



ANATOMIES  
*of*  
PAIN

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## ANATOMIES OF PAIN

## PREFACE

THE value of a patient's clinical history in medicine is so well recognised as to need no apologia; and the more experienced the clinician the more does he value the information gained from knowledge of a patient's past. Such recognition, however, is nothing like so widespread with regard to the history of medical problems. There appears to exist a widespread conviction that, owing to the technical advances of the last century, nothing of value can have existed previously that can cast any useful or revealing light on our present problems. The result is that historical introductions rarely press further into the past than to a vaguely defined "Victorian era"; and often with imperfect comprehension even this far. A case in point occurs in a comprehensive current work on the subject of pain, which by attributing the discovery of the spino-thalamic tract to Spiller in 1905, ignores some fifty years of significant previous work on this subject. To ignore the time dimension of any problem is to risk misunderstanding it. Particularly is this so if, as with regard to Pain, it involves neglect of the keenest and most brilliant thinkers the world has known.

It is only of recent years that Pain itself has emerged as a problem in its own right. Yet it has received special attention as part of disease from the earliest dawn of civilisation. It is the purpose of this book to show how the changing ideas on the anatomical and physiological basis of Pain have flowed as a continuous process from the most ancient medicine until the present day. To attempt this is not to attempt a complete history of the subject, but only to trace the growth of anatomy and physiological concepts which lie, often unconsciously, at the roots of our present ideas. To achieve such an integration I have necessarily been selective of those writers whose works are for the most part well known, for their influence has been greatest. Though authorities have been omitted whose names rightly carry much honour in the history of medicine, I have included all those I have found who made significant contributions to the process of the evolution of the subject.

It is my own conviction that "right thinking" is an impersonal mode of mental activity in the Buddhist sense; and that thinkers like Aristotle or Leonardo da Vinci achieve exquisitely intimate interpretations of observed phenomena, outstripping humbler thinkers, whenever they

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are born. However, one of the clearest lessons to be learned from such a survey is that it is not enough to have the right ideas; if they are to be fruitful of results, they must be produced at the right time, when there is sufficient contextual background to support them. It was just this failure of the intellectual *milieu* of his day that gave Leonardo's right ideas such poor fruit, leaving him in so many fields merely the "anticipator" rather than the recognised "discoverer."

In this book there will be found a story of anticipations needing firmer ground to raise them to discoveries. Some have achieved such status already; others await it. Perhaps one of the the most topical of such anticipations is the concept of the sensorium commune, which, far from being an idea of our Victorian ancestors (as stated in a current medical journal), is traceable back to the most ancient thinkers on the nature of sensation, and now appears due for rebirth.

It is my hope that present-day workers on Pain will find in these Anatomies of Pain a useful background to the problem, and possibly some still fertile seeds from the past worthy of germination.

To avoid the manifest risk of errors inherent in paraphrasing views of ancient authorities, I have freely quoted from their works. This however does not obviate the erroneous significance which may be attached, for example, to Aristotle's often quoted description of pain as a "passion of the soul," which words cannot be intelligible without some background of Aristotelian physiology. I have therefore endeavoured to introduce each authority's views on pain with a sketch of his concept of the basis of sensation sufficient to render the quotations comprehensible.

It has been my endeavour to render these accounts as objective as possible in all chapters, with the exception of the last, in which I have allowed myself to express a more personal interpretation of the present anatomy of pain.

With regard to the sources from which the following account has been derived, the plan of the book has demanded reference to the original works as far as possible; indeed very little integration of the subject is to be found in the standard works on the History of Medicine.

I have obtained much valuable information from J. Soury's *Le Système Nerveux Central*, the merits of which still appear to be little appreciated.

To Dr. Charles Singer I owe thanks for his encouragement and his interest in the project, for reading the manuscript, his helpful discussion of various problems, and also his permission to reproduce Figures 4 and 5, and Plate V.

I would like to acknowledge the invaluable help I have received, at all stages of the work, from Dr. F. N. L. Poynter, Librarian of the Wellcome

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Historical Medical Library. I would also like to thank the Wellcome Historical Medical Library for assisting me in reproducing illustrations from the works of Reisch, Descartes, Willis, Charles Bell and Edinger, and especially for permission to publish Plate II from their copy of Harderwyck's "De Sensu." I am grateful to Miss Barbara Nicholson for drawing Figure 14.

