The Healing Hand

MAN AND WOUND IN THE ANCIENT WORLD

GUIDO MAJNO

Guido Majno

The Healing Hand

Man and Wound in the Ancient World

Library of Congress Catalog Card Number 74-80730
ISBN 0-674-38330-3
Printed in the United States of America

To my generous wife
who for ten years
never quite knew
whether I was there
or somewhere
around 400 B.C.

schistosomiasis, but nobody really knows. Wounds, instead, are always wounds: they speak right out of the page. The problems of the patients, as of those who attend them, are obvious.

And then, long before the birth of anything that could be called experimental medicine, wounds also functioned as natural experiments, multiplied millions of times. They were treated with dressings, and in the long run the better dressings stood out. In this permanent battle between man and bacteria, it is thrilling to watch the birth of the first antiseptics, coupled with the history of wine, copper, honey, myrrh, and many other plant drugs and resins. In this sense, the wound was the first medical laboratory.

Besides infection, wounds have raised a series of problems, biological as well as human. Why do they bleed? Is there anything good about the bleeding? Does it have anything to do with pus, and how can one stop it? Can wounds be used as windows, to study live organs inside? What is the flesh made of? And for the historian, if a patient in any given place and time sought help from a physician, what were his chances of actually being helped? What did the physician do, why did he do it, and could it possibly work?

Because I am primarily interested in sick people, I have paid a great deal of attention to this last problem: trying to find out whether the patients were made better, or worse, by the treatment. In this respect, the medical writer can help the lay reader as well as the classical scholar, for the answers are usually buried in obscure drug names and cryptic medical explanations.

I have tried to find answers within the perspective of the time. This could not be done without a broad historical framework. The syringe, for instance, was invented in Alexandria, and its first medical use seems to have been on wounds. But to understand why this happened just in Alexandria required an excursion beyond the field of medicine.

My "patients," those whom you will meet in these pages, come from all parts of the ancient world, including China. In a recent treatise on the history of medicine, China was not even mentioned—silence was preferred to misinformation. But today, Joseph Needham's *Science and Civilisation in China* provides that guide to Chinese literature which had earlier been missing. So, with the courage of the amateur, I have dealt also with China.

This is my first experience with history, and I found it, from the point of view of the scientist, thoroughly exciting, yet often frustrating. Scientists like to run experiments and modify nature. Here all the experiments had been done, the records had not been well kept, and practically all the authors had died. To make up for the uncertainties, I chose some problems that could be tested in the laboratory and actually attempted some "experimental history," mainly with antibacterial drugs. These were most rewarding efforts.

I must also mention here a happy coincidence. As the last chapters were being completed, we happened to discover in our laboratory one of the basic mechanisms in healing a wound: the mechanism that draws one lip of the wound toward the other and closes the gap. I hope it is a good omen.

A history of the wound is necessarily born of untold human suffering. May this book be a drop in the sea of human understanding.

Acknowledgments

This book is the gift of hundreds of people. During the past eight years I have knocked at so many doors, and sent out so many calls for help, that I could not possibly acknowledge all my debts. The following list includes my major benefactors; others will be mentioned in the text and notes; to all, including my friends, colleagues, correspondents not mentioned here by name, I wish to express my perennial gratitude.

Financial support. It was Dr. George P. Berry, former Dean of Harvard Medical School, who made me realize that I would never succeed without substantial bibliographic help. This was made possible through a generous grant from the Commonwealth Fund of New York; my former chief, Dr. Arthur T. Hertig, Dean Berry, and Dean Robert H. Ebert, assisted me in obtaining it. When this grant ran out, the Société Académique de Genève came to my rescue. The experimental work was supported incidentally by research grants that I held while at Harvard Medical School (mainly from the National Institutes of Health) and in Switzerland (from the Fonds National Suisse pour la Recherche Scientifique and from Zyma S. A., Nyon); the Honey Industry Council of America, and Hood and Sons, Inc., Boston, supported specific projects.

Bibliographic assistants. Mrs. Ann M. Barry was the pioneer, courageous enough to get me under way when the book was merely a gleam in the eye. Mrs. Marie-Louise Bowditch was a jewel of insight and competence. Mrs. Martine Reed helped me wade through Chinese literature; Mrs. Pamela

Seldon, Miss Mary Perry, and Mr. Bert Collins carried the torch at various times. In Geneva, the intricacies of bibliographic work were handled with infinite care and precision by Miss Jeannine Merlo, whose finds figure in most of the following pages. Mrs. Meredith Frapier was my invaluable aide in Paris, always ready to tackle the most difficult subjects with the thoroughness and devotion of a true collaborator. After having shared so much research, anguish, and satisfaction, it seems absurd to acknowledge my debt in just a few words.

Libraries. The staff of the Francis A. Countway Library of Harvard Medical School, particularly Mr. Richard Wolfe and Miss C. L. Binderup, turned into pleasure for me what could have been a nerve-racking experience, extending their help even across the ocean. In Paris, I am greatly indebted to the Bibliothèque de la Faculté de Médecine (especially to Miss Germaine Le Noir and Mrs. Germaine Verhague); and in Geneva, to the Bibliothèque Publique et Universitaire (especially to Mr. Marc-A. Borgeaud).

Artists. Of the nearly four hundred pictures in this book, one hundred were drawn especially for it by the following artists—all of whom were delightful collaborators:

Mr. Joshua B. Clark, Framingham, Massachusetts: Plates 3.8, 4.1, 4.2; Figures 1.2, 1.6, 4.17, 4.26, 4.35, 4.36, 6.1, 6.4, 9.15, 9.33, 9.44, and all the chapter symbols.

Mr. Pierre Duvernay, Geneva, Switzerland: Plate 4.3; Figures 1.3, 1.17, 1.19, 2.3, 2.5, 2.8, 2.9, 2.13, 2.14, 2.17, 2.21, 2.24, 2.25, 2.27, 2.28, 3.1, 3.3, 3.11, 4.1, 4.3, 4.12, 5.4, 6.16, 7.2, 7.7, 7.8, 7.12, 7.13, 7.17, 7.21, 7.22, 7.23, 7.25, 7.28, 8.21, 9.12, 9.31, 9.32, 9.39, 10.6, 10.7, 10.13, 10.20.

Mr. Gilbert Sesenna, Geneva, Switzerland: Figures 1.5, 3.24, 4.8, 4.13, 4.14, 4.16, 4.23, 4.34, 5.12, 8.1, 8.15, 8.16, 8.17, 8.18, 8.19, 8.20, 9.6, 9.34.

Mr. Michel Czech and Mr. André Ruffieux, Geneva, Switzerland: Figures 2.1, 3.9, 3.16, 3.29, 4.33, 5.2, 6.4, 6.7, 6.20, 9.28, 9.34, 9.36, 10.18.

Mr. Axel Ernst, Geneva, Switzerland: Figures 4.15, 7.27, 8.9, 10.5.

Miss Judith D. Love of the Rhode Island School of Design: Figure 10.15.

Mr. Charles Ryser and his staff, Geneva, Switzerland: Figures 3.27, 3.28, 4.37, 6.5. The ability of Mr. Michel Czech in retouching photographs was always a pleasure to behold.

Secretaries. The trying business of typing and retyping corrected versions of the same text was gallantly faced by several young ladies, who were also generous with advice (and not only in matters of English). In chronological order, I wish to thank Mrs. Henrietta Bins, Miss Mary Viveiros, Mrs. Del Ryan, Mrs. Annemarie Lardelli, and Mrs. Karen E. Melia. To Miss Lise Piguet, who carried for five years the major responsibility of this enterprise—all the correspondence in four languages (usually not in her own), almost all the typing, some of the literature, the filing of some five thousand photographs, all the administration, and the endless series of loose ends that at times seemed to form a hopeless forest—I will never be able to repay my debt; her criticisms, penciled in the margin of the drafts, invariably led to an improve-

ment in the manuscript. Her sure sense of aesthetics is reflected in many of the illustrations. And how could I thank her for keeping her smile, even when work was not yet finished on Sunday afternoon?

Laboratory experiments. Mrs. Jean Thurston planned and carried out a number of experiments on the effect of honey-salve on wounds; Mrs. Elisabeth Bouchardy was responsible for similar experiments on the effect of the *barbarum* ointment of Celsus; to both, and to Miss Geneviève Leyvraz, I am also indebted for beautiful histological slides. Experiments on the bactericidal power of wine and ancient drugs were carried out in Geneva by Dr. Daniel Kekessy, and more extensively by Dr. Elisabeth Schorer and Mrs. Sylvie Dersi. The experiments on the bactericidal power of the honey-butter salve were carried out by Dr. H. L. Wildasin of H. P. Hood & Sons, Boston, and his collaborators. For several other projects of "experimental history" I enjoyed the help of Dr. Isabelle Joris, whose work is always flawless as well as aesthetic.

Photographers. Almost all the pictures in this book were taken, modified, or rephotographed by Jean-Claude Rumbeli, photographer of the Institute of Pathology of Geneva. Mr. Rumbeli rose to many a challenge and improved many a subject. I never resented the comment of a colleague—that my book was a series of legends to Rumbeli's photographs. The remaining pictures were taken at Harvard Medical School by Mr. Eduardo Garriga, in Geneva by Mr. Etienne Denkinger, and in Worcester by Mr. Peter W. Healey.

Help on specific chapters. Ch. 1 (Prehistory) was read and criticized by Prof. A. Leroi-Gourhan of the Collège de France, and by Dr. J. Dastugue of the Faculté de Médecine of Caen (France). To both go my warmest thanks, also for their patience with views that could not be their own. For advice in matters of ancient bones I am much indebted to Dr. Ronald Singer of the University of Chicago, Mr. Gilbert Stucker of the American Museum of Natural History in New York, and Dr. Léon Pales of the Musée de l'Homme in Paris.

