

# HEALTH AND STRESS

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## OUR STRESSLESS SAUDI ARABIAN ADVENTURE

KEYWORDS: Abdullah Al Abdugader, Rollin McCraty, James Lynch, Neha Sangwan, Claudius Galen, William Harvey, Al Razi, Ibn Sina (Avicenna), the Qanun, Ibn Al Nafis, Ebers, Smith and Thebes papyruses, artificial heart, natriuretic hormones, oxytocin, capillary pressure, heart's electromagnetic field, Franz Halberg, Blaise Pascal

I was asked to participate in the "Heart, King of Organs" conference, October 28-30, organized by the Prince Sultan Cardiac Center in Al Ahsa, Saudi Arabia. I had never been to Saudi Arabia and was not familiar with anyone there, but in his very gracious introductory invitation, Dr. Abdullah Al Abdugader, Director of the Center, explained that he had long been very impressed with the heart rate variability studies conducted by Dr. Rollin McCraty, Director of Research at the HeartMath Institute. He had asked Rollin, who had agreed to give several lectures, to recommend others that might contribute to this event, and had been advised to contact me.

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Rollin had previously called to alert me to this possibility, but indicated that he had never met Dr. Al Abdugader or visited Saudi Arabia and did not know what to expect. However, all U.S. speakers would receive reimbursement for all expenses, including First Class Airfare, as well as De Luxe accommodations at a Five Star Hotel. In addition, the scope of the program was very appealing, and reminiscent of the eclectic mix of topics responsible for the success of our annual Montreux International Congresses on Stress in Switzerland.

In that regard, Dr. Al Abdugader, further explained "I'm the founder of the International Summit on Advanced Cardiac Sciences in the Middle East, in which we are striving to gain specific understanding of the interactions of the Heart and neurological systems through fostering cross-disciplinary research meetings on Cardiac Sciences from different disciplines (Electrophysiology,

Electromagnetism, Endocrinology, Neurocardiology, Cardiac stress management, emotional science, etc.) It was also apparent that this conference would feature fascinating presentations dealing with the historical and philosophical aspects of mind/heart relationships that included the numerous contributions of early Islamic physicians to Western medicine that few of us are aware of. In this regard, it resembled the outstanding conference arranged by the Columbia Integrative Medicine program headed by Mehmet Oz that featured the Dalai Lama, that demonstrated how sophisticated technological advances supported the benefits of traditional Tibetan meditative techniques and other time honored practices. Elizabeth Blackburn and others from her group discussed telomerase and aging and the effects of stress, and Kevin Tracey's research on the cholinergic anti-inflammatory pathway (synopsized in last month's Newsletter) provided an excellent segue into my discussion of heart rate variability feedback rewards.

I asked for more information and in subsequent discussions, was asked to suggest other topics that would further the goals of this conference. All of these were enthusiastically received, which resulted in a request for me to now give three presentations. I was also asked to recommend other speakers. Good friends, such as Stewart Wolf, (often referred to as "The Father of Neurocardiology), Jim Henry and Ross Adey, all of whom would have been exemplars at such an event, had passed away. Others, like Björn Folkow, Franz Halberg, Kilmer McCully and Uffe Ravnskov had busy schedules, and would not likely be available with only two months advance notice. I also did not know what I would be getting them into and was not certain of being able to stay for the entire event due to other obligations. A few friends had expressed concerns about safety because of anecdotal reports of harsh punishments for unanticipated crimes, such as getting your hands cut off for inadvertently bringing miniature bottles of liquor into the country, since there is a strict ban on alcohol consumption. However, others who had lived in Saudi Arabia assured me that this was ridiculous and that the country was completely safe and visitors were treated with respect.

Giving up a glass of wine with dinner for a few days did not seem like a severe penalty for what promised to be a memorable meeting. I prevailed upon Jim Lynch, author of *The Broken Heart: The Medical Consequences of Loneliness*, *The Language of the Heart*, and *A Cry Unheard* to participate, especially since I had reviewed some chapters from his forthcoming book, *Speaking of Love*, and he was also asked to give three lectures. I invited James Gordon, a Harvard trained psychiatrist, Founder and Director of The Center for Mind-Body Medicine, Former Chairman of the White House Commission on Complementary and Alternative Medicine Policy and author of the best seller, *Unstuck: Your Guide to the Seven-Stage Journey Out of*

*Depression.* Jim had other commitments and suggested I invite Dr. Neha Sangwan, an internist who worked closely with him.