The drawings of Leonardo da Vinci, Figure 2, Plates III and IV, are reproduced by gracious permission of H.M. the Queen.

To Professor K. J. Franklin I would like to convey my appreciation of his kind and practical help in bringing this work to publication. And finally I hope Mr. Per Saugman will allow me to express my appreciation of the courtesy and efficiency of Blackwell Scientific Publications Ltd.

K. D. KEELE

*June 1957*

To my Brother,  
C. A. K.



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## Chapter I

### THE SENSORY HEART

THE treatment of pain is one of the oldest of human needs. From earliest times this need has been met by both rational and superstitious means. The pain of minor ills and wounds, so apparently obvious in causation, lent itself to simple rational domestic methods, to extraction of foreign bodies, dressings, etc. But pain of internal disease presented a more difficult problem, only to be solved by applying the principles underlying the practice of magic or superstition.

One of the oldest of such principles, formed in the absence of knowledge of human anatomy and physiology, attributed disease to two main causes, either abnormal intrusion of objects or spirits into the body, or abnormal loss of vital substance from the body. Intrusion was thought to induce a disordered increase of consciousness with pain, deprivation a loss of consciousness, wasting and death. The word "dis-ease" is singularly apt for indicating the touchstone of consciousness or awareness as the essence of significant pathology. To the primitive mind one cannot be diseased without feeling it.

In this view pain was a manifestation of object intrusion only, not deprivation. The object might be a pebble, or a piece of wood, but especially a harmful thing like an arrow, a needle, or fire. This must be despatched by some agent and by some route. Sufficient power for this act is most often to be found in a man (alive or dead) or the gods. The route used influences the particular technique of bringing the intrusion object into contact with the victim; and that is the task of the sorcerer with his tools of office. A typical example, practised from most distant times, to the present in Melanesia, is described by Rivers.<sup>1</sup> In this, the medicine man uses a "ghost shooter" consisting of a hollow bamboo cane filled with the bones of a dead man. Armed with this loaded weapon the sorcerer stalks his quarry, his thumb carefully closing the open end of the bamboo cane. When the victim is sighted the cane is aimed at him, and the obstructing thumb removed, so that the evil may stream out into the body of the victim, carrying with it disease by spirit intrusion.

Object intrusion of this kind inflicts painful disease, for example headache, pleurisy and rheumatism. This magical etiology of lumbago is still

reflected in its old Welsh name of "Shot of the elf," or the similar German term *Hexenschuss* (Witch's shot). And the influence of this conception of pain production is inherent in the words of the prophet Job whose pain he himself attributed to the "arrows of the Almighty within me" (Job 6. 4). David the Psalmist detected both arrows and pressure as painful when he used the words, "O Lord rebuke me not in thy wrath; neither chasten me in thy hot displeasure. For thine arrows stick fast in me and thy hand presseth me sore" (Psalm 38).

Such examples show how arrows were appreciated as both real and symbolic causes of pain. The idea is elaborated in the use of a pointing stick with a hook on the end. This is projected into the victim's body by a spirit who tugs it from time to time by an attached string in order to produce particularly objectionable stabbing pains.

Spirits intrude into the body through many routes; the skin appears readily permeable both to ingress and egress of the intrusion objects, for the medicine man as part of his curative procedure commonly draws the object out from beneath the patient's skin, either by sucking or manual manipulation (see Plate I). A common mode of entrance is by the nostril with the inspired air, and in the case of Egyptian lore the left nostril had this sinister function. Particular parts of the body are affected according to the site of the spirit intrusion—stomach pain from stomach intrusion, and toothache from the worm in the tooth, etc.

