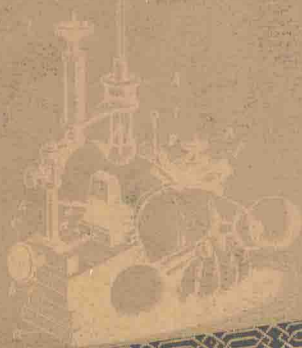


Classics in Arterial Hypertension



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of Internal Medicine
University of Texas
Medical Branch

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Health Service Hospital
Galveston, Texas

A Monograph in
AMERICAN LECTURES IN
CLASSICS IN SCIENCE
AND MEDICINE

Edited by

WIKTOR W. NOWINSKI

Ph.D., Dr. Phil. Nat.
Associate Professor
of Biochemistry

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Research Laboratory
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American Lecture Series®





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To Belle, Robert,
Paul, and Lorraine—
veri amici

The first volume of this

American Lecture Series
Classics in Science and Medicine


is in honor of

DR. CHAUNCEY D. LEAKE

*whose constant encouragement, interest
and help made their publication possible*

The Editor

PREFACE

 IN CHOOSING classic papers and excerpts, I have had the benefit of advice from numerous authorities in the field. I am indebted in this respect particularly to Arthur Grollman of Dallas, William Goldring of New York, Hyman I. Goldstein* of Camden, Henry A. Schroeder of St. Louis, Irvine H. Page and Harry Goldblatt of Cleveland, Raymond A. Gregory of Galveston, and among the Editorial Board, to John F. Fulton of New Haven and George Sarton† of Boston. Responsibility for the final choices is mine alone.

The editorial work of Dr. Wiktor Nowinski included repeated close inspections of the entire manuscript for which I am deeply grateful.† Dr. Chauncey D. Leake and publishers Charles C and Payne Thomas were extremely successful as usual in making the job as pleasant as possible.

The cooperation of Miss Elizabeth Runge and her Medical Branch library staff as well as that of the Armed Forces Medical Library is also gratefully acknowledged. My successive secretaries, Loraine Millican Seay, Margaret Musey, and Vivian Paysse are responsible for much of the arduous accuracy involved.


Finally, all translations, except that of Nei Ching for which thanks are due to Ilza Veith and the Williams & Wilkins Company, are my own. Making them more generally available is perhaps the most useful portion of this historical survey of arterial blood pressure.

A. R.

* Deceased.

† Throughout the text editorial changes and remarks are enclosed in brackets.

INTRODUCTION

 ONE JUSTIFICATION of looking backward is that, though sometimes thought stultifying by the plodding, past eminences are inspiring to the brave. The more recent acceleration of peaks of achievement (Fig. 1) is an overwhelming proof of the dictum "Die Methode ist Alles." The papers on *Methods*, as opposed to those on *Significance*, suffer also, it seems, less from the sad dictum of von Uexküll: "the scientific truth of today is the error of tomorrow." Yet even they should teach us that in science, as in human life, the search for truth and not constancy is the supreme law.

Doubtless, it is our own myopia that sees great discoveries in the field of blood pressure in geometrical progression (Fig. 1). It is, therefore, desirable to indicate the inevitable gaps. Many ancient opinions on apoplexy, pulse-lore, the use of venesection, leeches, cupping, and the like are known to us only through such historical reviews as that of Morgagni (1761).

Objections may be raised that the papers of Cushing, Hering, Koch and Mies, for example, deal with temporary elevations of the blood pressure rather than hypertension as an entity. Their inclusion, as that of Sir Clifford Allbutt, is justified by virtue of clear and cogent thinking in the wider field.

Otto Frank's (1910, 1925) optical manometer, which utilized membranes of high frequency of vibration and was modified by Hamilton (1934), and the more recent electrometric methods increased the accuracy of physiological measurements of the intra-

arterial pressure. Primarily refinements of the mechanical recorders of Huerthle (1888) and others, they are also omitted from the Section on *Methods*.

