

## THE ATHENIAN PLAGUE: SMALLPOX

ROBERT J. LITTMAN AND M. L. LITTMAN, M.D.

*Brandeis University and State University of New York, Downstate Medical Center*

Greek medicine began in the fifth century B.C. under Hippocrates and the Hippocratic school.<sup>1</sup> Under this influence in his *Peloponnesian War* Thucydides wrote a description of a plague which attacked Athens

<sup>1</sup> The number of articles on the Athenian plague is prodigious. We have not attempted to read them all, but rather concentrated on Thucydides' description and modern medical knowledge of the various diseases, since the identification of the plague must depend on these. D. L. Page, "Thucydides' Description of the Plague," *CQ* n.s. 3 (1953) 97-119, presents a very important treatment of the medical language of the Athenian plague. He provides some excellent bibliography. A. Parry, "The Language of Thucydides' Description of the Plague," a talk given at the 1969 summer meeting of the Hellenic Society in London, questions the extent of the "technical" medical language of Thucydides. We are indebted to Professor Parry for providing us with a written version of this talk. Another source of bibliography is J. F. D. Shrewsbury, "The Plague of Athens," *Bull. Hist. Medicine* 24 (1950) 1-25.

The case for measles has been made most recently by Shrewsbury and Page; for epidemic typhus by W. P. MacArthur, "The Athenian Plague: A Medical Note," *CQ* n.s. 4 (1954) 171-74 (see Page's reply, "The Plague: A Lay Comment on a Medical Note," *CQ* n.s. 4 [1954] 174) and J. C. Snyder, "Epidemic Typhus and Brill-Zinsser Disease," *Proceedings of the Sixth International Congresses on Tropical Medicine and Malaria* 5 (1958) 603; for ergotism by P. Salway and W. Dell, "Plague at Athens," *Greece and Rome* 24 (1955) 62-70; for smallpox by H. Zinsser, *Rats, Lice and History* (Boston 1963) 119-127; for bubonic plague by E. W. Williams, "The Sickness at Athens," *Greece and Rome* 26 (1957) 98-103, and E. M. Hooker, "Buboes in Thucydides?" *JHS* 78 (1958) 78-83.

On the medical aspects of smallpox see T. F. Ricketts and J. B. Byles, *The Diagnosis of Smallpox* (London 1908); for the history of typhus see Zinsser; for typhus see R. P. Strong et al., *Typhus Fever with Particular Reference to the Serbian Epidemic* (Cambridge, Mass. 1920) and S. B. Wolbach et al., *The Etiology and Pathology of Typhus* (Cambridge, Mass. 1922); for ergotism G. Barger, *Ergot and Ergotism* (London 1931); for bubonic plague W. E. Jennings, *A Manual of Plague* (London 1903) and J. Cantlie, *Plague* (New York 1900). An excellent introduction to the medical aspects of the viral and rickettsial diseases is T. M. Rivers and F. L. Horsfall (eds.), *Viral and Rickettsial Infections of Man*<sup>3</sup> (Philadelphia 1959); further medical bibliography on typhus, smallpox, and measles can be found at the end of the chapters on these diseases. We are indebted to Professors Sterling Dow and John Finley and to Dr. John C. Snyder.

in the spring of 430 B.C. This plague was said to have originated in Ethiopia, to have spread through Egypt and Libya; it finally reached Piraeus and Athens, where it raged intermittently for three years. Thucydides (2.48) says that he will report the actual course of this disease and describe its symptoms, from the study of which a person should be able to recognize it should it break out again; he himself had the disease and saw others infected with it. Various scholars have identified the disease from Thucydides' description as either bubonic plague, pneumonic plague, typhus, typhoid, smallpox, ergotism, or measles, and others as well. Since Thucydides' account of the plague is the only one that we have, it is from this that the identification must be drawn. In order to accomplish this the precise meaning of Thucydides' words must be examined. This was done in large part by D. L. Page in 1953. The following is his translation of 2.49. We comment only where we differ from his interpretation or where expansion is required:

It was generally agreed that in respect of other ailments no season had ever been so healthy. Previous diseases all turned off into the plague; and the rest of the people were attacked without exciting cause, and without warning, in perfect health. It began with violent sensations of heat in the head, and redness and burning in the eyes; internally, the throat and tongue were blood-red from the start, emitting an abnormal and malodorous breath. These symptoms developed into sneezing and hoarseness, and before long the trouble descended into the chest, attended by violent coughing. Whenever it settled in the heart, it upset it, and evacuations of bile ensued, of every kind for which the doctors have a name; these also together with great distress. Most patients suffered an attack of empty retching, inducing violent convulsions, in some cases soon after the abatement of the previous symptoms, in others much later. The body was neither unduly hot externally to the touch, nor yellowish in color, but flushed and livid, with an efflorescence of small blisters and sores. Internally, the heat was so intense that the victims could not endure the laying-on of even the lightest wraps and linen; indeed nothing would suffice but they must go naked, and a plunge into cold water would give the greatest relief. Many who were left unattended actually did this, jumping into wells, so unquenchable was the thirst which possessed them; but it was all the same, whether they drank much or little. The victims were attacked throughout by inability to rest and by sleeplessness. Throughout the height of the disease the body would not waste away but

would hold out against the distress beyond all expectation. The majority succumbed to the internal heat before their strength was entirely exhausted, on the seventh or ninth day. Or else, if they survived, the plague would descend to the bowels, where severe lesions would form, together with an attack of uniformly fluid diarrhoea which in most cases ended in death through exhaustion. Thus the malady which first settled in the head passed through the whole body, starting at the top. And if the patient recovered from the worst effects, symptoms appeared in the form of a seizure of the extremities: the privy parts and the tips of the fingers and toes were attacked, and many survived with the loss of these, others with the loss of their eyes. Some rose from their beds with a total and immediate loss of memory, unable to recall their own names or to recognize their next of kin.

*φλύκταιναι*: As Page observes, this word means a blister like that caused by a burn. Since this word is essential in identifying the disease, we list occurrences in which its meaning is clear. Its usual meaning is (1) a raised blister like that caused by a fire or (2) a boil. Hippocrates, *VM* 16.35, in describing blisters caused by frostbite, *φλύκταιναι ἀνίστανται ὥσπερ τοῖς ἀπὸ πυρὸς κατακεκαυμένοις*; in reference to carbuncles, Hipp. *Epid.* 2.1.1, *φλυκταινίδες ὥσπερ πυρίκαυστοι ἐπανίσταντο*. In talking of blisters from fire, Theophrastus, *De igne* 39, uses the word *φλυκτίδες* and in 57 *κωλύει φλυκταίνας ἐπαίρεσθαι*. Lucian, *D. mort.* 20.4, says *ὁ τὰς φλυκταίνας ἐξηθηκώς, τίς ἐστιν; Ἐμπεδοκλῆς, ὃ Μένιππε, ἡμίεφθος ἀπὸ τῆς Αἴτνης παρών*. Nicander, *Ther.* 240, *ἐν πυρὶ φλύκταιναι ἀραιαί*. Hesychius defines *φλύκταινα* as *τὸ ἀπὸ πυρὸς φύσημα γενόμενον ἐν τῷ σώματι*. Eustathius says *φλύκταινα* means *τὸ ἀποκαύσεως ἐν σαρκὶ ἀνάστημα*. Aristophanes takes it as a blister caused by rubbing, *Frogs* 236–38, *ἐγὼ δὲ φλυκταίνας γ' ἔχω χῶ πρωκτὸς ἰδίει πάλαι κᾶτ' αὐτίκ' ἐγκύψας ἐρεῖ*. Galen (Kühn 13.357) uses it to refer to boils: *ἐπαναστάσας φλυκτίδας βελόναις δεῖ κεντεῖν. ἀπὸ τούτων γὰρ ὕγρὸν ἀπορρεῖ*; Aristotle, *HA* 604b, *ἐκρήγνυνται γὰρ αἱ φλύκταιναι*, of boils from the bite of a shrew mouse. *Exodus* 9.9 uses *φλυκτίδες* as boils. In describing empyema, Hipp. *Prog.* 17, *φλύκταιναι γίνονται ἀνὰ τὸ σῶμα*. Diocles, F 82 Wellman, *τῶν δὲ φλυκταινίδων . . . τὸ μὲν καλεῖται τέρμινθος . . . ταχὺ πνούμενα πάντα*. In reference to blisters on bread, Lucian, *D. mort.* 20.4 *ὥσπερ ἐγκρυφίας ἄρτος, ὁ τὰς φλυκταίνας ἐξηθηκώς*.

**ἔλκος**: this word means (1) wound; (2) festering wound, sore, ulcer. Galen (Kühn 10.232) defines it as *ἡ τῆς συνεχείας λύσις ἐν σαρκώδει μορίῳ*. A brief glance at Hippocrates *Ulc.* shows the variety of uses this word has: from a wound, to a burn, to ravages of erysipelas. As Page says, “ἔλκος is a term of general reference, most commonly signifying a lesion of the soft parts of the body (the context must decide whether ‘sore,’ ‘ulcer,’ ‘wound’ or what else is intended).” In Thucydides it clearly means sore or lesion.