I was somewhat hesitant, since I did not know how a female physician would be received, or even if any females would be in the audience. I asked Neha to send me some biographical information and an abstract of her presentation to forward to the organizers. I was pleasantly surprised by their acceptance of this, especially since her proposed presentation on depression had nothing to do with the subject they had selected, which was how low heart rate variability was a powerful predictor of sudden death. Neha was also concerned about how she should dress and whether she would be able to move around freely or be allowed to eat with us. As a recent *Wall Street Journal* article on the popularity of the Oprah Winfrey TV show in Saudi Arabia had emphasized, "women are forbidden to vote, or to travel without the permission of a male guardian" and "many are largely confined to their homes and local custom often prevents them from participating in sports or even walking around their neighborhoods." In addition, her parents, who had immigrated to the U.S. from India, had told her about the constant battling between Muslims and Hindus in that country they had witnessed growing up and were concerned about her safety. These fears were also completely unwarranted. Neha was treated with great respect and joined the rest of us in all conference activities and meals, as well as a trip to the desert that had been arranged for us to visit a camel farm and drink fresh camel milk and another to learn about falcon hunting.

Dr. Abdullah not only provided an interpreter to take us shopping at local markets and malls, but also gave each of us \$500 to buy gifts for family and friends. Neha was taken on a special shopping trip with Dr. Abdullah's wife and daughters and bought some native garb and a rug. In addition to her presentation, she gave a workshop for female physicians, nurses and medical students. This was so packed and well received, she had to provide another one the following day. The vast majority of those we met, including children, spoke or understood English, and although most of the conference presentations were in English, headphones providing excellent simultaneous Arab-English and English-Arab translation were readily available. I was very impressed with the warmth of the participants, especially the genuine affection with which they greeted old friends or made new ones. In contrast to other scientific conferences, all I saw around me were happy faces and smiles and an emphasis on cooperation, rather than competition. I do not recall seeing any obese individuals, although this is apparently a problem in women, and may have been concealed by their loose fitting clothes. It seemed as if everyone had a cell phone, and usually one that could take pictures, but many also had small cameras. Pictures were constantly being taken that were later e-mailed to us, some of which are included below.



Sumptuous Dining



Jim, me, Rollin and Neha at lunch



At The Camel Farm



Drinking Fresh Camel Milk



More Fresh Camel Milk



Rollin and Falcon



With Dr. Abdullah

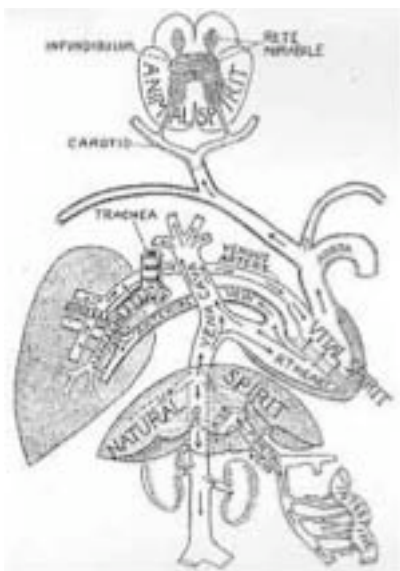
## Why Was This Called The "Heart, King Of Organs" Conference?

I was intrigued with this title. As previously noted, Aristotle and Virgil taught that the heart, rather than the mind, was the seat of the mind and emotions. A Chinese medical text 40 or more centuries old similarly states, "The heart is the root of life and causes the versatility of the spiritual faculties." The 35 century-old Ebers Papyrus suggests that the ancient Egyptians considered mind and body to be inseparable and includes a "treatise on the heart", which explains that the heart is the center of the blood supply, with vessels attached for every member of the body. This was not discovered until the late 1800s, and was translated into English less than 100 years ago.