Pulse-lore, unlike arterial pressure which became a routine

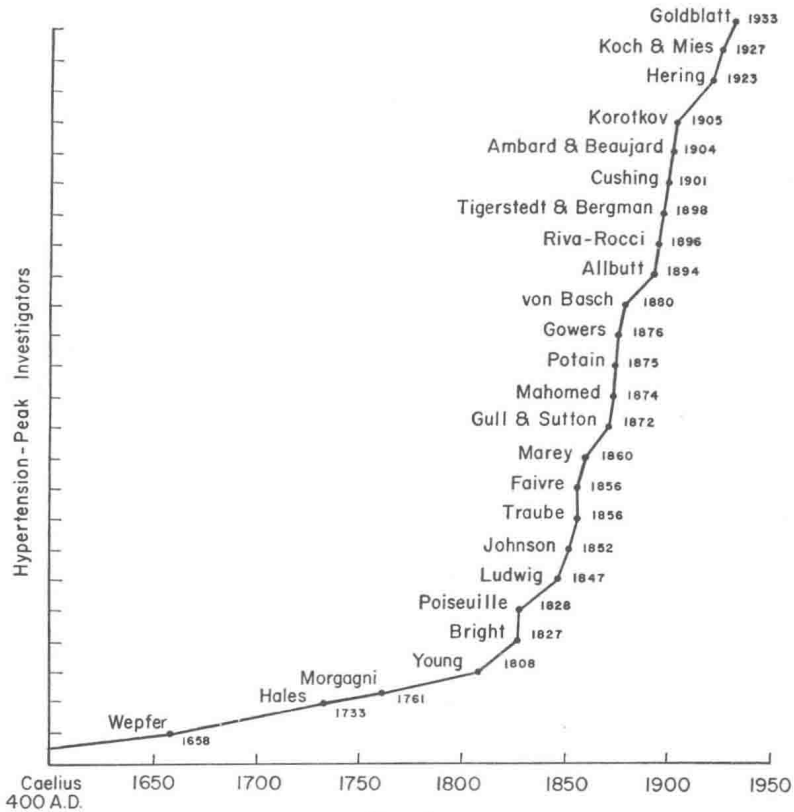


FIG. 1

clinical procedure barely fifty years ago, some 200 years after its first measurement (1711), goes back to antiquity. Already in the Yellow Emperor's Classic of Internal Medicine, the Minister Ch'i Po answers to the Plain Questions of the Yellow Emperor (2698-2598 B.C.) of China:

NEI CHING:
THE YELLOW EMPEROR'S CLASSIC
OF INTERNAL MEDICINE*

Book 2

5. *The Great Treatise on the Interaction of Yin and Yang*

"... The emotions of joy and anger are injurious to the spirit Violent anger is hurtful to Yin,† violent joy is hurtful to Yang.‡ When rebellious emotions rise to Heaven, the pulse expires and leaves the body. . . .

"... One should feel the pulse at the place of the 'cubit' and at the place of the 'inch' and one should observe whether the pulse is superficial or whether it is deep, whether it is regular or uneven; and then it becomes evident where the disease originates and it can be cured.

"Nothing surpasses the examination of the pulse, for with it errors cannot be committed. . . .

"... In order to examine whether Yin or Yang predominates one must distinguish a gentle pulse and one of low tension from a hard and bounding pulse.§ . . .

"When the blood hardens it should be cleared and made to burst forth. . . ."

Book 3

9. *Treatise on the Six Regulations Governing the manifestations of the Viscera*

"... The heart influences the face and fills the pulse with blood. . . .

10. *Treatise on the Five Viscera in Relation to Their Part in Perfecting Life*

"The heart is in accord with the pulse. The complexion of a person shows when the heart is in a splendid condition. The heart rules over the kidneys. . . .

* Huang Ti Nei Ching Su Wen: *The Yellow Emperor's Classic of Internal Medicine*, translated by I. Veith. Baltimore, Williams & Wilkins, 1949, Chap. 1-34, 253 pp.

† Yin = Female (passive) Principle of Lao Tze (600 B.C.)

‡ Yang = Male (active) Principle. The imbalance of Yang and Yin caused disease.

§ Wang Ping says: "A Yang-pulse is strong and pounding while a Yin-pulse is weak and of low tension." [Ed.]

Translation
of the
Huang Ti Nei Ching Su Wên
[The Yellow Emperor's Classic on Internal Medicine]



Title-Page of the
Huang Ti Nei Ching Su Wên

"Hence if too much salt is used in food, the pulse hardens, tears make their appearance and the complexion changes. . . .

"When the pulse has a red appearance and there is an obstinate cough, the examiner says that there is amassed air within (the heart) and it is dangerous to eat at this particular time. The disease is known as 'numbness of the heart.' It is contracted through external evil influences, causing anxiety and emptying the heart while the evil influences follow into it. . . ."

Book 5

17. *Treatise on the Importance of the Pulse and the Subtle Skill of its Examination*

"The pulse is the store-house of the blood. When the pulse beats are long and the strokes markedly prolonged, then the constitution of the pulse is well regulated; when the pulse beats are short and without volume, then the constitution of the pulse is out of order. When the pulse is quick, and contains six beats to one cycle of respiration, then it indicates heart trouble; and when the pulse is large the disease becomes grave.* . . .

"When the heart pulse beats vigorously and the strokes are markedly prolonged,* the corresponding illness makes the tongue curl up and makes the patient unable to speak. . . ."