**ἐλκωσις**: As Page (101) observes, this is a lesion, sore, or ulcer, generally on the soft parts of the body. Cf. Hipp. *Aph.* 3.21, 4.75, 4.81; *Alim.* 16; *Int.* 16; Xen. *Equit.* 5.1.

**ἀντίληψις**: Although Page rightly says that this word means a seizure by disease of parts of the body, his translation seems unclear (see translation below, under *στερισκόμενοι*).

**αὐτοῦ**: This refers to the disease and should be taken with *ἀντίληψις* rather than *ἀκρωτηρίων*. *ἀντίληψις* has generally been taken in conjunction with *στερισκόμενοι* to mean that gangrene attacked the extremities. However, blindness does not come from gangrene, which usually attacks only the hands and feet. The *ἀντίληψις* is clearly not gangrene, but rather the general attack of the disease on the extremities. (We would like this “attack” to refer to the usual concentration of the pustular smallpox rash on the extremities.) The phrase *καὶ πολλοὶ στερισκόμενοι . . . ὀφθαλμῶν* seems to be a parenthetical addition describing the results of the disease’s attack on the extremities.

**στερισκόμενοι**: Page translates this word as “lose,” taking the symptom to be gangrene. However, the medical parallels refer only to the eyes. Aeschylus *Agam.* 1530 has *φροντίδος στερηθείς*. We prefer to take *στερισκόμενοι* in the sense of “lose the use of.” *στερισκόμενοι* in fact may be simple paresis (which sometimes occurs in typhus—Strong 150) or stiffening of the extremities caused by the heavy concentration of the pustular rash of smallpox and subsequent swelling or from another cause. We are inclined to believe that while *ἀντίληψις* does not specifically refer to gangrene, *στερισκόμενοι* probably does. We translate *καὶ εἴ τις . . . ὀφθαλμῶν* as: “and if anyone recovered from the worst effects, the attack of the disease on the extremities was still a symptom: for it descended to the genitals,

the tips of the fingers and hands (and many survived with the loss of use of these, others with the loss of their eyesight).”

Besides the difficulties of the language of Thucydides' description, other problems are present in determining the nature of the disease. As a historian and a layman Thucydides emphasized symptoms that a modern medical writer would not. At times he stresses unimportant symptoms and slights important ones. For instance, his description of the rash is inadequate. He says nothing of its duration, its various stages, whether the *φλύκταιναι* and *ἔλκη* existed simultaneously or one developed into the other, or what was the process of healing of the rash. Thucydides emphasizes the fact that people threw themselves into wells out of great thirst; this has led to great controversy. Shrewsbury, followed by Page, goes to great lengths to parallel the Fiji islanders throwing themselves into water. MacArthur counters with an example of typhus sufferers doing the same. However, the symptom which Thucydides describes is great thirst. Throwing oneself into water may be a result of this thirst, but it is not a symptom of the disease. Since great thirst occurs in most of these diseases, arguments from this symptom are fruitless. Writers on the Athenian plague in general have paid too much attention to individual symptoms. A disease is characterized by over-all symptomatology. In isolation every symptom in Thucydides can be found in most febrile diseases. We must look at the normal course of each disease and then judge the importance of deviations from these norms.

There are a few individual symptoms which are *sine qua non* of a disease. The plague in Thucydides is contagious and confers immunity. Thus any non-contagious disease, or one that does not confer immunity, can be eliminated from consideration. Because of the similarities of infectious diseases and because of great variation in symptoms of the same disease, the physician uses differential symptoms to make his diagnosis and tends to search for key symptoms. On the other hand a layman would tend to assign equal importance to all symptoms described. In his attempt to provide a complete description Thucydides gives all symptoms equal importance.

As diseases adapt to new hosts under changing environments over the passage of years the symptomatology may change. This is

especially true of typhus and typhus-like fevers, but less so of smallpox.<sup>2</sup> Because of variations in resistance of the host, infectious fevers and diseases will not uniformly produce the same signs and symptoms in every outbreak. The major symptoms of a disease regularly appear, but the minor symptoms may or may not be present. Rarely does one individual exhibit every manifestation of a disease. In epidemics more than one form of the disease will appear simultaneously. Secondary infections such as pneumonia are common, and often become part of the complex of symptoms of the primary disease itself. In this article we re-examine Thucydides' description of the Athenian plague, attempt to place the symptoms in their proper perspective, and show that the case for the identification of the disease as smallpox is the strongest.

Bubonic plague, pneumonic plague, typhoid, and ergotism have been rejected as the Athenian plague, and the three main contenders are smallpox, typhus, and measles.<sup>3</sup> The identification of the disease

<sup>2</sup> See Zinsser 123. Rhazes' description of smallpox in the tenth century A.D. agrees with the modern accounts of the disease.