Ch. 2 (Mesopotamia) would never have been without the help of the late Prof. René Labat and Pablo Herrero of the Collège de France, who also read and corrected the manuscript. I often resorted to the generous advice of Mrs. Françoise Brüschweiler of Geneva and Dr. Miguel Civil of the Oriental Institute, Chicago.

Ch. 3 (Egypt) was read and criticized by Prof. Charles Maystre, Head of the Department of Egyptology of the University of Geneva. For the interpretation of *wḫdw* I enjoyed the advice of Dr. Robert O. Steuer in Paris, and for topics of Egyptian technology I was greatly helped by correspondence with Dr. John R. Harris of the Institute of Egyptology, Copenhagen.

Ch. 4 (Greece) was read by my friend Prof. Jean Starobinski, who was always on call—and always ready with treasures of knowledge.

Ch. 6 (China) would have been a disaster without the help of Professor Joseph Needham of Cambridge, whose precious letters I came to regard as blood transfusions. Prof. Needham and Dr. Lu Gwei-Djen also took the

trouble of combing through the chapter, helping me remove the major flaws (any left are strictly my own), and suggesting important additions (a forthcoming volume of Prof. Needham's *Science and Civilisation in China* will give the reader a much closer view of chinese medicine). In Geneva I was greatly helped by Prof. Jean-François Billeter.

For Ch. 7 (India) I obtained invaluable advice from Prof. Jean Filliozat, Director of the Ecole Française de l'Extrême-Orient in Paris; Prof. Henri Frei of Geneva; Miss Jeannine Auboyer, Conservateur en Chef, Musée Guimet, Paris; and Gopal Sukhu of Boston—who first introduced me to Sanskrit, with occasional lapses into Chinese, and delightful intermezzi on his classical guitar.

Ch. 9 (Rome) was weeded—of the major weeds—by Prof. R. W. Davies of the Sunderland College of Education. Prof. Davies was also generous with references and advice, as was Prof. Paul Collart of Geneva.

Dr. Graeme B. Ryan was kind enough to comb through several chapters, with a keen eye for flaws and contradictions; Miss Rindy Northrop took the trouble of doing the same with the entire manuscript; and so did Dr. Isabelle Joris, who also identified and numbered every single Egyptian hieroglyph, and helped correct all the galley proofs. A few words of thanks, for a job of this magnitude, are again an absurdity.

Other debts. The Latin and Greek texts I checked with the help of Mrs. Martine Vodoz, who also solved for me a host of disparate, historic, and philologic problems.

In matters surgical I enjoyed the advice of my old friend Dr. John P. Remensnyder of the Massachusetts General Hospital and Dr. Denys Montandon of Geneva.

Also in Geneva, I spent many enriching hours with Jacques Vicari, discussing matters of ancient architecture, Assyriology, hospital structure, philology, and humanity altogether.

Dr. Luigi Belloni, now Professor of the History of Medicine in Milan and long ago my teacher of pathology in Geneva, promptly rose to help on many occasions. So did Prof. Erwin Ackerknecht of Zürich, whose critical, "no-nonsense" way of dealing with medical history has been a guiding light. I owe him much advice and encouragement, and dearly hope that this book will live up to it.

I also enjoyed a vast amount of negative help. There were times, especially in Geneva, when the members of my department would have liked to see me in the autopsy room or before a microscope—while I was before my typewriter or buried in some ancient text. Hence, this book is also the product of their patience, and to all of them goes my unending gratitude. I wish to thank them personally: Drs. Anne-Marie Schindler, Isabelle Joris, Jocelyne Grobéty, Pierre Vassalli, Guilio Gabbiani, Yusuf Kapanci, François Chatelanat, Sven Widgren, Jeremiah Cox, Chadli Bouzakoura, and Bernard Portmann.

The memory of Andrew Turnbull, a much lamented friend and one-time neighbor, lingers throughout these pages. Long ago, while he was finishing his

masterpiece, *Scott Fitzgerald,* Andrew came over to check some medical facts in my library. To my amazement, he was genuinely pained, not at the contents, but at the poor style of what he read. So real was his shock that he tried his best to prevent me from doing the same; he rewrote the introduction to one of my own scientific papers, and then took the trouble of explaining to me, patiently, some of the tricks of writing in English, like replacing nouns with verbs—not *reaching a conclusion* but just *concluding.* I must have thought of that lesson thousands of times since. Though English is not my language, it came closer to being so thanks to Andrew Turnbull.

My friends at Harvard University Press left their masterly touch in every part of this book: Arthur Rosenthal in the title and first chapter, William Bennett in every chapter, Virginia LaPlante in every paragraph, and Gretchen Wang in the design.

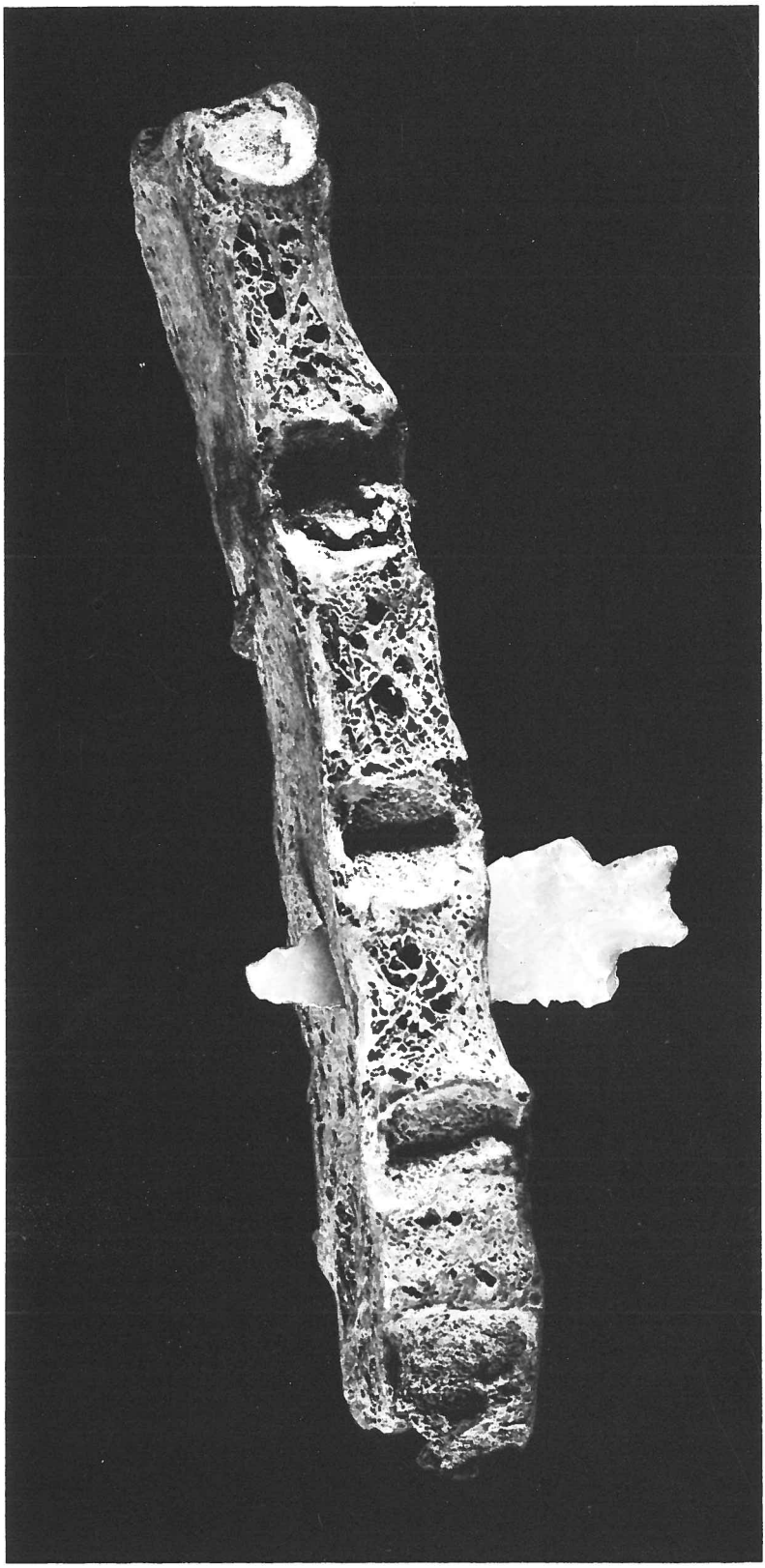
To thank my family in just a few words is another impossible task. The text is mine, but the time was largely theirs—hence the authorship should read, more precisely, "Guido and Fritzi Majno, with the assistance of Corinne, Lorenzo, and Luca."

Contents

Illustrations

Color Plates

The Healing Hand



1.1 A flint arrowhead in a human sternum. It struck the inner side of the bone, which means that the arrow came from the rear, passed between two ribs, and crossed the whole chest: a deadly wound.

1 Prelude

Sample of prehistoric life from Patagonia: an arrowhead in a human bone (Fig. 1.1). This timeless opposition of stone and flesh will recur like an echo to the end of this book: life is fragile, to be hurt is part of the game.

There are many ways to be hurt, of course, and it can happen without arrowheads. Yet physical trauma has always fared high on the list of man's problems. Prehistoric man left pictures of himself pierced by arrows. Thousands of years later, trauma is just as inevitable: coping with this reality is one of our chores. Mexican children begin to adjust while playing with one-legged dolls, or nibbling at candy coffins.