Primitive human thought thus links pain closely with object intrusion. The power of the object to make effective contact is explained according to the spurious science of magic, by the principle of association, in what Frazer<sup>2</sup> terms the Law of Contact or Contagion, and the Law of Sympathy or Similarity. According to these laws the cause of painful disease is usually remote from the victim, often it is to be found in another man, either alive or dead, in the form of his spirit searching for a new body, or in a deity. This causal agent, by charm or spell, charges an object with spirit energy, and directs it into the victim's body, thus inflicting pain. Diagnosis for the medicine man consists of identifying the links in the chain, according to the laws of contagion and sympathy. Prophylaxis consists in supplying potential victims, i.e. healthy people with barriers through which object intrusion cannot take place, such as charms, spells, amulets, seven knotted cords, even mascots. Treatment consists of neutralising the chain of events either by placating the god, destroying the demon spirit, casting stronger protective spells, or by extracting the intruding object; intervention at any of these links will relieve the patient of his pain. The chosen mode of treatment depends upon the particular application of the laws of sympathy and contagion relevant to the patient's circumstances.

## THE SENSORY HEART

The most striking feature of this magical conception of the experience of pain is its divorce from physiological processes; only the last stage of a complex chain of events takes place in the patient's body. Details of the action of the intruding object on the body appear to be ignored as compared with remote factors such as an evil spirit or sorcerer. Since the body is assumed to be sensitive in all its parts, the anatomy of pain is projected almost entirely outside the body of the person who experiences it. It is largely therefore towards these extra-corporeal links in the chain that treatment is directed. Such projection indicates the importance of the powers of thought, of cerebral cortical function, in the mechanism of pain of magical origin. The effectiveness of treatment based on such ideas will depend on psychological rather than physiological factors. To this extent is it successful—so successful, indeed, that the therapeutic methods of suggestion and "shock" remain potent with us today, untouched by increasing comprehension of the physiological aspects of the problem of pain. "It is quite unnecessary to go to Australia or Central Africa to find the savage," wrote Dean Inge<sup>3</sup>; "he is our next-door neighbour. The mentality of the Stone Age exists on our platforms and in our pulpits. There is no superstition too absurd to find credence in modern England . . . fetishes and tabus dominate London drawing rooms." This statement is confirmed by contemporary examples of "paranormal healing" described by Dr. Louis Rose,<sup>4</sup> and I have myself recently encountered two men wearing hares' feet tied round their necks as amulets against disease, and that only 15 miles from Hyde Park Corner.

For the ancient Egyptians painful afflictions, other than wounds, were caused by magico-religious influences, by gods, or spirits of the dead, which might arrive in darkness "gliding in the nose backwards and the face turned" as described in the Berlin Papyrus.<sup>5</sup> The anthropomorphic nature of the spirits is very evident in this description, and the sinister significance of the left nostril or ear as portals of entry for evil extends through ancient Egyptian physiology. The types of the demons of Egypt were legion, but the spirits of the dead were most prominent amongst them, and "foreign women," "asiatics" or "negresses" were also popular. Of the gods, Sekhmet and Seth were the most active in inflicting pain, a power which Sekhmet as consort to Ptah possessed alongside that of healing. Even in the treatment of superficial wounds, cuts, snake bites or scorpion stings, magico-religious treatments were combined with rational therapy.

Some of the spells cast light on the anatomical knowledge that was slowly growing up in Egypt. A vehement short spell to rid the body of its spirit of pain, to be found in the Berlin Papyrus,<sup>6</sup> runs, "Get thee hence, thou female breaker of bones, thou crusher of stones who enters

into the vessels." This female "breaker of bones" recalls the symptoms of the painful "break-bone fever" of dengue, transmitted by the mosquito *Aedes aegypti*. It is noteworthy that this demon indulges in her painful activities "in the vessels." Here is reference to the blood vessels whose organisation into a vascular system centred on the heart the Egyptians definitely appreciated. From another spell we learn that the routes of departure of the intruding demon could be by the vomit, urine, "the sneeze of the nose" or the sweat of the limbs.<sup>7</sup>

A further source of Egyptian anatomical knowledge lay in their custom of identifying parts of the body with particular gods. According to Origen some thirty-six such parts were recognised each under the ægis of a god possessing powers of healing his own part. A remnant of this custom remains in our anatomical nomenclature of the "atlas" or the "mons veneris."