<sup>3</sup> Ergotism is a non-infectious toxemia caused by ingestion of fungus-infected rye or other grains. We shall not deal with ergotism because the arguments against it seem conclusive. (See J. H. Finley, *Thucydides* [Cambridge, Mass. 1942] 158-59 for a summary of literature and arguments. Finley bases part of his case on the fact that rye was not used by the Athenians. However, ergotism can be spread by other grains.) The greatest objection is that ergotism is not an infectious disease. Thucydides clearly considers the plague infectious (2.51.5, 58.2). The pattern of the spread of the disease, especially in that it attacks the port first, is that of an infectious disease, not of ergotism. A strong argument in addition is that ergotism is never accompanied by a vesicular rash of the body. Thucydides says that the rash covered the body. However, in ergotism there may be trophic disturbances which may be blistering, but these are usually only at the ends of the fingers and toes, due to vascular insufficiency produced by the ergot. Salway and Dell have not sufficiently answered these objections. Barger (42) also rejects ergotism as the cause of the Athenian plague. See Williams' arguments against ergotism (99-103).

Williams tries to revive the theory of bubonic plague as the disease, based on the sole fact that animals "contracted" the disease. He does not explain why Thucydides failed to mention the most characteristic feature of bubonic plague, the buboes, the swelling of glands in the groin and armpits. As Page (115) remarks, one has only to compare Procopius' description of the bubonic plague at Constantinople in 542 A.D. to see the differences between his and Thucydides' account, even though Procopius used as much of Thucydides' language as possible. It is inconceivable that Procopius would describe these swellings, while Thucydides, whose account is otherwise very detailed, would omit this important and obvious symptom. E. M. Hooker proposes to identify the *ἐλαγχ* in Thucydides with buboes. Her analysis is not convincing. She

as smallpox was favored in the last half of the 19th century and the first part of the 20th, though there was much controversy. In 1950 Shrewsbury suggested measles; this diagnosis was reaffirmed by Page in 1953. Page's work is very significant in that he deals with the precise meaning of the medical terms in Thucydides' description. In

assumes that Williams is right in his suggestion that Hippocrates' description in *Epid.* 2.2-15 is of bubonic plague and then argues that ἔλκος there refers to buboes. Williams, however, only makes a suggestion and does not argue the case. (MacArthur is convinced that Hippocrates' epidemic is typhus.) Hooker assumes Galen's plague is bubonic plague (she mistakenly says that the general opinion favors bubonic plague for Galen's epidemic; on the contrary smallpox is favored). She wants to identify the ἐξανθήματα μελάνα in Galen with the φλυκταίναις μελαίναις in Procopius. Galen refers to the rash (which covers the whole body) as becoming hemorrhagic. Procopius talks of two things, the buboes and the black blisters (plague boils, see Jennings 87) covering the body. The basic reason that ἔλκος in Thucydides does not mean buboes (aside from its general meaning) is that Thucydides is describing a rash which covers the body. Buboes do not cover the whole body, but are localized swellings in the armpits, groin, and near the ears. The general meaning of ἔλκος in Hippocrates is one of sore or ulcerated spot, which is also its meaning in Thucydides. Hooker tries to avoid accepting this general meaning by confining her discussion to the term as used in epidemics. However, she can find this term used in describing epidemics only in Hippocrates' account of erysipelas. Her late parallels, such as *Exodus* 8.1-11, do not help establish what ἔλκος means in Thucydides (the meaning of this word in most of these parallels is unclear). Since ἔλκος does have such a wide variety of meanings from wound to ulcer in the fifth century, the only instance where the word is clearly equated with buboes (Rufus, *ap. Orib.* 44.18, who was writing in the time of Hadrian, 600 years later) has no bearing on its specific meaning in Thucydides. If Thucydides were using ἔλκος outside of the normal general meaning of sore or ulcer, we would expect him to define it more specifically.

Williams maintains that, since bubonic plague attacks animals, this is the disease in Thucydides. However, Thucydides does not say that the disease infected animals, but only that birds and four-footed carrion avoided the corpses or died if they fed on them. Thucydides (2.50) makes this conclusion from the observation that carrion birds became scarce. However, this is no indication that the birds had contracted the disease or died. He also says dogs gave a better opportunity to observe what happened because they lived with man, but he failed to expand this point. Does he mean that the dogs avoided the bodies, or that they died after eating corpses (but dogs are not carrion)? We infer that Thucydides meant that dogs also avoided the corpses. Wild rodents and rats are generally the most susceptible to bubonic plague. According to K. F. Meyer in R. J. Dubos (ed.) *Bacterial and Mycotic Infections of Man* (Philadelphia 1952) 462, "Among the domestic animals dogs are usually refractory [to bubonic plague]; cats moderately susceptible. It has been claimed that sheep and camels may be infected. Birds are not susceptible." See also Cantlie 14. In the case of smallpox, monkeys are known to contract the disease, while other animals are only slightly susceptible, as is the case with typhus and measles. Because of lack of detail in Thucydides' account it is impossible to make definite conclusions. There are many other symptoms of the bubonic plague incompatible with Thucydides' description.