But then, injury has also helped to shape life itself, by eliminating the unfit.[1] It has left its imprint in our tissues, even in our cells, in the form of built-in, life-saving reactions, ready to be triggered at an instant's notice. And myriads of wounds have become stepping stones to one of man's greatest creations—the art of healing.

A Five-Minute Lecture on Wounds

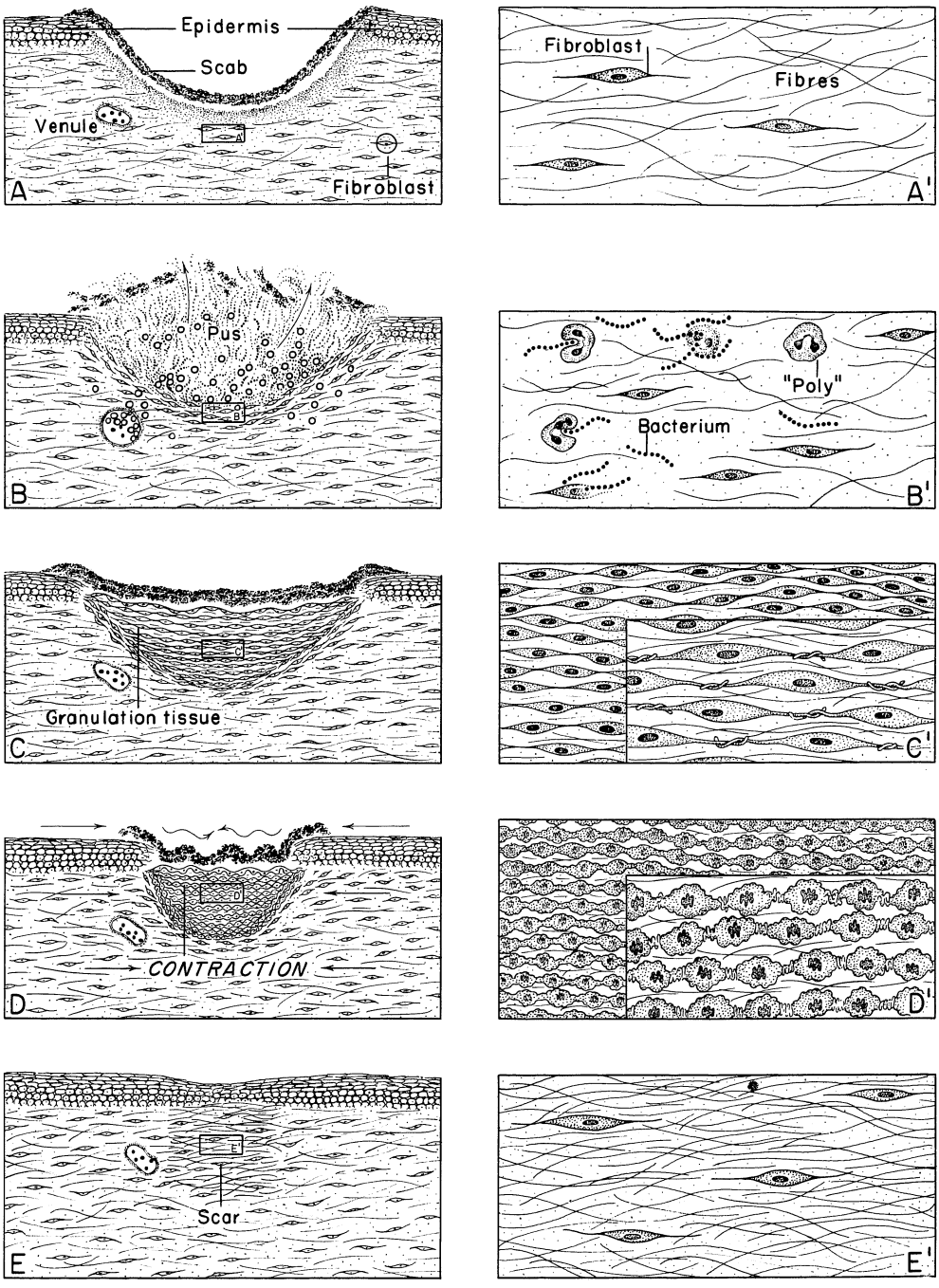
In classical Greece, every cultured layman was supposed to know the basic principles of medicine.[2] These first few pages are dedicated to my nonmedical readers, in that same spirit, for I do believe that everyone should know the beautiful deeds of which his or her tissues are capable.[3]

The first point to grasp is that a wounded salamander does much better than man. It can afford to lose a whole limb, because it will grow a new one,

skeleton and all. In scientific terms, it has a great capacity to regenerate. In mammals, only a few tissues, like the epidermis, regenerate really well; severed muscles never grow back, and even as modest an item as a hair root is too complicated to rebuild. So man's wounds heal mainly by a patching-up process called "repair." The loss is made good not with the original tissue but with a material that is biologically simple, cheap, and handy: connective tissue. This is a soft but tough kind of tissue, specialized for mechanical functions, primarily that of holding us together; it fills the spaces in and around all other tissues. Under the microscope both its softness and its toughness are explained, for it is constructed of a loose, three-dimensional network of fibers—some inextensible, others rubbery—bathed in a jellylike fill (the technical names of these three components are collagen fibers, elastic fibers, and mucopolysaccharides). Scattered throughout this system are several types of cells, including the ones that built it. In normal life these slender cells, called fibroblasts ("fiber-makers"), lie peacefully in their self-made jungle (Fig. 1.2A).

Now imagine a wound in this system. It disturbs millions of fibroblasts, which promptly set about the task of repair. But at the same time the wound has created a dreadful mess of spilled blood, dead cells, foreign material, and some bacteria. To cope with the debris, nature has devised an automatic mopping-up operation, called acute inflammation. As the first step in this sequence of events, blood flow around the injured area increases, helping to meet the emergency by bringing in extra "manpower" in the form of white blood cells, as well as supplies of antibacterial proteins and other chemicals. This rush of supplies is speeded up by another emergency device: the finest vessels, especially the venules, develop temporary leaks, so that fluid, without cells, actually pours out (hence the local swelling). The white blood cells, however, crawl out of the blood vessels by their own means and set about their different jobs. Some, specialized to fight bacteria, concentrate on swallowing and killing the intruders; these cells are called polymorphonuclear granulocytes, or polys for short (Fig. 1.2B). White cells of another kind, called macrophages (literally "big eaters"), consume and destroy the other debris left lying around. All these events are triggered by chemicals released from the damaged tissue. Note the elegant coordination: the tissue injury itself sets off the mechanisms for cleaning up the effects of that injury.

The two operations, clean-up and rebuilding, go on side by side. But just as a burning house cannot be rebuilt while the fire is raging, healing cannot be effective if bacteria keep on destroying tissues. So the wound can take, schematically, two different courses, depending on the presence or absence of infection (Fig. 1.2). If infection is absent—or minimal—the white blood cells undertake their routine clean-up, and in the meantime the fibroblasts bring about repair undisturbed. Slowly they multiply and fill up the gap with new fibers and the jellylike substance; blood vessels also grow into the region of repair, to support the building operations. The result is a new mass of connective tissue, called *granulation tissue* because—to the eye of the surgeon—its fleshy red surface looks bumpy or "granular." This type of



1.2 Stages in the healing of a wound, as seen through the microscope. The column at right shows details of the figures at left.

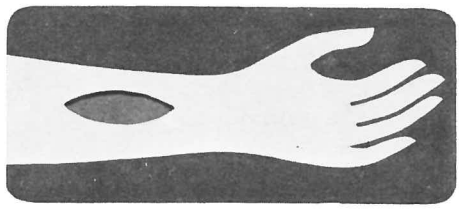
wound healing, in which bacteria do not interfere, goes under the ancient and venerable name of "healing by first intention" (Fig. 1.2 omitting phase B).

Things are very different when infection flares up. Bacteria delay healing in two main ways. First, they destroy live cells and tissues, so that the repair work of the fibroblasts is continually frustrated. Second, many types of bacteria raise havoc by starting a battle: they cause defending polys to flood the scene in such numbers as to form a thick cream, called pus. As the polys die within the pus, they let loose chemicals that were not used up in digesting bacteria. This is both good and bad: good because it helps to digest away dead tissue, where bacteria lurk; bad because the same wave of breakdown interferes with the constructive efforts of the fibroblasts (Fig. 1.2B). Healing can really get under way only after the infection has been beaten back. This course of events is called, in traditional terms, "healing by second intention."

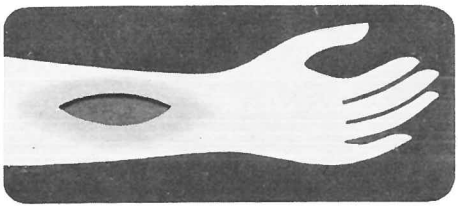
Pus is therefore a noble substance: it is made of brave cells that never sneak back into the blood vessels to escape; they all die in the line of duty. Note also the double meaning of suppuration: it indicates that there is an infection, but also that the body is fighting it well. The outcome of the battle can be predicted, to some extent, from the aspect of the pus, as was observed even in ancient times. The whitish, creamy kind (and therefore rich in polys) is "preferable," because it indicates that an infection is being fought effectively. Hence its ancient Latin name of *pus bonum et laudabile,* "good and laudable pus." Thin or malodorous pus suggests a poor defense or especially vicious bacteria.