18. *Treatise on the Manifestations of Health and Man*

". . . The viscera are in thorough communication and bound by circulation with the heart, and the blood that is stored by the heart, and thus the blood fills the pulse with the forces of life (breath). . . .

". . . When the pulse beats resemble too closely the tautness of musical strings a disease breaks out presently. . . .

". . . When it is stone-like but also like the beating of a hammer, a disease will make its appearance in Summer. When the sound that is comparable to the beating of a hammer is too strong, the disease will develop at once. . . .

". . . When the pulse is abundant but tense and hard and full like a cord, there are dropsical swellings. . . ."

Book 6

19. *Treatise on the Precious Mechanism of the Viscera*

"Now one can repress the disease [due to evil winds] and can administer drugs. If a cure is not achieved the kidney's will

* Wang Ping explains: "at the pulse of the hand." [Ed.]

pass on the disease to the heart. The muscles (sinews, nerves) and the arteries (veins, pulse) will disunite from each other and an acute illness will develop, which is called 'convulsions.'* . . .

"Ch'i Po answered: 'When the pulses are abundant the skin is hot, the stomach is swelled out with dropsy, there is no circulation between front and back, and the center is obscured; then it is said that the five viscera are entirely full of (evil influences).'[†] . . .

Book 7

24. *The Order and Scope of Man's Vigor and Constitution*

"When the body is content but will and ambition are in distress, disease arises from the pulse; and in order to cure it one uses moxa treatment and acupuncture. . . ."

Book 8

28. *A Thorough Discussion of the Hollow and the Solid, The Fullness and the Insufficiency (of the Body)*

"Ch'i Po answered: 'When there is troubled breathing and wheezing while resting the shoulders, the pulse is large and full. When it is slow it means life; when it is rapid it means death. . . .

"The Emperor asked: 'What can be done when the pulse is insufficient or (too) full and when there are fits and madness?'

Ch'i Po replied: 'When the pulse is wanting then the disease can be cured; when the pulse is (too) full then death will occur. . . .

"Generally one can cure digestive diseases, strokes, and falling prostate, paralysis on one side, impotence, and that fullness of vigor which gives rise to disorders. When these diseases occur with wealthy people, then they are ailments caused by rich fare. When there are divisions, blockages, closings, and cuttings off, and circulation ceases above and below, then there are diseases brought about by violent (sudden) stress. . . .

Book 9

34. *Treatise on Rebellion and Harmony*

". . . Hence if the habits of life are as usual and the breathing

* Wang Ping explains: "When the kidneys do not work sufficiently, then no water is generated; consequently the muscles become parched, dry, and convulsed and therefore disunite from each other." [Ed.]

† Wang Ping explains: ". . . means 'abundant with evil influences.' The pulse which is abundant with evil influences is that of the heart, the chilled skin belongs to the lungs, an inflated stomach belongs to the spleen, lack of circulation between front and back belongs to the kidneys, and an obscured center belongs to the liver." [Ed.]

is noisy, then the veins of the lungs are in disorder. The vessels are not in harmony with the main vessels which ascend and descend. Hence the main vessels are restrained and cannot function, and man suffers from a disease of the veins.

"If, however, the habits of life are as usual and breathing is noisy; and if one cannot rest, or if one rests there is troubled breathing, then something has temporary residence in the breath; water follows the saliva and circulates. The water of the kidneys influences the saliva, disturbs the rest, and causes the troubled breathing."

"The Emperor said: 'Excellent!'"

It is interesting to compare "the blood current flows continuously in a circle and never stops" to the experimental conclusion of William Harvey (1616) who said in the Lumleian Lecture before the Royal College of Physicians: "a perpetual movement of the blood in a circle is caused by the beat of the heart."

The Chinese also recognized that "lack of temperance in eating and drinking" and "the emotions of joy and anger" were injurious and sometimes fatal. Much later Talmudic and Mohammedan writings were in agreement with these views. The Arabic *AL-ZAKHORA* (The Treasury) was explicit: "Nothing is more harmful to an aged person that to have a clever cook and a beautiful concubine."

In regard to prognosis: "In cases of apoplexy, the pulse should be superficial and slow; if it is firm, rapid, and large, there is danger. . . . It is unfavorable if the pulse is large, scattered and irregular. . . . Where there is pulmonary congestion a wiry and large pulse is favorable; but few can recover quickly if it is deep, small and thready." These statements are to be found in the voluminous *Pulse Classic* of Wang Shu-ho, *MO CHING*, published in 280 A.D.

Various Chinese texts advised acupuncture or venesection "when the blood hardens," just as the tablets from the Ashurbanipal (669-626 B.C.) Library at Nineveh referred to apoplexy, venesection and cupping. Blood-letting, trepanning, and cupping (using a cut-off buffalo horn) were indeed common practices of the North and South American Indians. Leeches were used, in addition, by Brahman, late Roman, Talmudic, Mediaeval Arab (and Stalin's) physicians.