**Above** -13th century manuscript depicting the circulatory system.

**Below** – From William Harvey's 1547 edition of Galen's works.



Nevertheless, it is clear that Muslim physicians anticipated William Harvey's discovery of how blood circulates throughout the body several hundred years earlier. They were also the first to challenge the views of Claudius Galen, which dominated Western medicine in medieval times and persisted well into the 19<sup>th</sup> century.

Galen believed that "vital blood" was made by the heart and flowed through the arteries to carry the vital spirits. This was different from "nutritive blood", which was made by the liver and carried through veins to body organs that consumed it to provide energy. Galen also believed that blood passed through the septum of the heart from one ventricle to the other through tiny invisible pores, rather than arteries. Blood flowed from the liver to the right ventricle of the heart and nourished the lungs via the veins. The left ventricle nourished the rest of the body through arteries that he thought were air pipes, but also contained vital spirits.

In addition, the heart did not pump blood, but sucked it in from the veins. The rise and fall of the pulse came from a contraction and relaxation, which originated in the arteries, rather than from any pumping action of the heart.

Harvey was the first person to study biology quantitatively, and showed that **according to Galen, the liver would have to produce 540 pounds of blood a day.** He demonstrated that: the dynamical starting-point of the blood is the heart and not the liver; it was the contraction, not the dilatation of the heart, that coincided with the pulse; that the pulse was not produced by the arteries enlarging and contracting but by being filled with blood with each contraction; there is no pulsation in the veins, but rather a constant stream of blood from the periphery to the heart; the blood in the arteries is the same as that in the veins, there were no pores in the septum between the ventricles; the action of the right and left auricles and ventricles and the valves between them is the same with respect to the reception and propulsion of liquid, not air, since the blood on the right side, although mixed with air, is still a liquid; blood in the right ventricle is sent to the lungs and via the pulmonary veins returns to the left atrium and is then sent into the arteries and returns through veins that empty into the vena cavae, which returns it to the right side of the heart to complete its circulation.

It is impossible to overestimate the power Galen had over medicine at the time. He was such an unquestioned authority **that he was later referred to as "The Medical Pope of the Middle Ages."** Although Harvey announced his discovery in 1615, he waited 13 years before publishing his results since it was considered sacrilegious to challenge Galen. Any contrary opinions were considered to be heretical, and would not only quickly end your career, but could even cause you to be burned at the stake. Harvey's hesitation to openly defy Galen proved to be justified. Most physicians rejected his 1628 book because he could not explain how the arteries and veins met. If organs did not consume blood, how did different parts of the body obtain nourishment? If the liver did not make blood from food, where did blood originate? Why was blood blue in veins but red in arteries? It took two decades for Harvey's colleagues to acknowledge his achievements.

### **The Unappreciated Contributions Of Arabic Physicians To Cardiology**

Around 830, Hunayn ibn Ishaq, an influential physician and scientist, translated 129 of Galen's works from Greek into Arabic, and they soon became gospel. Galen was so revered, that when dissections disputed his anatomical teachings, every attempt was made to somehow fit them into his system or to apologize profusely. In his *Doubts about Galen*, written around 900, Muhammad ibn Zakariya al-Razi (Al Razi), rejected several claims, including Galen's theory of the four humours. Other physicians accused him of ignorance and arrogance, even though Al Razi explained:

"I prayed to God to direct and lead me to the truth in writing this book. It grieves me to oppose and criticize the man Galen from whose sea of knowledge I have drawn much. Indeed, he is the Master and I am the

disciple. Although this reverence and appreciation will and should not prevent me from doubting, as I did, what is erroneous in his theories. I imagine and feel deeply in my heart that Galen has chosen me to undertake this task, and if he were alive, he would have congratulated me on what I am doing. I say this because Galen's aim was to seek and find the truth and bring light out of darkness. I wish indeed he were alive to read what I have published."