Either mode of wound healing—by first or second intention—leads to the same result: a gap filled or lined with granulation tissue, and covered by a scab of dried-up blood. The wound is now ready for the final step in the healing process (Fig. 1.2C). At this stage, although man lags behind the salamander, he is at least ahead of the tree. In an injured tree-trunk, new tissue simply grows in from the sides of the wound, very, very slowly. There is no other option. Human granulation tissue goes one step further: as it fills the gap, it also pulls the margins together—a process called wound contraction. As the wound closes, new epidermis creeps in beneath the scab and seals off the raw area. Deep down, more fibers are formed, while most of the cells die and disappear. The end result is a dense mass of fibers with few living cells: a scar.

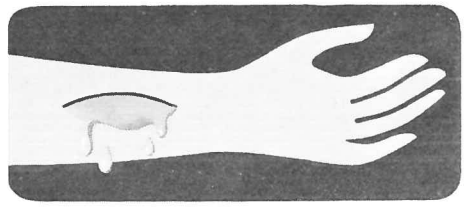
Several things can go wrong with the process of wound healing. Most of the mishaps are caused by bacteria; and their visible effect depends on the kind of bacteria as well as on the response of the tissue (Fig. 1.3). The most common accident is suppuration, which brings about healing by second intention. Suppuration, incidentally, is caused by bacteria that have the property of attracting many white blood cells (a truly suicidal trait). A spreading, superficial infection forms a red halo, for which the Greeks coined the term *erysipelas.* An infection spreading into the depths of the tissue and causing blood vessels to leak extensively produces much swelling (*tumor* in ancient Latin terminology). Sometimes, unaccountably, an excess of soft red granulation tissue mushrooms out of the wound, a complication once known



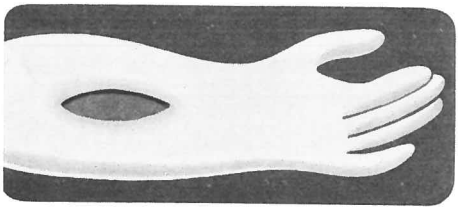
Fresh, uncomplicated wound



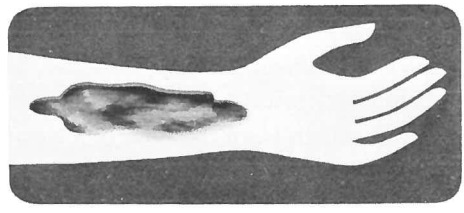
Reddening caused by superficial inflammation ("erysipelas")



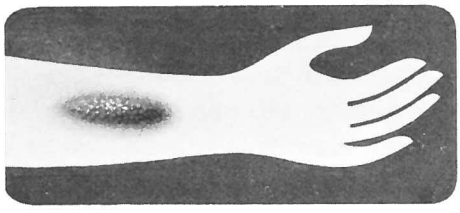
Suppuration



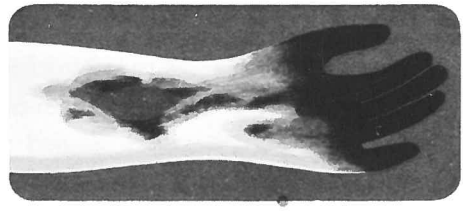
Swelling caused by deep inflammation



Spreading ulcer



Excess of granulation tissue ("proud flesh")



Gangrene

1.3 Six major "wound diseases": complications that can occur to a wound. The cause of "proud flesh" is not understood; all the others are due to bacteria.

as proud flesh. If the bacteria gain ground on the defenses, spread, and kill more and more tissue, the wound becomes a spreading ulcer, called also serpiginous or phagedenic. A massive death of tissue goes under the name of gangrene; the Greeks also called it "blackening" (*melasmós*). A hard, bulging, overgrown scar is called a keloid. Its cause still unknown, the keloid is the curse of plastic surgery. These various clinical problems of healing wounds can be so distinctive that the ancients thought each kind represented a special disease, requiring its own special treatment: a view that was not totally wrong, for some of the clinical peculiarities do correspond to differences in the invading bacteria.

The mechanism that makes an open wound contract, as if an invisible force were drawing its margins together, was an ancient puzzle. Clinical and experimental observations suggested that the source of the pull was in the granulation tissue, but neither the fibroblasts nor the various kinds of fibers seemed to have the qualifications of a pulling machine. The answer is extraordinary. When a wound must close by contraction, the versatile fibroblasts perform two feats that allow them to behave like a pulling machine: they join end to end, and they develop internal bundles of contractile fibers, similar in all respects to the contractile component of muscle (Fig. 1.2C,D). Thus transformed, they respond to the same substances that cause involuntary, or "smooth," muscle to contract. In the laboratory, a little strip of granulation tissue, taken from the floor of a wound and maintained in a warm bath, can be made to contract or relax like a muscle when certain drugs or chemicals are added to the bath.[4]

Still unknown is how the fibroblasts are induced to join together and pull, but the fact is that they do. I suspect that during evolution they became programmed to respond in this manner because of the great advantages to wound healing. If there is any truth to this suggestion, it follows that injury has shaped the behavior of human cells.

A Glance at the Fossil Evidence

Wounds involving bones or shells left traces in fossils long before man or mammals appeared on the scene. The healing process of wounds in ammonites, about 200 million years ago, left imperfections in their lovely spirals.[5]

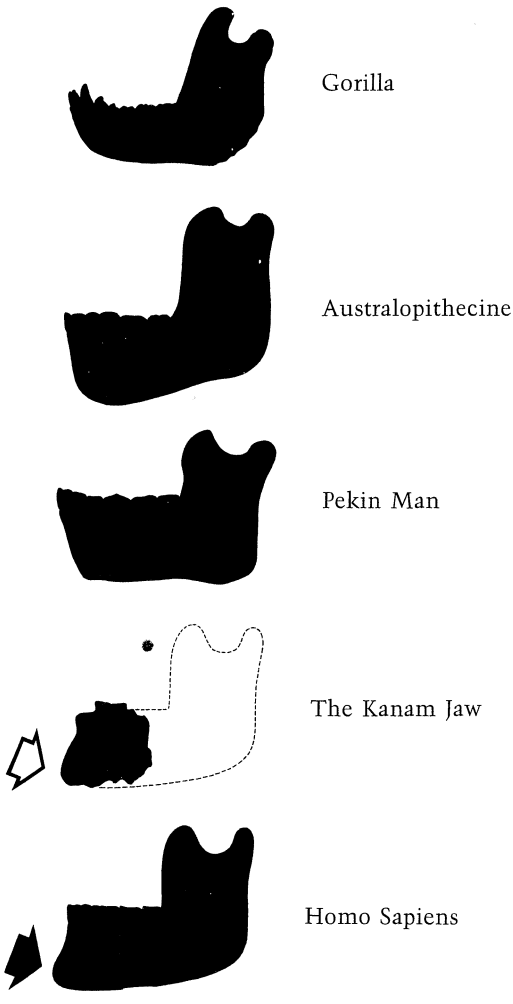
Moving up to about five million years ago, we meet the man-ape who seems to be our likeliest ancestor:[6] *Australopithecus africanus*, "the South African ape,"[7] whose remains perhaps bear witness to the "first wound." It all began when Raymond Dart, examining the skulls of his newly-found australopithecines and of baboons lying with them, noticed peculiar double depressions shaped like a squat 8 (Fig. 1.4).[8] Encouraged by a professor of forensic medicine, who saw the marks as evidence of attack with a weapon, he searched the fossil-bearing limestone for objects that could have been used as a club, and found remains of antelope bones that could have served the purpose: the best candidate was the lower end of the humerus, which had

1.4 The skull of an australopithecine who, according to Dart, was clubbed to death by another australopithecine—the double depression reflecting the shape of the bone club. If Dart's interpretation is right, this accurate, vertical blow was delivered, perhaps from the rear, as much as three or four million years ago.

two knuckles that fitted neatly into the double depression.[9] The overall conclusion was such bad news that it could not fail to make headlines: the australopithecines, having discovered the principle of bashing skulls with clubs, placed such demands on their primitive nervous system to develop this skill in weaponry that the evolution of their brain was accelerated; hence, violence created man.[10]

Recent developments are more optimistic. Flaked stones found among the fossils show that the australopithecines were already exploring the possibilities of handicraft, and fashioning simple tools from pebbles, as early as 2.6 million years ago.[11] Now here is a more constructive occupation to have given our ancestor's brain a push in the right direction. In the wake of this discovery, the double depressions in the skull have been almost forgotten.[12] Although it turns out that chimpanzees in the wild use clubs to attack leopards,[13] and even hurl stones at baboons,[14] nobody has tried to find out, experimentally, whether an antelope bone could really produce an acceptable double depression in a baboon skull.

To sum up the story of the "first wound," we are left with the portrait of a stone-chipping artisan painted over a somewhat faded image of Cain. Perhaps both are authentic. In any event, after having been told that bloodshed is inevitably our lot, because we are the product of violence, we



1.5 The chin that caused most trouble: the Kanam fragment.

should find it welcome news that work may be our lot, because we descend from a craftsman.[15]

Among the fossils that stirred up controversy was a small piece of jaw from Kanam, Kenya, dating roughly from the time of the australopithecines—an impossible jaw, because it had a chin (Fig. 1.5).[16] Nobody but man has a chin. Even Pliny said so: *mentum nulli praeter hominem.*[17] It is true no one knows exactly when man appeared (we were definitely here 30-35,000 years ago, perhaps as early as 100,000 years ago, side by side with the Neanderthals), but surely we did not live at the time of our australopithecine ancestors. The jaw remained a puzzle until P. V. Tobias decided to cut the Gordian knot. In fact, he cut the jaw and looked at it with the microscope. The chin was a lump of callus over a nasty infected fracture; so its owner was just a miserable hominid who had been hit in the face.[18]

The Neanderthals are a mysterious lot. They lived from approximately 150 to 40,000 years ago, had clothes and fire, and spoke some sort of Neanderthalese.[19] Their brains were at least as large as ours, and they looked very much like us. *Homo sapiens* and *Homo neanderthalensis* may even have

intermarried.[20] Then, unaccountably, the Neanderthals vanished. Yet one of them must be remembered here because he has been described as the first known case of surgical amputation (whereas the story itself, I fear, should be amputated). The facts are as follows.