In *India*, hemiplegia and the Vasuna-curse—"water belly" (*jalo-dera*) were mentioned in the *ATHARVA-VEDA* (ca 1000 B.C.). A disturbance of the phlegm was supposedly reflected in a slow heavy pulse. The Hindu Charaka (6th Century B.C.?) counted the pulse to tell the action of the heart, and the great surgeon Susruta (6th Century B.C.?) was depicted as feeling the pulse. In males it was the custom to palpate the pulse in the right wrist, and in females in the left wrist. It followed that in Bagdad: "The physician attending Sa'd-ul-Doula refused to take his pulse from the left wrist, even though his patient being paralyzed down the right side was unable to offer him the correct hand." [Elgood, 1951.] "What about eunuchs?" asks Evan Bedford.

The *Egyptians*, cf., the *Edwin Smith* papyrus (17th Century B.C.), the *Thebeth* papyrus (1522 B.C.), and the *Ebers* papyrus (1552 B.C.) all based on teachings of 3000 to 2550 B.C., counselled not only examinations of the various pulses but also direct auscultation of their source, the heart.

In the anatomical section of the Papyrus Ebers we find the following description:

"The beginning of the physician's secret: knowledge of the heart's movement and knowledge of the heart. There are vessels from it to every limb. As to this, when any physician, any surgeon, or any exorcist applies the hands or his fingers to the head, to the back of the head, to the hands, to the place of the stomach, to the arms or to the feet, then he examines the heart, because all his limbs possess its vessels, that is: the heart speaks out of the vessels of every limb." [Major, 1954.]

In the *Bible* can be found many instances of paralysis and sudden death, possibly from apoplexy, due apart from the wrath of God, to the violence of emotion, exertion, overeating or drunkenness.* The death of Menelaus' pilot on severe exertion (plus Apollo's darts) in Homer (*Odyssey*, Book III), just as that of the aged Sophocles from the excitement of victory on reading *ANTIG-*

* I Maccab. 9:55 (Alcimus- ". . . his mouth was stopped and he was taken with a palsy. . . ."); III Maccab. 1:21-24 (Philopator); I Samuel 25:36-38 (Nabal); I Samuel 4:17, 18 (High Priest Eli); II Samuel 6:7 (Uzzah); Judges 4:7-21 ((Jael and) Sisera); Acts 5:5-10 (Ananias and Saphira); I Chron. 13:7-10 (Uzza).

ONE in the play contest with Euripides, could have been due to apoplexy (or coronary insufficiency). Political leaders dying in the arms of their mistresses are modern parallels.

In this connection, the list of probable deaths from hypertension would include the Earl Godwin (Father of King Harold), King Charles II, Nell Gwyn (his mistress); the doctors William Harvey, Marcellus Malpighi, Carl Linnaeus, Oliver Goldsmith, Edward Jenner, Richard Bright, Dominick Corrigan, Louis Pasteur; Woodrow Wilson, Franklin Delano Roosevelt, and many other figures of renown.

Greco-Roman medical writings abound in treatises on the pulse, and description of plethora, apoplexy, paralyzes, paresis, hemiplegia, paraplegia, ascites, and anasarca.

Podaleirios, son of the future god, Asklepios of Thessaly, is credited with curing a fit (of unconsciousness) by bilateral venesection (ca. 1250 B.C.). By a similar feat he also won the hand of the daughter of King Dametos.

Herophilos (335-280 B.C.) of Chalcedon and Alexandria, where Ptolemaios I Soter allowed human autopsies, was a pupil of Praxagoras of Cos (340-320 B.C.) and wrote of the "pulse of the heart" and resulting sudden death. Unlike most of the later authorities, he knew that the arteries were much thicker than the veins and contained blood. His musical pulse notations anticipated those of Marquet (1747) and were supposedly timed by a clepsydra or water clock. The next we hear of pulse counting is by means of the *Pulsilogium* (1610) of S. Santorio (1561-1636) based on the pendulum of Galileo, and the *Pulse-Watch* of Sir John Floyer (1707). The *pulsus caprizans* (goat-leap) of Herophilos became the *pulsus gazellans* (gazelle-leap) of Avicenna.

The representative of the Cnidian School in Alexandria, *Erasistratos* of Chios (310-245 B.C.), also dissected freely, and studied paralysis, ascites, and dropsy, explaining them in terms of overflow of blood into the arteries, i.e., *plethora*. The writings of Herophilos and Erasistratos' *Book on Paralysis*, etc., are all lost, but the latter's doctrine of active arterial dilatation, attraction and propulsion of vital spirit stamped itself on later authorities from Galen to Thomas Linacre.