippocrates (460-377 BCE) and other Greek practitioners argued that the balance of the four humours would be helpful to curing a patient. For example, if someone has a fever he would have been thought to have had too much blood in his body. The logical cure therefore was to 'bleed' the patient. Use of the Four Humours as a diagnostic tool would result in doctors looking for symptoms, and marks the first time that clinical observation of a patient was recorded. The Four Humours could also be connected to the four seasons of the year: Yellow bile with summer, black bile with autumn, phlegm with winter, and blood with spring. Through the Age of Enlightenment, medical students relied on astrology and the doctrine of humors to treat patients.

Aristotle (384-322 BCE) included **aether** as the fifth element, or quintessence, rationalizing that while fire, water, earth, and air were earthly and corruptible, the stars were eternal, and were therefore not made out of any of the four elements, but rather from a heavenly substance. (*Aether* is from the Greek word for eternity.) Galileo would poke holes in this theory when he observed the defects on the moon through a telescope, releasing all of Shakespeare's poetry concerning the corruption of the heavens and doom in so many of his tragedies. (*Julius Caesar, Hamlet, Macbeth, King Lear…*) During the Middle Ages, *aether* was associated with the existence of the sou1. A famous reference is found in Shakespeare's *Hamlet*, "And yet to me what is this quintessence of dust?" The non-existence of aether would lead to problems in using Newtonian physics when measuring the universe and pave the way for Einstein's theory of relativity.

Einstein replaced the *aether* in Newton's math with a "cosmological constant" to counter the effects of gravity in the math of his General Theory of Relativity. He later called this his "greatest blunder" since it did not jive with Edwin Hubble's later observation of an expanding universe, which introduced the Big Bang Theory. However, as scientists today struggle to come up with a Grand Unified theory to explain the physics of planets *and* the quantum mechanics of subatomic particles, they are finding evidence that Einstein's cosmological constant exists, perhaps caused by "dark energy" left over from the Big Bang, which they are calling, in a wonderful example of goes-around-comes-around theory, *quintessence*. Science

Little advances on these notions of medicine occurred through the Middle Ages, when the Christian world viewed human reason as a means to support faith, and a theological form of demonology was reintroduced to explain much emotional behavior. Disease was often regarded as a punishment for sin, and required prayer and repentance. Nursing the sick became a church function. Hospitals were established by religious orders to combine physical and spiritual healing. Many saints became healers for certain diseases: St. Roch for the plague, St. Vitus for cholera (St. Vitus's dance).

In 1163, by papal decree, the clergy were forbidden to shed the blood of others. Since Monks were required to undergo bloodletting at regular intervals, these duties were turned over to the barbers, who were familiars in the monasteries because the monks had to be clean-shaven. This led to the practice being adopted by barbers, and for the following six centuries, barbers were also surgeons. The barbers also lanced abscesses and treated wounds and fractures. The barber-surgeons organized a guild in 1361. The guild amalgamated with physicians in 1540 under Henry VIII, and to this day, doctors in Britain are called Mister, not Doctor, to reflect their more humble origins.

The first organized medical school in Europe was at Salerno, in Italy. The school admitted women. (1221 – The pope decreed that the masters of Salerno had to approve a student before he or she could practice medicine) John Gaddesden, the model for the doctor of physics in the Canterbury Tales, went to school in Salerno. He is duly mocked, since physicians in Chaucer's time, and beyond, were known charlatans.

Moliere, in *The Imaginary Invalid* (1673) mocks the cupidity of doctors. Their cures often killed, and they collected hefty sums of money to do so! Hippocrates' famous motto, *primum non nocere* (First, do no harm) was, it seems, forgotten. In the Middle Ages, Europe is far behind the Arab world in sciences, math,

technology and medicine – Islam encouraged the pursuit of knowledge, and the intellectuals often fled persecution to universities or cultural centers in these regions. Ibn Sina (980-1037) (*Avicenna* in Latin) is a noted scientist and physician whose treatises *The Book of Healing* and *The Canon of Medicine* were the most advanced texts in medicine of their time—and later. His understanding of the circulation of the blood is not understood in the West until the late 17th Century. Setting the Record Straight, Islamic Science

Medieval physicians analyzed symptoms, examined excreta and made their diagnoses. They might prescribe diet, rest, sleep, exercise or baths. They could administer emetics and purgatives, or bleed the patients. They could treat fractures and dislocations, repair hernias and perform amputations. They prescribed opium or alcohol for pain, and administered these during the many nasty medical procedures of the day that induced pain.

