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Carl F. Schmidt
The Early History of Instrumental Precision in Medicine

When Galileo, but eighteen years of age, a student of medicine, counted the vibrations of the great bronze lamp swinging in the gloom of the Duomo of Pisa, he conceived them to be in equal time. Desiring to test the truth of his conclusion, he is said to have used his own pulse as a measure of the correctness of the pendulum. Forty years later, in describing the accuracy of his first clock-work, he says with enthusiasm, "My clock will not vary so much as the beat of a pulse." Says Viviani, his biographer, "The unerring regularity of the swing of a suspended lamp suggested to the young medical student the reversed idea of marking with his pendulum the rate and variation of the pulse. Such an instrument he constructed after a long series of experiments. Though imperfect, it was hailed with wonder and delight by the physicians of the day, and was soon taken into general use." Unclaimed by Galileo, it was attributed to Paolo Sarpi, and clearly enough was appropriated at a later date by that notable genius, Sanctorius, who also, like Galileo, called it the pulsilogon. . . . It is interesting to observe the tendency towards securing accuracy in medicine thus shown by Galileo at the outset of his medical career. . . . With his thermometer and the pulsilogon, and with this picture of his testing the accuracy of the swing of the lamp by his own pulse, this marvelous mind passes out of medical history. Where he would have left it had he remained with us, who indeed can say? Of his loss to us, a poet has spoken:

Ah! when in Pisa's dome
He watched the lamp swing constant in its arc,
He gave to man another punctual slave,
And bade it time for us the throbbing pulse.
Not that grave Harvey whom Fabricius taught,
Not sad Servetius, nor that daring soul,
Our brave Vesalius, e'er had matched his power
To read the riddles of this mortal frame.
And then he left us. Would our strange machine
Had kept his toil, and cheated heaven's fair stars!

Ventriculotomy in the Right Ventricle


Sometimes, amid campaigns against so many diseases we don’t want to die of, I think, somewhat flippantly, that we might sensibly focus our attention on deciding which among several mortal diseases we do like, which exits we prefer; and, in dignified acceptance of the inevitable, we might depart after perhaps less stampeding and general confusion.—Alan Gregg, M.D. Challenges to Contemporary Medicine. New York, Columbia University Press, 1956, p. 91.


Now the properties of water have the result that more readily than other substances it exists simultaneously and in large quantities in the three phases of solid, liquid, and gas as ice, water, and aqueous vapor. This depends upon the high latent heats of fusion and vaporization, the high freezing point of water, and its vapor tension. Water enhances the complexity of the environment, and is one principal factor in the mobility of the environment as a whole. Further, it makes for stability; other things being equal, the greater the number of phases, the less the tendency to change. Among phases the disperse colloidal type is unique and of very great importance—almost the sole basis, indeed, of great physical complexity—and, as above shown, the peculiar properties of water highly favor the colloidal condition.

The solvent power of water much increases the number of components which may enter into a system of which it is a part; hence the large number of components of sea water, blood plasma, etc. The variety of compounds, both organic and inorganic, which contain carbon, hydrogen, or oxygen also causes enormous increase in the number of components of biological systems like protoplasm.

The specific heat of water, its latent heats of fusion and vaporization, and the high freezing point all contribute to the restriction of temperature range within the organism, in the waters, and over the whole surface of the earth. The vapor pressure of water has been shown to possess great and exceptional variability with change of temperature. This is the most important property of water meteorologically, and is the necessary condition for its ample circulation. The ratio between the gas pressure of carbonic acid and its concentration in water (absorption coefficient) has been shown to be the great factor in establishing the mobility of that substance.—LAWRENCE J. HENDERSON. The Fitness of the Environment. New York, The Macmillan Co., 1924, p. 258.


References


Though old Fort Crawford on the upper Mississippi has vanished, the results of the experiments Beaumont conducted within its walls have come down to us with undiminished luster through more than a hundred years and are an enduring portion of America's gifts to science. "Truth, like beauty," Beaumont wrote, "when unadorned is adorned the most, and in prosecuting these experiments and inquiries I believe I have been guided by its light." Such is the ideal and such is the faith of the frontiersman in science, and in so far as he is loyal to his convictions he will leave behind him, as Beaumont did in his records, lasting contributions from his fleeting years.—Walter B. Cannon, M.D., The Way of An Investigator. New York, W. W. Norton & Company, Inc., 1945, p. 29.