However, Galen became worshipped even more due to the writings of Ibn Sina, the most prominent physician and philosopher of his time. Better known as Avicenna, his Latinized name, he wrote over 400 tracts or books, the most famous being the *Al-Qanun fi al-Tibb* (The Law of Medicine), which he completed in 1025. It is usually referred to as the Qanun or *The Canon Of Medicine*, and its 14 volumes containing over one million words was elaborately divided and subdivided to cover every conceivable aspect of medical practice. Much of it was rooted in Galen's works, with elaborative supportive commentary based on his personal experience that was supplemented with information he had obtained from ancient Arabian Persian and Indian medical texts. A Latin translation of the Qanun (*Canon Medicinæ*) appeared in Europe in the 11th century, quickly followed by others, and its 1593 publication in Rome made it one of the first Arabic books to be printed. From the 12th to 18th century, the Qanun was the most important medical text in the world because of its encyclopedic comprehensiveness and systematic arrangement. It is believed to have influenced Leonardo Da Vinci, and Sir William Osler wrote, "The Qanun has remained a medical bible for a longer time than any other work".

The Qanun also dominated Islamic medicine, until it was questioned by Ibn-Al Nafis, the Chief Physician at the Al-Mansouri Hospital in Cairo and the Sultan's physician. As with most other Muslim physicians of his time, not only did Ibn Nafis excel in medicine, but he was also well versed in several languages, philosophy, Islamic law and history, and he wrote numerous works disputing both Galen and Avicenna. Al Nafis is correctly considered by many to be the Father of circulatory physiology because of his accurate description of the pulmonary and coronary circulation, and his anticipation of the existence of capillaries that were the interface between veins and arteries. One of his most important books, the 20-volume *Commentary on Anatomy in Avicenna's Canon*, written in 1242, explained that there were only two ventricles, not three, there were no pores through the interventricular septum and the ventricle received its nourishment from the coronary vessels, not, as Galen and Avicenna had also claimed, from blood deposited in the right ventricle. His premonition of a precursor to the capillary circulation was due to his discovery that "the pulmonary vein receives what comes out of the pulmonary artery, **this being the reason for the existence of perceptible passages between the two.**"

Al Nafis was an early proponent of experimental medicine, postmortem autopsy, and human dissection, at which he excelled. He drew several diagrams of his new physiologic system, some of which have been preserved, but his skill and ingenuity are evident in the following excerpts.

The blood from the right chamber of the heart must arrive at the left chamber but there is no direct pathway between them. The thick septum of the heart is not perforated and does not have invisible pores as Galen claimed. **The blood from the right chamber must flow through the (pulmonary artery) to the lungs, spread through its substances, be mingled there with air, pass through the pulmonary vein to reach the left chamber of the heart and there form the vital spirit.**

The heart has only two ventricles ...and between these two there is absolutely no opening. Also dissection gives this lie to what they said, as the septum between these two cavities is much thicker than elsewhere. **The benefit of this blood (that is in the right cavity) is to go up to the lungs, mix with what is in the lungs of air, then pass to the left of the two cavities of the heart.**

Al Nafis also disproved Galen's theory that "every part of an artery pulsates simultaneously" and that the motion of the pulse was due to "the arteries expanding and contracting naturally". He attributed the pulse to the force of cardiac contraction, noting that "the arteries and the heart do not expand and contract at the same time, but rather the one contracts while the other expands" and vice versa. He also recognized that the purpose of the pulse was to help disperse the blood from the heart to the rest of the body. **All of these observations were made almost 400 years before Harvey, who was unable to explain how blood was transferred from arteries to veins.** The existence of capillaries, which were invisible even with the microscopes that were available at the time, was first made by Marcello Malpighi in 1642, over two decades after Harvey died.

All of these important observations were not known in Europe until 1547, when Andrea Alpago translated some of Al-Nafis' writings into Latin. However, it is important to emphasize that Galen's authority, like that of the Pope, could not be disputed. Six years later, Michael Servetus described the pulmonary circulation in his theological book, *Christianismi Restitutio* as "air mixed with blood is sent from the lungs to the heart through the arterial vein; therefore, the mixture is made in the lungs. The bright color is given to the sanguine spirit by the lungs, not by the heart." This was almost word for word what Al Nafis had written but was considered heresy. Servetus was later burned at the stake along with his book for suggesting that the blood actually passed from the right ventricle to the left side of the heart via the lungs, rather than through the interventricular septum.