1954 MacArthur argued for typhus. The present consensus inclines toward typhus. Page's work upset the assumptions made by previous writers. For instance, Shrewsbury chose not to discuss the exanthem because he maintained that it was not known exactly what Thucydides had meant. He then rejected the conclusions of those who determined the nature of the plague by the description of the rash. It is now recognized that the meaning of Thucydides' words can be precisely determined.

The differential diagnosis for many exanthematous diseases (where a skin eruption occurs) is the rash. Dr. J. C. Snyder states (*italics ours*),

*Before the appearance of the characteristic rash, and on clinical grounds alone, it is impossible to assert with accuracy that a patient is suffering from typhus. The clinical picture of the early stages of several acute infectious diseases closely resembles that of epidemic typhus. Those which are likely to be confused with it are murine typhus, smallpox, relapsing fever, malaria, typhoid fever, meningococcic meningitis, measles and yellow fever. The appearance and the evolution of the typhus rash serve to distinguish it from eruptions which are features of certain other acute infectious diseases.*<sup>4</sup>

Dr. Snyder told us in conversation of his experience with typhus and smallpox while he was a young physician in Cairo. Simultaneous outbreaks of the two diseases occurred, and it was often impossible to distinguish between the two in their early stages.

Since the fully developed rashes of smallpox, typhus, and measles are characteristic and enable differentiation, Thucydides' description of the rash becomes the key to the identification of the Athenian plague. Thucydides describes the body as flushed and livid with an efflorescence of small blisters and sores (*φλυκταίναις μικρῶις καὶ ἔλκεσιν*). This agrees closely with the smallpox eruption, which begins with a single crop of skin lesions, and progresses synchronously through a macular, papular, vesicular, and pustular stage (see Figs. 1 and 2). In contradistinction, the typhus rash (macular or maculopapular) appears as slightly raised rose spots which blanch on pressure, become permanent and later purpuric, but never vesicular (see Fig. 3). The measles rash (macular or maculopapular) is a blotchy erythema which becomes

<sup>4</sup> In Rivers and Horsfall 811.





FIGURE 1. The Petra spring, commonly identified with Telphusa.



FIGURE 2. The Hagios Nikolaos spring (1969).



FIGURE 3. The rock Petra.



FIGURE 4. Chapel and crag of Hagios Nikolaos in middle distance just below the rocky peak; Tilphusaion pass to left.



FIGURE 5. Village of Ypsilanti in middle distance, left; above, at center of picture, convent and crag of Hagios Nikolaos; Mt. Tilphusion in background.



FIGURE 6. The crag above the Hagios Nikolaos spring from north; wall of chapel enclosure at lower left.

CHARACTERISTIC RASHES OF SMALLPOX, TYPHUS, AND MEASLES



FIGURE 1. Smallpox  
(From Ricketts and Byles p. 20)

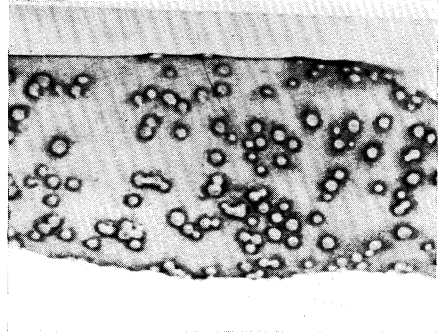


FIGURE 2. Smallpox  
(From Ricketts and Byles p. 32)

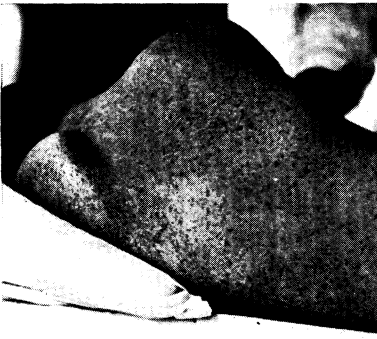


FIGURE 3. Typhus  
(From Wolbach p. 20; courtesy of  
Harvard University Press)