Some 46,000 years ago there lived in a cave of northern Iraq a sorry specimen of Neanderthal.[21] Early in life something went wrong with his arm, which remained stunted. Years later he lost half of the same arm.[22] He carried on by gripping things with his jaw, so he wore down his teeth quite badly.[23] Then he lost two front teeth.[24] A blow received on the top of his head healed well, but another one that smashed the left side of his face probably left him blind in that eye. In the meantime, he reached the ripe old age of forty (equivalent to about eighty in our day) and developed a bad case of arthritis. Finally the roof caved in, and he was killed near his hearth.

His discoverers grew rather fond of him. They called him Nandy[25] and composed over his bones a bit of romance.[26] Perhaps his amputation was an example of "very early surgery" (although there were surely more lions than surgeons in the immediate neighborhood). And perhaps Nandy's remains were themselves mute evidence of "man's humanity to man."[27] Nandy could have been making himself useful around the place; his comrades, though cannibals, were human enough to recognize his virtues and allowed him to live on; when he died, they even took the trouble of piling rocks over his remains.[28]

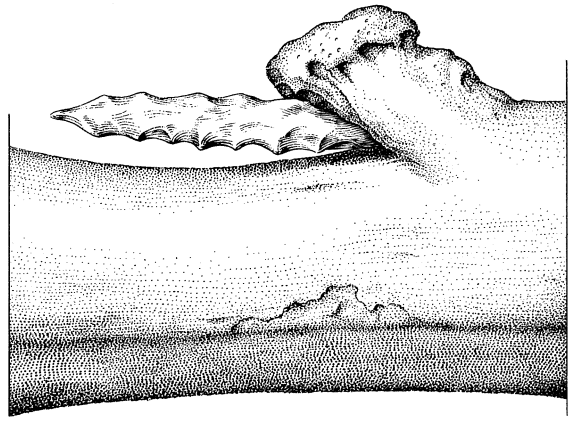
Maybe it is true that Nandy represents fossilized compassion, to the extent that a cripple was allowed to live on rather than being reutilized as food (a level of human decency that is current among animals). But asking Nandy to play the role of surgical patient is too much; it assumes that Neanderthal surgery had gone beyond the level even of Hippocrates, who did not know how to amputate. The real lesson of Nandy, I believe, is that nature alone is able to staunch the bleeding and stamp out the infection, even after such major accidental wounds as those of amputation.

Stepping into the era of *Homo sapiens,* among Stone Age fossils we find scores of arrowheads embedded in bones, especially in lumbar vertebrae, possibly because shields protected the upper part of the body.[29] In many cases it is obvious that the wounded must have died immediately (Fig. 1.1); others lived long enough to produce an intense bony reaction (Fig. 1.6). For the medical historian there is not much to learn from these fossils, except that killing technology had advanced a great deal since the primordial clubs.

A Role for Pleasure

Sometime, somewhere, the striking hand must have also learned to accomplish a healing, soothing gesture. It is difficult to discuss prehistoric therapy without running into Calvin Wells' veto: "imaginative insight must stop well short of delirium."[30] But we can try to look back and see when the footsteps of medicine began to emerge from the night of time.

Certain gestures, like scratching, have defied time and evolution as



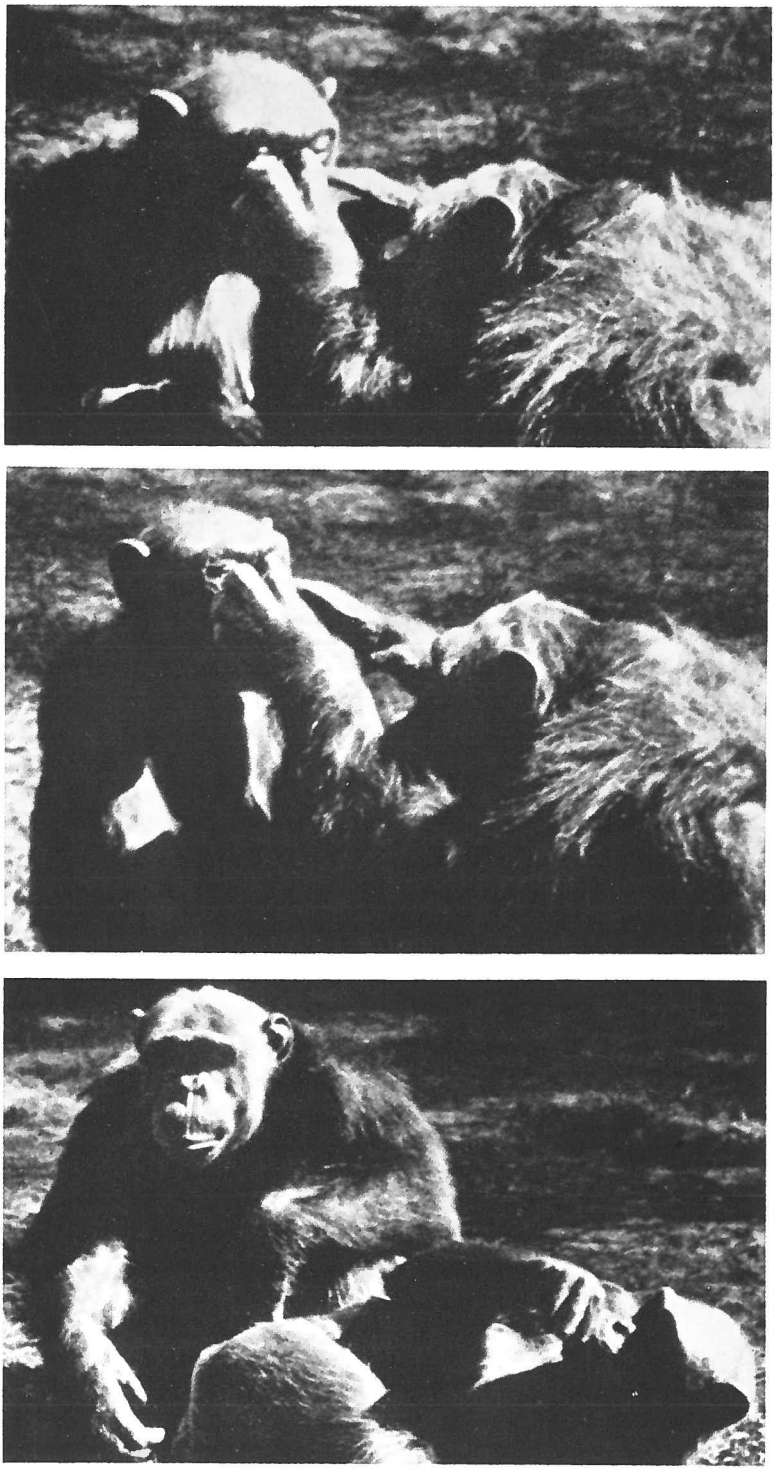
1.6 In prehistoric France, a grazing shot landed this flint arrowhead against a human tibia. The subject survived, and the arrowhead, presumably helped by bacterial infection, caused the formation of a peculiar bony lump (top right). This development must have taken months, possibly years.

effectively as fossils.[31] As to medical gestures, nobody knows how long they may have survived. However, professional historians in search of man's earliest medicine do not refrain from looking into the habits of primitive tribes.[32] Not being a professional historian, I feel even less inhibited: how about inquiring into our relatives the apes?[33]

Nobody alive could testify more competently than Jane van Lawick-Goodall, who actually shared the forest with wild chimpanzees.[34] Here is the status of wound care among wild chimpanzees, as I learned it directly from Dr. Goodall.[35] A wounded chimpanzee takes care of himself to some extent: "a chimpanzee will pick leaves, dab at a fresh bloody wound, lick the blood off the leaves, and then dab again. A sore on the back, or side, or head will often be pressed with the fingers, which are then licked, then pressed again to the wound." Care of a wounded companion, however, is somewhat disappointing. Dr. Goodall has seen, "on one or two occasions, one chimpanzee lick the wound of another. On the other hand, when one female had a really bad puncture wound in her shoulder, which she repeatedly presented for grooming to an adult male, he appeared fearful, whimpered, and hurried away from her . . . We have seen chimps, especially youngsters, staring intently at a wound of another chimp, putting their faces close to it, but not doing anything else; even in the case of a mother carrying a badly wounded infant."