A smattering of anatomical knowledge, combined with crude physiology, emerges from the accounts in the Edwin Smith and Ebers Papyri. These contain two treatises on the heart and blood vessels<sup>8</sup>; one of which is named "The Physician's Secret; Knowledge of the Heart's Movement, and Knowledge of the Heart." In this the fact that vessels go from the heart to every limb is stated, "and by feeling the pulse you feel the heart which speaks out of the vessels of every limb." The vessels of the body are then enumerated, forty-six in all. This enumeration contains many points of interest, some relevant to the physiology of pain. No mention of the brain or its blood vessels is made, though it is stated that "there are four vessels in the interior of his temples which then give blood to his eyes; all diseases of the eye arise through them . . .".

The breath of life is described as entering the right ear, and the breath of death the left. "Humour and air" are carried by the vessels in the lungs, spleen and liver—diseases of the latter being due to "overfilling with blood"; and four vessels are described as opening at the anus—"it is they which cause humour and air to be produced for it." The importance of humour and air is apparent from these descriptions of the vessels; precursors of the Greek pneuma and humours would seem to lie in these Egyptian physiological entities. The "breath" of death recalls the intrusion of pain-producing demons into the vessels previously mentioned. Disease of the liver due to "overfilling" presents a hyperæmic basis for pain, to be developed thoroughly in later times.

In the second treatise the vessels and heart are again considered. In this account twenty-two vessels are enumerated: "they carry the air to his heart and also carry the air to all his limbs." Of the two vessels in the neck it is claimed that "if he is dim sighted . . . the vessels of the neck have

received the disease." There is again no mention of vessels to the brain.

In glosses made by the scribes who transcribed these passages from ancient Egyptian texts, further remarks are made wherein it is stated that the breath which enters the nose enters into the heart and lung "and these give to the whole belly." Here too it is noted that faintness is due to the heart "not speaking" since "the vessels of the heart are dumb, there being no perception of them under thy fingers; it arises through the air that fills them."<sup>9</sup>

From these two accounts it is evident that long before the writing of the two papyri, probably before 2,000 B.C., the Egyptians were aware of the heart as the central organ of a widely distributed network of "vessels" which they called "*metu*." That many of these "*metu*" were arteries is clear from the description of their pulsation; but such vessels are also described as carrying not only humours, heat and air, but fæces and the impulses of movement and sensation.

As Sigerist says, "it is futile to guess whether these vessels were arteries, veins or nerves, or anything else";<sup>10</sup> for they carried through the body its blood, air, semen, humours and nervous impulses, all of which were centred on the heart.

The elevation of the heart to pre-eminence among the organs coincides with the abasement of the brain so low as to fail to gain mention in either of the above-mentioned lists of the main *metu* of the body. The same values are reflected in that characteristic Egyptian procedure of embalming the first stage of which consisted of extraction of the brain. This was done by forcing a chisel up the left nostril, through the ethmoid bone into the cranial cavity; the brain was then swept out of the cranial cavity, its fragments being removed through the nose. Following this the cranial cavity was irrigated with a corrosive mixture until cleansed of all brain substance.

Such treatment contrasts sharply with that of the heart during the same process. Following an incision in the left flank all the abdominal viscera were removed; then an incision was made in the diaphragm through which the lungs were extracted, but the heart and aorta were always left behind. If by mistake the heart was cut loose, then it was left in the thorax and not removed, a fact emphasised by Elliot Smith and Warren Dawson.<sup>11</sup> And whereas the other viscera were wrapped up and placed in canopic jars, or in later times restored into the abdominal cavity, the brain was the only organ thrown away as waste.

The Egyptians regarded the heart and vessels as vital to an Egyptian, in much the same way as the Nile was to Egypt. Equally clearly the brain was not so considered, and no idea of a central nervous system enters into

their speculations. All those sensory and motor functions which we know to be an expression of activity of the central nervous system were allotted to the heart and its vessels. Thus painful diseases were often associated with the vessels to the heart; and local pain when not due to an obvious cause was considered to be felt by the vessels of the part affected.