FIGURE 4. Measles  
(From Ricketts and Byles p. 116)

slightly elevated, tends to coalesce, may develop a hemorrhagic non-blanching component, and also never becomes vesiculated<sup>5</sup> (see Fig. 4). Thus Thucydides' description of the skin eruption fits only smallpox. The measles and typhus rashes cannot be described as blisters and sores.<sup>6</sup> It is interesting to note that in the tenth century A.D. the Persian Rhazes distinguished smallpox and measles by their different skin rashes. He observed that the smallpox papules were round and prominent, while the measles papules were nearly level with the surface of the skin.<sup>7</sup>

Another distinguishing feature of exanthematous diseases is the distribution of their rashes. Smallpox is a "centrifugal disease," in that the eruption most severely attacks the extremities, i.e. the head, hands, feet, and genitalia. The typhus rash begins in the armpits and does not attack the limbs, though there can be gangrene of the extremities. Measles rash first appears on the neck, then chest, back and abdomen and face, but not to any large degree on the extremities. In summarizing the course of the disease, Thucydides says that it begins in the head and passes down through the body; and that a sign

<sup>5</sup> Some cases of acute pemphigus in which bullous eruptions occur have been described mistakenly as measles.

<sup>6</sup> MacArthur (174) refers to blisters occurring in some summer outbreaks of typhus. If this is true it is most unusual. In all our reading we have never found the typhus rash associated with blisters. Ricketts and Byles (109) report that typhus is sometimes confused with hemorrhagic smallpox when hemorrhages appear in the skin in the pre-pustular stage. These outbreaks to which MacArthur refers may not have been typhus at all. In order to support his case MacArthur uses similarities of Thucydides' plague to the plague known as the "Black Assize" which broke out in Oxford in 1577. MacArthur without comment assumes that the "Black Assize" was typhus, when there is considerable doubt and controversy about the disease (see Shrewsbury 22). Without MacArthur's references it is impossible to refute him further.

<sup>7</sup> In the first printing of his history of typhus in 1934, Zinsser (123) noted that Thucydides' description of the rash as being raised and vesiculated was clearly not that of typhus. Unfortunately this observation was not given its full value. Zinsser believed on the basis of this that the Athenian plague was most likely smallpox. For Rhazes see *A treatise on the smallpox and measles by Abu Becr Mohammed ibn Zacariya ar Razi (commonly called Rhazes)*, trans. W. A. Greenhill (London 1848). In his description of the plague of 153-168 A.D. in Rome, Galen (*Methodus medendi* 5.12) described the rash as *ἐλακσιν* covering the whole body, in language similar to Thucydides. Galen's excellent description of the exanthem as vesicular and pustular makes the identification of smallpox likely. Galen also makes no mention of scarring. Rhazes felt that Galen's plague was smallpox and modern writers tend to concur with this (Zinsser 135-37). We hope to discuss Galen's plague in a future article.

of the disease was its attack on the extremities, for it descended to the genitals and fingers and toes, and many survived with the loss of use of these, and others the loss of their eyesight. Thucydides may be referring to the spread of the rash. But in any event, smallpox particularly attacks the extremities. Blindness is frequent in smallpox.<sup>8</sup> On the other hand, it is very rare in typhus and measles.

The only symptom described by Thucydides which is not usually characteristic of smallpox is loss of memory (see Appendix). Thucydides says that loss of memory was present in some instances when the patient rose from his bed. There is insufficient information about this symptom, whether it was total or partial amnesia, or if the condition was permanent, or if not, its duration. In the light of this, arguments from this symptom are inconclusive. Encephalitis is a complication of smallpox and can produce mental symptoms such as loss of memory. In some cases of smallpox the mind may become clouded toward the end of the disease (Ricketts and Byles 87). Either of these explanations may account for the symptom in Thucydides. Thucydides also says that many survived with the loss of use of their fingers and toes. This is probably gangrene. It is not a usual complication of smallpox, but is seen fairly often. W. Osler says, "Among the most constant and troublesome complications [of smallpox] are those involving the *skin*. . . . Local gangrene in various parts may occur."<sup>9</sup> If *στερισκόμενοι* means only loss of use, the symptom can be explained by stiffening of the fingers and toes caused by complications involving the skin, swelling, and secondary infection. At any rate, loss of memory and gangrene do occur in smallpox. In view of the lack of detail on these symptoms in Thucydides, the identification as smallpox is not impaired.<sup>10</sup>

<sup>8</sup> Smallpox is the commonest cause of blindness in India: K. Sen, *Indian Med. Gaz.* 80 (1945) 181.