The same species in captivity seems to have done better. First aid among captive chimpanzees was actually recorded in a unique photographic sequence (Fig. 1.7).[36] Pan and Wendy, a pair in their early thirties, had been sharing a Florida enclosure for twenty-nine years. One morning in February 1954, Dr. Walter Miles happened to be standing nearby, armed with a camera. Pan was engaged in his usual noisy, belligerent display. Suddenly,

> . . . in the midst of Pan's excited behavior, Wendy came up behind him whimpering. Pan suddenly turned, looked, and approached her. She sat down on the ground; he immediately crouched in front of her and with his two forefingers began manipulating her left eyelid . . . The first photograph taken shows Pan crouching in



1.7 Medical aid among chimpanzees. *Top:* Wendy, at left, has just signaled that something is in her left eye. Pan crouches before her and pulls down her lower eyelid. *Center:* The search goes on. Wendy has pulled back her head a little, as most patients would. Pan seems to stabilize it with his left hand (note the little thumb of his right hand). *Bottom:* Just after success, both chimps relax. They have switched places. Wendy lies down; Pan, who moments before had been romping wildly, is now in a pensive mood.

front of Wendy and very near, as he views her left eye. He is using both his hands for the task of searching. With his left hand he appears to stabilize Wendy's head. With his right forefinger he has drawn down the lower eyelid exposing the pink mucous membrane. Wendy's head is tipped toward Pan, who is viewing her eye from a distance that we estimate as 5 to 6 inches . . . The moment when Pan withdrew his fingers from Wendy's face, signalling success of his attempt, occurred with such suddenness it was not captured by a photograph. As Wendy experienced relief, there was a quick change in her posture from sitting to lying down. Pan turned so that he could again see his two human observers. He glanced briefly at Wendy's genital area and then assumed the relaxed sitting posture immediately behind Wendy . . . He seemed to look at his human observers with a much altered perceptual attitude . . . He sat quietly . . . for about five minutes.

The motives behind ape first aid—as seen by a human primate—have been explored by W. Koehler:

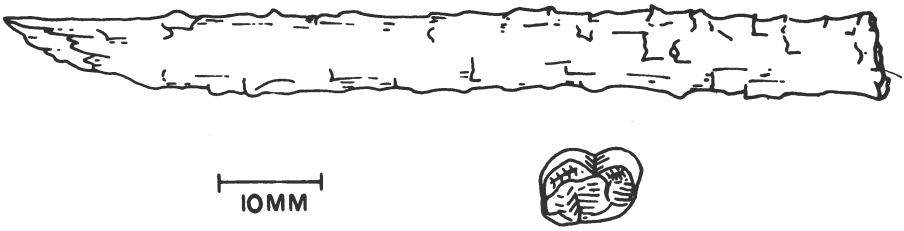
Monkeys of many kinds have a custom of mutual personal "inspection," and skin treatment. But we are at present in the dark as to the reasons for the popularity of this investigation of skin, hair, and hind quarters, which is carried out with the greatest eagerness and attention—and is a pleasure shared equally by the active and passive parties in the process . . . As a branch of the same activity, the chimpanzee likes to pay attention to wounds or injuries received by his fellows; but hardly urged thereto by motives of "mutual aid." *To handle such things gives him pleasure* [italics mine] and there is sometimes a helpful and beneficial result. Once an enormous abscess had appeared on the lower jaw of one of our chimpanzees. When it became noticeable through the extent of the inflamed surface and secretion of pus, another of the apes would not stir from the patient's side, but pressed and kneaded the injured jaw, until the pus was removed, revealing a raw, gaping wound. The animal thus treated made no objections. As apes like using diverse objects in all eager manipulations, the operator worked with a large piece of old rag in his hand. Yet, wonderful to relate, the wound—itself probably originally caused by skin treatment with filthy hands—healed rapidly and completely. Chimpanzees also like very much to remove splinters from each other's hands or feet, by the method in use among the ordinary human laity. Two fingernails are pressed down on either side and the splinter levered upwards, to be caught and removed by the teeth. At the risk of infection, I went up to a chimpanzee on one occasion when I had run a splinter into one of my fingers and pointed it out to him. Immediately his mien and expression assumed the eager intensity proper to "skin treatment"; he examined the wound, siezed my hand and forced out the splinter by two very skillful, but somewhat painful, squeezes with his finger-nails; he then examined my hand again, very closely, and let it fall, satisfied with his work.[37]

In summary, nature does most of the job, while the chimps perform a few helpful gestures. And some of these gestures are derived from grooming, *in the pursuit of pleasure.* No barber-surgeons are left to testify on the basic interrelations of pleasure, grooming, and surgery.[38] But to turn to my surgical colleagues: would anyone deny that cleaning up an untidy wound still is, deep down, a pleasure?

News of more chimpanzee medicine came recently from the Delta Regional Primate Center in Louisiana, where seven young chimps, seven to eleven years old, had been living together for three and a half years.[39] Their

1.8 Dental care between Belle and Bandit, two chimpanzees.

home was a one-acre outdoor enclosure, with an overhead deck from which Dr. William McGrew and Caroline Tutin could study their behavior. The greatest surprise came from Belle, a female, who had developed a definite bent for dental grooming. In six weeks of observation she was seen performing this service forty-five times, especially on a young male, Bandit, who seemed to be the perfect patient because he was both losing his baby teeth and enjoying the attention. "Her usual procedure was to begin normal social grooming directed to the hair of Bandit's torso, limbs or head. She then concentrated on his face and, finally, opened his mouth . . . Belle adopted a variety of postures while working: sitting, bipedal standing, crouching, reclining. The patient usually lay supine, but Belle maneuvered him through other postures."[40] On four occasions she found it necessary to pick up a stick to use as a tool (Fig. 1.8); once it was a twig of red cedar, which she stripped of leaves before using it. Her major feat was the removal of a deciduous molar with the help of a pine twig (Fig. 1.9).



1.9 A unique surgical specimen: Bandit's lower left deciduous second premolar, and the pine twig used by Belle in removing it.

Why Belle developed this specialty is not explained. There is no reason to believe that she was copying human behavior, such as tooth picking; and no encouragement was offered. I submitted the problem to Dr. Goodall, who replied that chimpanzees in captivity "typically *do* more things—they have more leisure time." Belle is now dead and she took her secret with her: perhaps a blend of pleasure, leisure time, and skill.

The Wound As a Problem

A million years ago, as now, a wound implied three major medical problems: mechanical disruption, bleeding, and infection. Nature is prepared to cope with all three; but man can help, even with simple means.

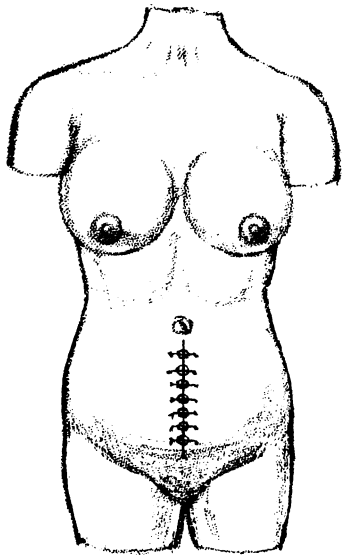
On the question of mechanical damage, nature's contribution to repair needs no advertising. In a survey of 118 wild gibbons, 42 had fractures (up to four apiece) and all healed, even in the humerus and femur,[41] with just enough exceptions to show that gibbons can be human.[42] Whatever apes do or do not do, it works. As to wounds, apes make no active attempt to help, such as holding the margins together; but man too has been very slow at that, perhaps because nature proved so fast. Stitching of wounds among primitive people is exceptional.[43] Sometimes the wound is really sewn with fibers or shreds of tendon; sometimes the lips of a wound are pinned together by a thorn or spike used like a skewer, and its protruding ends are wound around with fiber (Fig. 1.10)—a technique that is not wholly obsolete. But we cannot be certain that any of the few examples observed nowadays is truly native or had a prehistoric equivalent.

Yet the act of sewing is probably older than *Homo sapiens,* since Neanderthal man wore some sort of clothing.[44] So why the delay? Was it lack of imagination? I doubt it. Perhaps stitching was tried off and on, but without enough success. In wounds contaminated with bacteria, sutures are a mixed blessing: they favor infection and may actually prevent the wound from healing. We teach today that dirty wounds are better off unsewn. Besides, there are three good ways to hold a wound closed even without thread and needle: a simple bandage, adhesive tape, and clips. Bandages must be as old as clothing; the oldest known were found in Egypt and represent an advanced state of the art, since they were applied with splints.[45] Adhesive tape has a shockingly modern ring, but the notion may well be four thousand years old and possibly older than sutures, for "stickiness" is a very early and basic concern, bound to the use of resin, that all-purpose material.[46] As to clips, insect mandibles are used to this end by primitive people today. Their use in prehistoric times cannot be documented, however, and they first appear in history with ancient Hindu medicine.

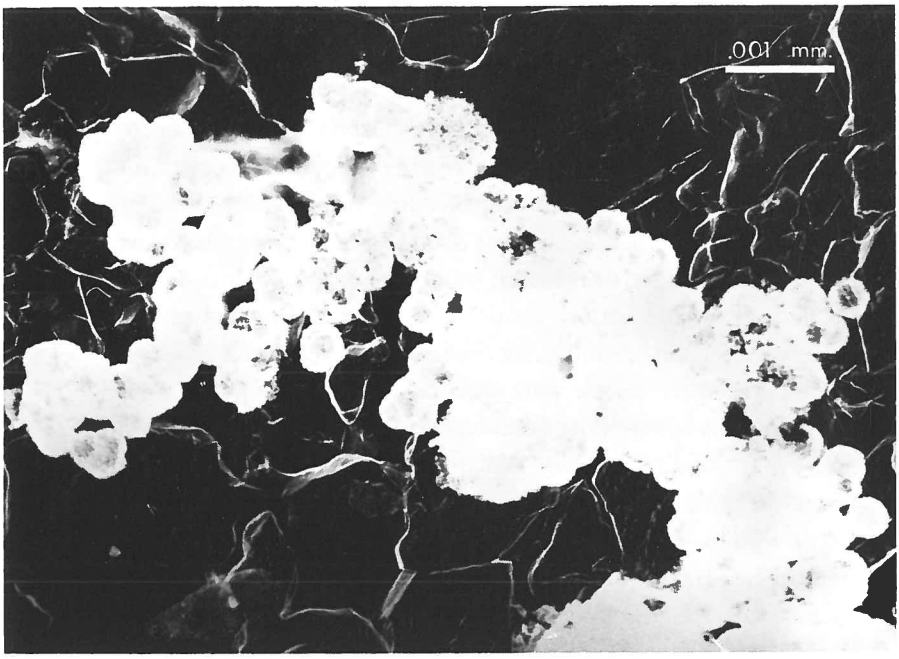
For clearcut evidence of stitches in live flesh (which the Egyptians may have tried) we have to wait for the classical writings of India and Greece. But the overall priority for stitching goes to the ants. They had the idea long before man, perhaps millions of years ago. *Oecophylla smaragdina,* as we shall see, discovered a way to sew leaves with a triple combination of clamping, stitching, and gluing.[47]