Speaking of alcohol, in the Middle Ages doctors recognized four stages of drunkenness, which correlate to each of the four humors: Lion-drunk, meant you were drunk and choleric. Ape-drunk (or monkey drunk) meant you were drunk and sanguine. Mutton-drunk, meant you were drunk and phlegmatic, and swine-drunk meant you were drunk and melancholy! Folks were known to steal wine by sucking it out from bung holes in wooden casks through a small pipette, or straw, and this practice was called "sucking the monkey."

Love was also considered a sickness through the Middle Ages. The ideal of courtly love was part of the chivalric code, and demanded eternal devotion for unrequited love: it was just your burden to bear. Likely this philosophy emerged from the realities of young death during these times. Another "cure" for lovesickness was sex. Many pastoral poems of the times complain of "death" due to the fact that the beloved would not consent to sexual intercourse. Shakespeare, in the more enlightened Renaissance, would create Rosalind to acknowledge that, "Men have died from time to time, and worms have eaten them, but not for love." (*As You Like It* 4.1.81-92) In *Romeo and Juliet*, this is the love Romeo has, and discards, with Rosaline, in favor of a more satisfying, though ultimately deadly, love with Juliet. Science of Love.

In modern times, scientists have isolated hormones called phenylethylamines (PEA) that are released during early love, which are closely related to opioids and other psychoactive drugs including adrenaline and dopamine. Serotonin and oxytocin are also in the mix. It takes somewhere between six months and three years for these chemicals to gradually stop flooding your brain. Like drugs, they do interfere with logical thinking. Only after they have abated can you begin to consider that the relationship might be "true love." Chocolate also releases PEA and nuns were forbidden to eat this supposed aphrodisiac when it first arrived in Europe,

With the Age of Enlightenment, Rene Descartes (1596-1650) came up with a theory that explained human behavior in two separate classes: involuntary and voluntary. *Involuntary* behavior was purely mechanical and operated according to the principles of mechanics and hydraulics current in 17th-century physics. This included heartbeat, breathing, excretion, and flow of blood. Such behavior was animal-like, and the proper study of physiologists. *Voluntary* behavior was in the realm of reason and fell within the fields of philosophy and theology. This enlightened view would, in the practice of medicine in the West, sharply sever the idea of any connection at all between mind and body. Only now is that over-reaction to what came before being reconsidered, and a mind-body connection being reestablished, through scientific experiments, in the study of medicine. What goes around…. See also: Medical Astrology.

The Connections of the Four Elements to the Body, Emotions, and Seasons:

Fire	blood	heart	heat	spring
Air	yellow bile	liver	dry	summer
Earth	black bile	spleen	cold	autumn
Water	phlegm	brain	moisture	winter

Heat and Moisture = sanguine nature
Heat and Dry = choleric nature
Cold and Moist = phlegmatic
Cold and Dry = melancholic

sanguine: heart and brain
choleric: heart and liver
phlegmatic: brain and spleen
melancholic: spleen and liver

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Photo Gives Weight to Einstein's Thesis of Negative Gravity

By JAMES GLANZ

A photograph of a distant exploding star has given astronomers the first direct evidence that a mysterious "negative gravity" force swept through and still pervades the universe, scientists announced at a NASA news conference yesterday in Washington.

The Hubble Space Telescope by chance photographed the exploding star, the most distant ever observed, in 1997. Scientists say subsequent detective work on the relative intensity of its light confirms one of Einstein's conjectures about the universe: that all of space is bubbling with an invisible form of energy that creates a mutual repulsion between objects normally attracted to each other by gravity.

Einstein himself thought the force, which he called the cosmological constant, was so strange that he later repudiated his conjecture. But the idea gained theoretical support in 1998 with findings suggesting that the expansion of the universe was accelerating and that the force accelerating the expansion, negative gravity — the manifestation of the cosmological constant — overtook the force of gravity in the last few billion years.