<sup>9</sup> W. Osler, *The Principles and Practice of Medicine*, ed. H. A. Christian (14th ed., New York 1942) 323. See also J. E. Smadel in P. B. Beeson and W. McDermott (eds.), *Textbook of Medicine* (Philadelphia 1963) 44.

<sup>10</sup> D. L. Page raised three objections to smallpox besides the absence of pock marks. They are the absence of both physical prostration and delirium at an early stage, and lack of mention of pains in the loins and back. Thucydides' account is in no way inconsistent with early prostration. Although there may be prostration at an early stage in smallpox, the patient can still be fit, though disinclined to physical exertion. The degree of prostration depends on the severity of the fever (Ricketts and Byles

The factor that has most prevented the identification of smallpox is the absence of the pock marks in Thucydides' description. (In his attempt to prove that the Athenian plague was smallpox, von Hagen went so far as to examine a portrait bust of Thucydides for scars.<sup>11</sup>) In order for smallpox to be considered, we must explain the omission of scarring from Thucydides' text.

The pock marks, usually appearing on the face, are an indelible sign of smallpox. If the disease were smallpox, Thucydides himself must have borne the scars of it. The explanation for the lack of pock marks lies in Thucydides' relation to the Hippocratic school of writing. C. N. Cochrane<sup>12</sup> has demonstrated that Thucydides' principles of historical writing are very similar to the doctrines of the Hippocratic school.<sup>13</sup> Cochrane (p. 27) notes that Thucydides follows the Hippocratic procedure in his account of the plague: a general introduction 2.47-48; then a description of symptoms to the crisis. The most striking feature of Hippocratic theory is the concept of crisis in a disease. Most important to the Hippocratic school was the prognosis, that is to understand in advance the course of symptoms. It was believed that only through prognosis could a physician know when the crisis would occur and thus what daily relief could be given to the patient to strengthen his resistance. Cochrane demonstrates that the canons for prognosis of the Athenian plague are the same which Thucydides uses in his *History*, to enable men to recognize recurring

59-60). Contrary to what Page says, delirium generally occurs in the *later* stages of smallpox (Ricketts and Byles 39, 59-60, 87). In regard to pains in the loins and back, Ricketts and Byles say (59), "From a good many patients the existence of pain in the back is elicited only by inquiry. Others complain of pain not so much in the back as in the limbs, or 'all over'." Pains in the loins and back occur in many febrile diseases, and backache is very common in typhus and measles. Severe backache is most common in hemorrhagic smallpox, while it is less severe in other forms of the disease. Most important, these objections become meaningless because it is often impossible to distinguish exanthematous diseases before their characteristic rashes develop. Page's objection that gangrene does not occur in smallpox has been discussed.

<sup>11</sup> B. von Hagen, "Die sogenannte Pest des Thuk.," *Gymnasium* 49 (1938) 120 ff., examined the Naples bust of Thucydides for pock marks (we know this article only from Page's account of it).

<sup>12</sup> C. N. Cochrane, *Thucydides and the Science of History* (London 1929).

<sup>13</sup> A. Parry (see above, note 1), on the other hand, feels that the "technical" nature of Thucydides' language has been greatly over-emphasized. He also questions Cochrane's parallels between Hippocrates' *Epidemics* and Thucydides' plague.

phenomena in order to deal with them. In 1.22 Thucydides announces the prognostic purpose of his *History*, saying that it will be sufficient for him that those who will want to know clearly what has happened and what will someday probably happen again in the same or similar way, judge his work useful. In 2.48 Thucydides says that he will describe the actual course of the disease, explaining its symptoms from the study of which a person, having knowledge of the disease beforehand, would not fail to recognize it should it ever break out again.

Thus it is clear that Thucydides is primarily interested in the prognosis and only secondarily in the diagnosis of the disease. The pock marks are not a symptom of the disease, but rather a result of it, and do not appear until many weeks after the disease has run its course. Given Thucydides' method and purpose and his frequent omission of details that do not fit in his focus, such as the absence in the *History* of Aspasia, Pericles' mistress, the lack of reference to the pock marks is understandable. There are modern near parallels: in the account of smallpox in Van Rooyen's *Virus Diseases of Man*<sup>14</sup> there is no mention at all of the characteristic pock marks. In the description of smallpox by Ricketts and Byles only one paragraph in the entire book deals with the pock marks.

The attempt at identification of the Athenian plague as epidemic typhus encounters certain objections. Most important, the rash of typhus is very characteristic as to its appearance and location, and never becomes vesiculated, as does the rash in Thucydides. Although typhus begins abruptly and causes headache and marked prostration, the duration of the disease tends to be longer than that in Thucydides' description. The fever in typhus usually does not exceed 103–104° and then remains continuously elevated for 10–14 days. During the second week of this disease the patient tends to be stuporous or to have active delirium followed by profound stupor. This may progress to coma. In Thucydides patients were sleepless and unable to rest. There are other minor inconsistencies which are summarized in the Appendix: particularly blindness seldom occurs in typhus; neither are vomiting, toxic diarrhea, and intestinal lesions a usual part of the syndrome.