The problem of hemorrhage was mastered even later than stitching. Mankind had great difficulty in grasping the main facts about bleeding and how to stop it. Minor hemorrhages are checked by the simple act of bandaging, and a few among the infinity of materials that have been stuffed into wounds may actually help blood clotting. The most effective means developed by primitive people to stop bleeding is the cautery,[48] which might possibly have been used as far back as 3000 B.C.;[49] but wounds to any major vessel meant bleeding to death until well into historical times. Even the Greeks had very vague notions about hemostasis; if Hippocrates ever tied a spurting vessel, he never said so. By the time the tourniquet was a well-recognized procedure, people were shooting guns.

How could it take so long to understand something so simple—in concept—as turning off a faucet? Although it did take a long time, in retrospect the problem was not so simple. First, there is no closing of a faucet for people who have never seen a faucet. Then in many cases, such as a major blow on the head, the wound itself is the lethal event; bleeding is incidental. In other cases it does not help at all to stop the outward loss of blood, because bleeding continues inside. This holds for all penetrating wounds of the chest and abdomen. Besides, the ligature itself is a hazard. Consider the case of a Neanderthal man who has his femoral artery torn open in fighting off a cave bear. His neighbor is a genius and ties off the thigh with a strip of hide. The bloody fountain dries up. But then what? The magic gesture has simply traded hemorrhage for gangrene: the great first-aid principle of the tourniquet fails unless the torn vessel itself is tied and the tourniquet is released within a very few hours. Finally, to the unprepared mind, the blood lost is only that which was contained in the wounded part, which deprives the event of some of its urgency. To take an optimistic view of this prolonged human failure, let us say that death by hemorrhage was given an extended chance to work for natural selection.



1.10 Primitive wound closure with iron spikes, wound around with thread. A successful Caesarean section, under anesthesia with banana wine, from Uganda, 1879.

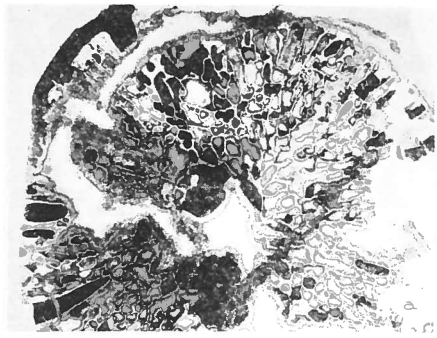


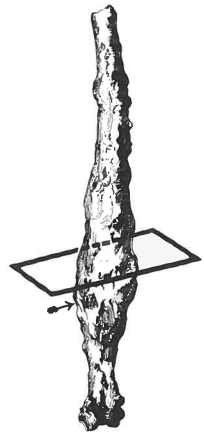
1.11 Fossil bacteria two billion years old. From gunflint chert, a Precambrian sediment in southern Ontario. Enlarged about 15,000x.

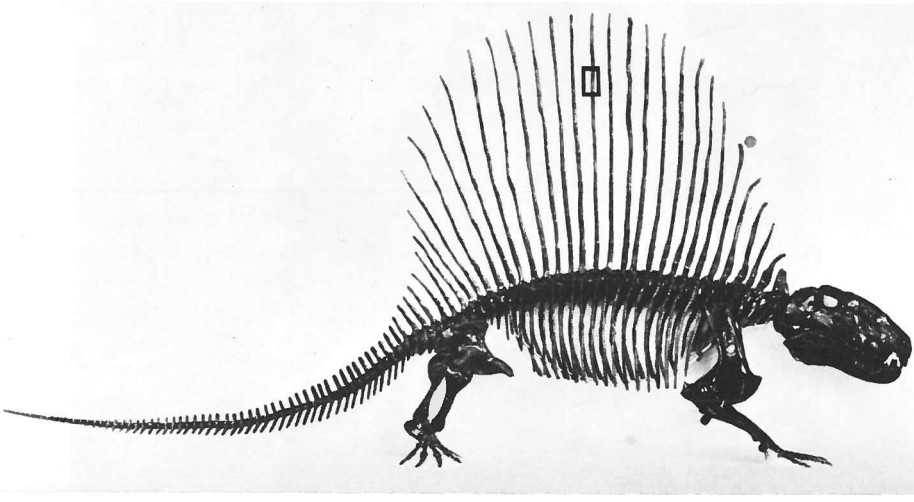
As for the problem of infection, bacteria should have been old hands at causing trouble by the time that man came around. Clostridia in particular should have been rampant, for they are able to survive in inanimate nature and also happen to cause two of the deadliest wound infections, tetanus and gas gangrene.[50] For those who like concrete evidence I will submit a picture of fossilized bacteria 2 billion years old (Fig. 1.11) (primates began to appear only about 65 million years ago).[51] These fossils were embedded in rocks that could be dated—some as far back as 3200 million years.[52] From their shape, their arrangement in little chains, and their remains of organic content, there can be little doubt that they represent fossil bacteria.[53]

Bone disease caused by infection (osteomyelitis), if long standing, usually causes the bone to swell and become riddled with channels (sinuses) through which the pus drains. The first acceptable evidence of osteomyelitis is far older than man: it concerns a Permian reptile, whose gnarled bony spine suggests that the basic changes of osteomyelitis have not changed much in the last 200 million years (Fig. 1.12).[54] Osteomyelitis has been described in many other fossils, animal and human.[55]

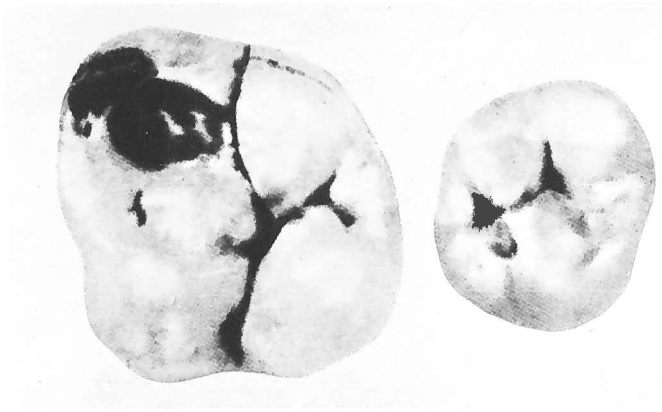
To me as a pathologist, the diagnosis of "infected bone" in most of the fossils thus labeled seems acceptable, although nobody can guarantee that these infections were caused by bacteria rather than by other agents, such as protozoa or fungi.[56] However, we do know that tooth cavities are the work of bacteria, and of bacteria alone. Thus, unless the biology of caries has changed a lot in the last 3 to 4 million years, the teeth of *Australopithecus* have preserved the oldest known evidence of bacterial infection, albeit of a special variety (Figs. 1.13–1.14).[57]





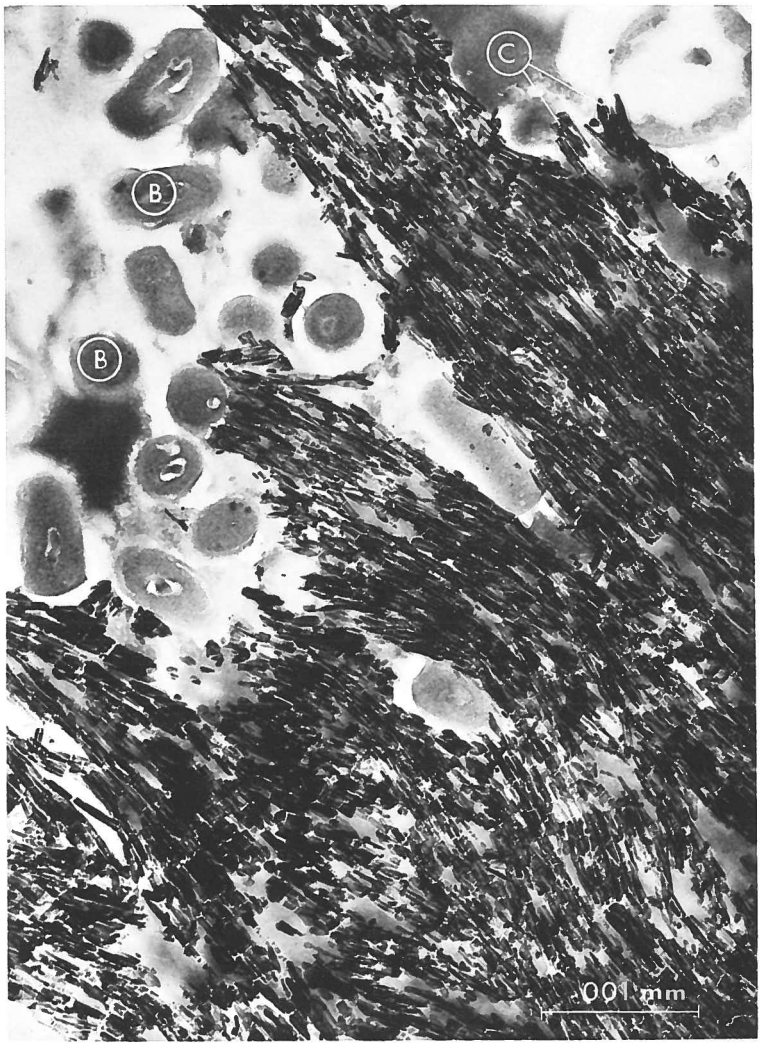


1.12 Oldest known trace of an infected wound. About 200 million years ago, in Texas, a Permian reptile broke one of its dorsal spines: it was a *Dimetrodon,* like this nine-foot specimen (bottom). The bone healed but remained swollen (center), as if it had become infected through a break in the skin (arrow: site of fracture). A microscopic section across the spine (top) shows a honeycombed structure, which Moodie interpreted as infected bone riddled by sinuses full of pus. Unfortunately he gave no picture of a normal spine.