The great anatomist Vesalius also described the pulmonary circulation in his book *De Fabrica*, in a manner similar to Al Nafis. It is interesting that in the first edition (1543), Vesalius agreed with Galen that the blood "... soaks plentifully through the septum from the right ventricle into the left." In the second edition (1555) he omitted this, and replaced it with "I still do not see how even the smallest quantity of blood can be transfused through the substance of the septum from the right ventricle to the left". A similar description was given by Realdus Colombo in his 1559 book *De re Anatomica*. **All of these were obviously based on the 1547 translation of Ibn al-Nafis' work, but without ever acknowledging this.** The important contributions of Al Nafis were largely forgotten and these details only came to light after 1924, when an Egyptian physician studying the history of Arabic medicine discovered a handwritten script identified only as No. 62243 in the archives of a Berlin library. It included a portion of the *Commentary on Anatomy in Avicenna's Canon* that contained what was clearly the first accurate description of the pulmonary circulation. Al Nafis also identified mistakes made by Galen and Avicenna on how blood entered the brain and pointed out other errors in his subsequent *Al-Shamil fi al-Tibb* (*The Comprehensive Book on Medicine*). This 44-volume encyclopedia was much larger than Avicenna's more famous Qunan (*The Canon of Medicine*), but only several volumes have survived.

### Why The Heart Is Much More Than A Mere Pump

I had been asked to give a lecture to demonstrate that a high fat diet and elevated cholesterol did not cause coronary atherosclerosis, and another to present proof that stress was a much more important contributor to heart attacks and sudden death. The third was to be devoted to an explanation of why the heart was much more than a pump, which would support justification for the "King of Organs" description. As background, I discussed all the above and other Arabic physicians, like Averroes, in this presentation, although it was "bringing coals to Newcastle." Arabian authorities on the history of medicine expanded on these and also gave scholarly presentations about Muslim doctors that had also contributed to philosophy and theology, often citing support from the Holy Qur'an (Koran).



Seeds being emptied from the container on the right

I had referred to the Ebers papyrus, but was not aware of the 1600 BC Edwin Smith papyrus shown to the left. It contained hieroglyphs and other illustrations that showed how to count the pulse. This was long before sand clocks, hourglasses or sundials were available.

The Therapeutic Papyrus of Thebes, which is believed to antedate the Ebers papyrus, similarly viewed the heart as the source of all pulses, noting

If the physician places his finger on the head, neck, arms, hand, feet or body, everywhere he will find the heart, for the heart leads to every member and speaks in the vessels of every member.

I had long believed that the heart was more than a pump, and support came in January 1985, when despite the adequate pumping of William Schroeder's artificial heart for over a month, his doctors reported that he had an "unusual excess of fluid retention" (around 30 lbs) that could not be explained and was difficult to reduce. He had suffered one stroke and subsequently had two more that left him in a vegetative and bloated state for over a year, when he died from a lung infection. In a letter to the *New York Times* entitled "Can An Artificial Heart Have Its Reasons", I noted that the heart, in addition to being a pump, was also an exquisite endocrine organ that secreted powerful atrial natriuretic hormones that responded to excess fluid loads and lowered blood pressure faster and more profoundly than any known drugs. Deprived of this homeostatic mechanism, it was not surprising that an accumulation of excess fluid that his doctors said "could squash the blood vessels, slowing the circulation and thus increasing the chances for clots to form." Since then, it has been found that the ventricles also secrete a similar blood pressure reducing hormone, that all four chambers of the heart can make and secrete oxytocin, the bonding and cuddling hormone. The heart also has abundant oxytocin receptors.

There were numerous reasons why the pumping action of the heart was insufficient to propel blood around the body, including:

1. **There is not enough force to move a viscous fluid like blood through more than 25,000 miles of vessels. This would require lifting 4,000 tons up over a yard each year annually.**
2. A pump works efficiently with a closed system but the entire non-corpuscular volume of the blood is replaced 80 times each day. With this "leakage," there would be no venous return because of the lack of pressure after the capillaries opened into tissues.
3. An efficient pump would be designed to work directly on the system with the greatest volume and the veins contain much more blood than the arteries (65% compared to 12%).
4. The relationship between flow and pressure is opposite to what one would expect if the heart's pumping action were responsible. The highest pressure and lowest volume throughout the system (including the veins) should occur when the heart's pumping action is greatest. However, blood volume and venous pressure increase when the heart's pumping action weakens.
5. The aorta bends in systole, but should straighten under higher pressure.