Although no clear conception of a physiology of pain could emerge from such scanty speculations, there is, in this idea of the *metu* and their co-ordinating function, one of the earliest associations of sensation with physiological as opposed to purely psychological mechanisms. Only a glimmer as yet, it was to grow into a fully fledged physiological hypothesis of sensation which dominated the thinking of many Greek philosophers, and through Aristotle has penetrated the centuries down to our own era.

In the Mesopotamian civilisations the heart appears as the seat of intellect, and other viscera too acquire psychological functions, the liver becoming the centre of emotion, the stomach of cunning, the uterus of compassion, and the ears and eyes of attention. But no such function is allotted to the brain. So far no evidence has emerged that the Babylonians and Assyrians were aware of the Egyptian "vessels." In lists of names of parts of the body, probably made from religious motives, only the liver, on account of its importance in divination (hepatoscopy) received detailed attention. With them the prevailing etiology of disease and pain is that of sin against the gods from which "uncleanness" of the body is derived. In the absence of anatomy no "humoral" or "pneumatic" theory of disease is possible, and so in Babylo-Assyrian medicine one sees common sense and magico-religious treatment unhampered by physiological considerations. Object intrusion is the basis of painful disease. The worm as a cause of toothache, for example, evokes an interesting incantation describing this kind of pathology. "The worm came weeping unto Samas, came unto Ea, her tears flowing. 'What wilt thou give me for my food, what wilt thou give me to destroy?' 'I will give thee dried figs and apricots.' 'Forsooth, what are these dried figs to me, or apricots? Set me amid the teeth, and let me dwell in the gums, that I may destroy the blood of the teeth, and of the gums chew their marrow. So shall I hold the latch of the door.'"<sup>12</sup>

The crudeness of such magico-religious theories of disease should not be allowed to conceal the fine powers of observation displayed by both Egyptian and Babylo-Assyrian physicians and surgeons—observations so clearly described in some instances as to enable us now to make diagnoses impossible to them. For example, two patients described in the Edwin



Smith papyrus had sustained injury to the cervical vertebræ. Each is reported as being "unconscious of his two arms and his two legs." To us these symptoms strongly suggest a lesion of the cervical spinal cord, but the Egyptian surgeon ascribed the effects to a lesion of bone marrow. Similar Assyrian powers of observation are to be seen in that magnificent dying lioness displayed to everyday view in the British Museum. An arrow pierces her spine and her paralysed hind quarters bring to twentieth-century eyes a vivid picture of division of the spinal cord with paraplegia—but for the Babylonian this was sheer descriptive art deriving from pure observation and not to be confused with modern neurological interpretation.

In India the earliest traditions of medical knowledge are attributed to the god Indra. That accumulation of wisdom to be found in the Vedas and Upanishads cannot be dated. Buddha about 500 B.C. attributed the universality of pain in life to the frustration of desires founded on sense impressions. "Birth is attended with pain, decay is painful, disease is painful, death is painful. Union with the unpleasant is painful, painful is separation from the pleasant; and any craving that is unsatisfied, that too is painful. In brief, bodily conditions which spring from attachment are painful." "And the whole truth concerning the destruction of suffering; verily it is the destruction in which no passion remains of this very thirst; it is the laying aside of, the being free from, the dwelling no longer upon this thirst—it is the noble eightfold path . . ." so said Buddha in his famous sermon at Benares.<sup>13</sup>

Though recognising pain as a sensation, Buddha, and indeed Hindu thought in general, attaches far more significance to the emotional level of the experience.

The location of these painful feelings from the earliest Upanishads is in the heart. In the Chandogya Upanishad, for example, may be found a passage on emancipation which runs: "There is this city of Brahman, the body, and in it the palace, the small lotus of the heart, and in it that small spirit. Now what exists within that small spirit, that is to be sought for, that is to be understood, both heaven and earth are contained within it . . . in it all desires are contained. It is the Self free from sin, free from old age, from death and grief, from hunger and thirst, which desires nothing but what it ought to desire, and imagines nothing but what it ought to imagine."<sup>14</sup>

The heart as a palace within the city of the body, within which all joy and pain are experienced through its inner spirit, is a concept quite consistent with the views of the first of India's great teachers of medicine, Charaka, Court physician to Kanishka of Peshawar about A.D. 100. His