Circulation, Volume XXIV, September 1961
There is certain evidence in the history of research for the belief that some discoveries could not have been made until some other discovery had been made. This fact underlies an aspect of research that has nothing to do with our roulette or chance. But it does have to do with the imagination and creativeness of a good researcher. It underlies, too, what are called “good leads,” for when knowledge in one field reaches a given stage, men in other fields may see how to incorporate that new knowledge or method in fruitful ways. And sometimes they may not: witness the lapse of time between the synthesis of one of the sulfa drugs in 1908 and its successful use in bacterial infections in the thirties. This dependence of some discoveries on antecedent discoveries furnishes the main reason for saying, “You can’t just go out and buy the discoveries you want.” Some discoveries have cost a good deal of money. But one can’t infer from that fact that spending a good deal of money will buy whatever you want. In Professor V. R. Khanolkar’s laboratory in Bombay I saw an excellent statement: “Il faut chercher pour trouver mais pas pour trouver ce qu’on cherche”—you must search to find but not to find what you are searching for.—Alan Gregg, M.D., Challenges to Contemporary Medicine. New York, Columbia University Press, 1956, p. 71.
BRAUNWALD, FRAHM

On Cardiac Murmurs
By Austin Flint, M.D.

The mitral direct is a pre-systolic murmur; this name expresses its proper relation to the heart sounds, and it is the only murmur which does occur in that particular relation. The time of its occurrence as just explained, and as expressed by the term pre-systolic, is sufficient for its easy recognition when once it is fully comprehended.—Am. J. M. Sc. n.s. 44: 29, 1862.
In (7), if \( T \text{(ac)} \) is the total length available for line a + c, then
\[ c = T \text{(ac)} - a. \]
Inserting this in (7):
\[ a = \left[ T \text{(ac)} - a \right] \frac{N_2}{N_1} 8.95 \text{(DN)} \div \]
\[ a \left[ \frac{N_1}{N_2} + 8.95 \text{(DN)} \right] = T \text{(ac)} 8.95 \text{(DN)} \div \]
\[
(8)
\]
(5), (6), and (8) are then solved for the values of \( \Delta D \), \( t \), and \( DN \). These quantities are then plotted on the specified, b, d, or \( \text{(ac)} \) lines with the value of \( \Delta D \), \( t \), or \( DN \) used to calculate a particular point noted next to that point. If \( T \text{(b)} \), \( T \text{(d)} \), and \( T \text{(ac)} \) are in inches, then \( N_1 \) and \( N_2 \) will be in units/inch and \( a \), \( b \), and \( d \) will be in inches.

**The Internal Environment**

Ancient science was able to conceive only the outer environment; but to establish the science of experimental biology, we must also conceive an inner environment. I believe I was the first to express this idea clearly and to insist on it, the better to explain the application of experimentation to living beings. Since the outer environment, on the other hand, infiltrates into the inner environment, knowing the latter teaches us the former's every influence. Only by passing into the inner, can the influence of the outer environment reach us, whence it follows that knowing the outer environment cannot teach us the actions born in, and proper to, the inner environment. The general cosmic environment is common to living and to inorganic bodies; but the inner environment created by an organism is special to each living being. Now, here is the true physiological environment; this it is which physiologists and physicians should study and know, for by its means they can act on the histological units which are the only effective agents in vital phenomena.—**Claude Bernard. An Introduction to the Study of Experimental Medicine.** New York, The MacMillan Company, 1927, p. 76.
may have accounted for the absence of symptoms until the age of 17 years. Diagnosis was established by cardiac catheterization and angiocardiography. Surgical correction by an Ivalon graft with end-to-end anastomosis to the right pulmonary artery and end-to-side anastomosis to the main pulmonary artery was accomplished; however, the patient died 5 hours after completion of surgery.

Our patient has been examined 15 months after surgery. He has grown and developed normally and is asymptomatic. A soft systolic murmur persists at the base of the heart, but examination otherwise is normal.

References

This aspect of the regulation of cardiac output in human disease warrants more investigation.

Summary

A case is reported of isolated anomalous drainage of the inferior vena cava into the left atrium, the second in the literature and the first with catheterization data and dye-dilution curves. The anomaly is reflected by a well-defined clinical syndrome, is compatible with full cardiac competence at least until middle life, and should be relatively simple to correct surgically.

Acknowledgment

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References


Art and Science

In art and letters, personality dominates everything. There we are concerned with a spontaneous creation of the mind, that has nothing in common with the noting of natural phenomena, in which the mind must create nothing. The past keeps all its worth in the creations of art and letters; each individuality remains changeless in time and cannot be mistaken for another. A contemporary poet has characterized this sense of the personality of art and of the impersonality of science in these words—"Art is myself; science is ourselves."—CLAUDE BERNARD. An Introduction to the Study of Experimental Medicine. New York, The MacMillan Company, 1927, p. 42.


Laennec's contributions to the study of diseases of the lungs, of the heart, and of the abdominal organs really laid the foundation of modern clinical medicine.—SIR WILLIAM OSLER, Aphorisms from His Bedside Teachings and Writings. Edited by William Bennett Bean, M.D. New York, Henry Schuman, Inc., 1950, p. 112.