6. The location of the heart in the upper third of the body makes no sense from a functional goal. Putting a pump at the top of a hill, where it works by suction, would obviously not be as efficient compared to the pushing effect achieved by placing it at the bottom of the hill.

7. With respect to the physics and hydraulics of fluid flowing in a closed system, the velocity at any point is inversely proportional to the size of the area. However, the velocity of the blood is greatest at the level of the heart and slowest at the capillary level, where it needs the greatest push.

8. Finally, **replacement by a mechanical pump only works for a relatively short period of time, in contrast to heart transplantation.**

So how does blood get to circulate through the body? **The clue may lie in the capillaries, which although microscopic in size, total over 25,000 miles in total length, and if laid end to end, would cover the area of three football fields.** It would be impossible for the heart to pump air through this system, much less blood. Our cells are churning engines of metabolic activity, taking in vital nutrients and expelling waste products in capillary beds throughout the body. This creates a gradient of increasing osmotic pressure that drives fluid from the arterial to the venous side of capillaries, to vessels that become progressively larger as they near the heart. One illustration of this powerful capillary hydrostatic pressure can be seen if you insert a glass tube of small diameter into water. The water level in the tube immediately rises and the narrower the tube, the higher the rise. Since the smallest diameter of any glass tube is thousands of times larger than a capillary, osmotic pressure produced by metabolites in our 40 to 50 million capillaries may furnish the force that pushes blood back to the heart.

### **Could The King Of Organs Also Be The Sovereign Of The Soul?**

More than a pump, I believe the heart listens and senses changes in the blood and maintains homeostasis and optimal cell function by utilizing its hormones, and possibly subtle energies that are not yet fully appreciated.

**The heart's electromagnetic field is by far the strongest in the body.** It is 40-60 times greater than the brain's field and is detectable 12 or more feet from the body. There must be some reason for this. As we learned at this conference, Franz Halberg's research has shown that the heart is also sensitive to solar and geomagnetic forces that could explain the increase in heart attacks and emotional complaints seen with certain weather changes.

Harvey never said the heart was a rigid pump, but likened it to a bellows that lifted water by using clacks (valves). "From the structure of the heart it is clear that the blood is constantly carried through the lungs into the aorta as by two clacks of a water bellows to raise water." This is the only mechanical analogy he ever offered, and is based on Aristotle's, "It is necessary to regard the structure of this organ [the lungs] as very similar to

the sort of bellows used in a forge, for **both lungs and heart take this form.**" Harvey clearly recognized that the heart was much more than a mechanical pump, and that it reflected emotions and feelings, when he noted, "Every affection of the mind that is attended either with pain or pleasure, hope or fear, is the cause of an agitation whose influence extends to the heart." In the dedication of his book to King Charles I, he also wrote:

Most serene King! The heart of animals is the foundation of their life, **the sovereign of everything within them**, the sun of their microcosm, that upon which all growth depends, from which all power proceeds. Equally is the king the basis of his kingdoms, the sun of his microcosm, the heart of the state; from him all power arises and all grace stems. - *De Motu Cordis* 1628

In other words, just as the king is the sun that makes the body politic work, and does so from the center, so the heart is the sun that is the **sovereign of the body and soul**. Harvey also considers circulation in the Aristotelian sense - which is cyclical, (such as the movements of the heavens), rather than being perfectly circular. Another example is the cycle of the sun causing evaporation, water condensing in the clouds, which falls as rain, and is again evaporated. Thus, he also writes in *De Motu Cordis*, **"We have as much right to call the motion of the blood circular as Aristotle had to say that the air and rain emulate the circular movement of the heavenly bodies."** Thus, water gives life to land just as blood gives life to the body. Harvey needed this air-water-air analogy to explain the transfer of blood from arteries to veins since capillaries had not yet been discovered.

As Blaise Pascal, one of Harvey's supporters, wrote, "The heart has reasons that reason knows not of. We feel it in a thousand things . . . . **Do you love by reason?** " It is the heart which perceives God and not the reason. **That is what faith is: God perceived by the heart, not by the reason.**" For more on the possible significance of these statements and future conferences on the "King of Organs" here or abroad, - stay tuned!

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Editor-in Chief

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