The new findings confirm that crucial part of the theory. And they rule out several competing explanations.

Because the amount of negative gravity in any given volume should be minuscule, its effects would not be felt in everyday life. But over vast distances involving huge volumes of space, the effect would be powerful enough to push galaxies and clusters of galaxies apart from one another.

Exploding stars, or supernovas, like the one that turned up unexpectedly on a photograph made by the Hubble telescope, can be excellent probes of those grand forces. The new observation is of a star that exploded about 11 billion years ago, when the universe was a quarter of its present age and when, scientists theorized, the cosmological constant, often called "dark energy," was less powerful than gravity, the opposite of what prevails today.

As a result, the expansion of the universe was slowing at that time. This meant that the star was closer to earth when it exploded than it would have been if dark energy had dominated gravity then — a fact discernable in its brightness. Astronomers said it was twice as bright as it would have been under competing theories about the universe.

A team led by Dr. Adam G. Riess, an astrophysicist at the Space Telescope Science Institute in Baltimore analyzed the data. Dr. Riess, who worked with Dr. Peter E. Nugent of Lawrence Berkeley National Laboratory, said the measurement "nails the existence of the dark energy."

Dr. Michael S. Turner, an astrophysicist at the University of Chicago not involved in the work, called the dark energy "one of the most important discoveries in all of science."

"If Einstein were around today, he would get another Nobel Prize for his prediction of repulsive gravity," Dr. Turner said.

He added that research would now shift to a hunt for the source of the energy and efforts to observe many other distant supernovae to pin down the characteristics of the dark energy.

The universe is expanding as a legacy of its violent birth, which is believed to have occurred in a great explosion or "big bang" roughly 14 billion years ago. Until recently, scientists were all but certain that the gravitational attraction among the galaxies would slow the expansion.

But in 1998, two teams began presenting data on supernovas that they had observed as a way to measure the change in the expansion rate over the last few billion years. They used a class of supernovas that explode with nearly the same

brightness each time, like bulbs of a known wattage. This constancy enabled scientists to measure the speed at which the expansion of the universe had swept these supernovas away: the dimmer they appeared from earth, the farther away they were.

Those observations revealed unexpectedly dim supernovas, suggesting that something, perhaps clouds of cosmic dust, was obscuring them or that they were farther away than expected, perhaps driven away by an anti-gravity force.

To find the explanation, astronomers tried to observe objects so distant that their light had been traveling to Earth for billions of years.

"You need things that you can see across to the other side of the universe," Dr. Nugent said.

If cosmic dust were dimming this light, they reasoned, the objects would be dimmer the farther they were from Earth. But if Einstein's explanation were correct, extremely distant supernovas should appear to brighten relative to some standard, rather than continuing to dim.

Because they are so faint and are obscured by Earth's atmosphere, very distant supernova explosions are rarely seen. But a break came in 1997 when teams led by Dr. Ronald L. Gilliland of the space telescope institute and Dr. Mark Phillips of the Carnegie Institution of Washington made long-exposure Hubble photographs of a tiny part of the sky. The pictures revealed a supernova in the distant gloom of space.

A difficult and time-consuming analysis of light from the star showed that it was twice as bright as it would have been if cosmic dust had been obscuring it or, as another hypothesis held, if supernovas had somehow evolved steadily in brightness over the history of the cosmos.

The finding, said Dr. Saul Perlmutter, a physicist and supernova-hunter at the Berkeley laboratory not involved in the work, was "not very consistent with simple dust or evolution models."

"That's the standout story here," Dr. Perlmutter said.

Cosmologists will have to cope with a universe that seems increasingly filled with mysterious stuff that scientists cannot see and do not fully understand. The dark energy joins dark matter as an invisible constituent of the cosmos. Dark matter's gravitational effects are known, and despite its invisibility it is presumed to give the universe much of its mass.

Physicists will try to explain the source and exact nature of the dark energy. Dr. Turner said these questions appeared to lie at the crossroads of several of the most important problems in physics.

"In `The Graduate,' that guy told young Dustin Hoffman, `plastics,' " Dr. Turner said. "My advice to the next generation of particle physicists and astrophysicists: dark energy."