<sup>14</sup> C. E. van Rooyen and A. J. Rhodes, *Virus Diseases of Man* (New York 1948) 286–98.

The identification of the Athenian plague as measles also encounters a number of objections. Although adults can contract the disease, it usually attacks children. The disease does not have a very abrupt onset, as do typhus and smallpox. The rash of measles never becomes vesiculated, nor pustular, which alone differentiates it from Thucydides' description. Toxic diarrhea is rare and the breath is not fetid. Despite the effect of measles on virgin populations, as in the Fiji epidemic of 1875, measles is basically a mild disease, while smallpox and typhus are very severe. This was recognized as early as the 10th century by Rhazes.

Thucydides' description of the Athenian plague is compatible with smallpox in its sudden onset, duration, severe toxemia, and constitutional symptoms. Most important, the appearance of a vesicular rash and pustules makes the case very strong. The omission of the characteristic pock marks is explained by Thucydides' relation to the Hippocratic school.<sup>15</sup>

<sup>15</sup> It is interesting to note that smallpox has always been endemic to Africa, where Thucydides says the Athenian plague originated.

A version of this paper was presented at the 1969 American Philological Association convention in San Francisco.



## APPENDIX

Described in Thucydides	Occurs in Smallpox <sup>2</sup>	Typhus	Measles
MAJOR SIGNS AND SYMPTOMS <sup>1</sup>			
Contagious (started at port, spread to city, attacked densely populated areas)	YES	YES (spread by lice— not incompat- ible with Thuc.)	YES
Immunity to second attack	YES	YES	YES
Abrupt onset	YES	YES	YES
High fever (headache)	YES	YES	YES
Prostration	YES	YES	YES
Vomiting	YES	RARE	YES
Thirst	YES	YES	YES
Attacks head first, spreads through body—attacks extremities	YES	Rash rarely on face, first in axilla	Rash first on neck, then chest, back, abdomen—does not usually attack fingers and toes
Vesicular eruptions, blisters	YES	Raised rose spots, never vesiculated	Red spots, never vesiculated
Crisis 7–9 day	YES	YES	YES
MINOR SYMPTOMS			
Fetid breath	YES	YES	NO
Conjunctivitis	YES	YES	YES
Inflammation of mouth	YES	YES	YES
Toxic diarrhea	YES	Not usually toxic, constipation more common	Not usually toxic
Intestinal lesions	YES	RARE	RARE
Cough, bronchitis	YES	YES	YES
Blindness	YES	RARE	RARE
Convulsions	YES	YES	RARE except in children
Retching	YES	NO	YES
Intolerant of clothes	YES	YES	YES
Body lividity	YES in hemor- rhagic type; purpuric and confluent	YES	YES in hemorrhagic or confluent

Described in Thucydides	Occurs in Smallpox <sup>2</sup>	Typhus	Measles
Threw themselves in water	YES: Ricketts and Byles (60) report case of man nearly throwing him- self into the Thames from Tower bridge	YES if the Black Assize of Ox- ford is typhus	YES
Sleeplessness	YES	Not characteristic. Consciousness dulled—stupor and coma	Not characteristic of measles
Attacks genitalia	YES	YES	YES
Loss of memory (complication in some cases)	RARE except when encephalitis occurs	RARE except when encephalitis occurs	RARE
Loss of use of fingers and toes (gangrene)	Not characteristic but occasionally	YES	RARE

<sup>1</sup> The absence or presence of individual symptoms varies in importance; all this chart does is to provide a rapid survey of the differences in the diseases.

<sup>2</sup> Smallpox occurs in several forms, each with slightly different symptoms. Outbreaks of the disease usually exhibit all the forms. These are discrete, confluent, hemorrhagic (toxic), and purpuric. A good illustration of how they occur is the Minneapolis outbreak of 1924-25. S. E. Sweitzer and K. Ikeda, "Variola; a clinical study of the Minneapolis epidemic of 1924-1925," *Arch. Dermat. Syph.* 15 (1927) 19-29, report 581 cases of which death occurred in 246; the breakdown was as follows: 10 unclassified, no deaths; 225 discrete type, 14 deaths; 151 confluent type, 68 deaths; 144 hemorrhagic, 113 deaths; 51 purpuric, 51 deaths. The symptoms in the chart occur in all varieties to some degree.