1.13 *Left:* Bacterial infection about two million years ago—two cavities in an upper molar of an australopithecine. *Right:* A comparable human molar.

1.14 Caries in a modern human tooth, photographed through the electron microscope, to show that caries is a bacterial infection. A swarm of bacteria (B) are burrowing into the enamel. The small black segments (C) are enamel crystals; they are being dissolved by lactic acid produced by the bacteria. Enlarged about 21,000x.

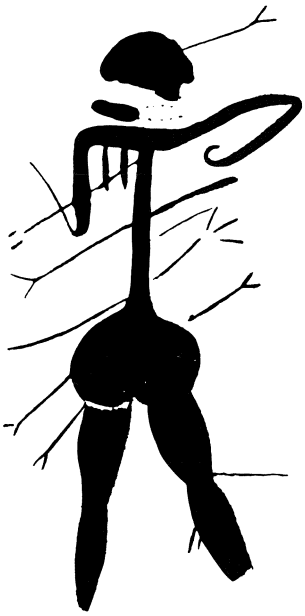


Franz Weidenreich suggested, on rather slim grounds, that primitive man may have been generally more resistant to infection. His argument was based on the jaws of Pekin man, which remained perfectly healthy despite the teeth, which had been heavily worn down by a gritty diet.[58] Yet there are jaws of Neanderthal men with retreating gums and related problems,[59] and the full-blown picture of dental infection is painfully clear in a famous skull of Rhodesian man, 30 to 40,000 years old. Its teeth, worn or decayed, allowed bacteria to penetrate into the bone, which is honeycombed with abscesses.[60] These isolated cases are clearly not enough to decide whether our ancestors were better off than us in their daily fight against bacteria.

Messages from Primitive Art

Not long after the disappearance of Neanderthal man, *Homo sapiens* invented art; that was about 35,000 B.C.[61] From then on the wound was potentially available as a subject of artistic expression. But astonishingly, our ancestors did not seem to think so, for the drawings they left are infinitely milder than those of historical times. In the caves of France and Spain, the catalog of prehistoric art runs to 2260 figures:[62] only a fraction of these portray wounds or scenes of violence (Fig. 1.15). The most common victim is the bison, and even his casualty rate is less than 2.5 percent.[63] I can offer no explanation.

A prehistoric message that may or may not concern medicine is painted all over the Gargas cave in southern France.[64] Something very strange went on there, perhaps 25,000 years ago. Men of the Aurignacian culture left "signatures" on the walls of the cave, as negative imprints made by smearing or



1.15 This wretched little man, surrounded by archers, is painted on a rock in eastern Spain. Is he trying to pull out one of the arrows?

1.16 Negative imprint left on a wall of the Gargas cave in southern France about 25,000 years ago, when a human being smeared red color around a hand. Four fingers are too short. Of over one hundred hand imprints in the cave, most are "incomplete." Ritual amputation? Disease? Sign language?

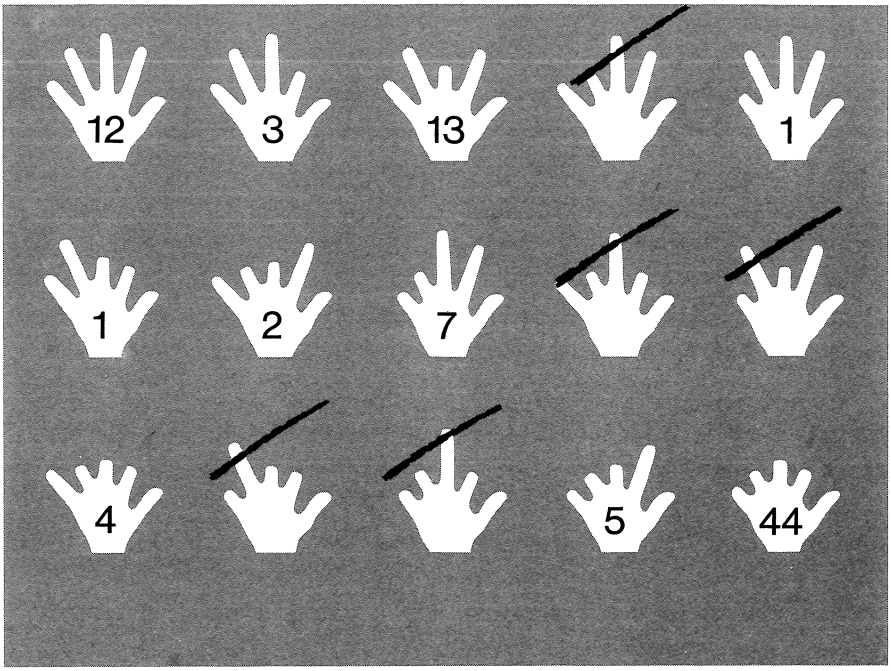
blowing black or red color around the hand laid on the rock (Fig. 1.16). Many of these hands lack one or more fingers; the thumb seems to be spared.[65] One possible explanation is that the whole group suffered from Raynaud's disease, a familial condition that could have led to gangrene of the fingers in a cold land where the mammoth still roamed.[66] But similar hands turned up in the Maltravieso cave in central Spain, where the climate was milder.[67] Could it have been ritual amputation?

For once, the truth may not be as gruesome as it seemed. A. Leroi-Gourhan noticed recently that the commonest types of "abnormalities" correspond to fingers that are most easily bent down, alone or in combination (Fig. 1.17). Thus, the hands could have been laid backward against the rock, while the fingers were making a conventional hunting sign. Some of the hands also seem to show that a finger was retouched off, as one would retouch an *E* to make it look like an *F* (Fig. 1.18). The prevailing combination, "thumb only, all fingers down," could have been the sign for the prevailing bison.[68] Bushmen still use such a code (Fig. 1.19).[69]

But the Bushmen also do something else that casts new light on the problem. Like other primitive peoples, they have been known to chop off fingers as a form of sacrifice (Fig. 1.20).[70] Several Indian tribes of northwestern Canada do the same thing "when death is too assiduous in his visits to a family: the survivors . . . place the little finger on the edge of the coffin and sacrifice the first joint, in order, as they say, *to cut off the deaths.*"[71] Robert Gardner recently filmed a similar rite in New Guinea among the Dugum Dani tribe.[72] The occasion was the death in combat of a tribesman, and the

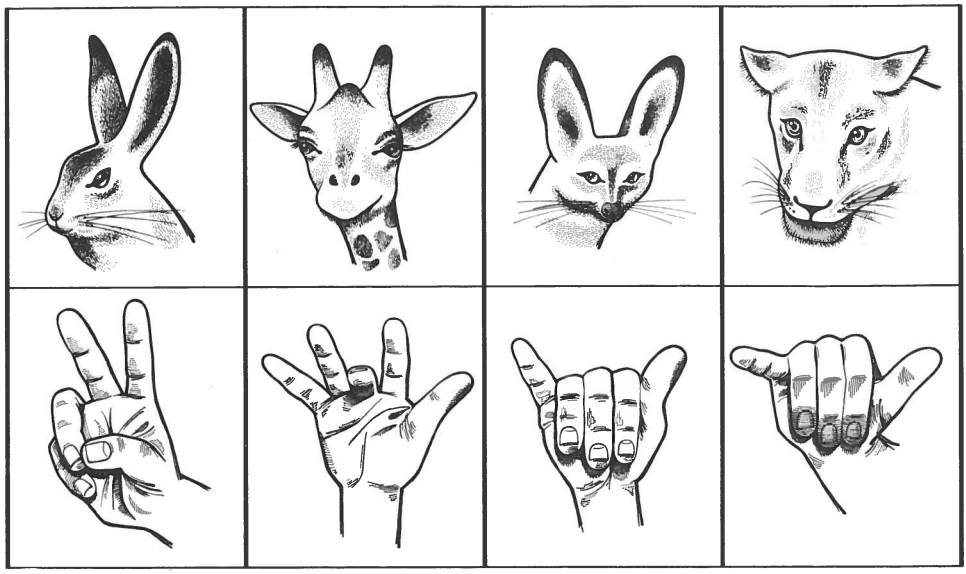
sacrificial victims were, as usual, little girls, selected for a certain consanguinity (Fig. 1.21). That particular sacrifice was a way of expressing the solidarity of the kin group and the grief of the family; it also served to placate the ghost of the dead relative.[73] Almost all Dani girls lose several fingers yet maintain a high degree of manual skill (Fig. 1.22).[74]

From the medical point of view, the overall conclusion—once again—is that mutilated fingers can heal quite predictably, without much danger of infection. At least in the forest.

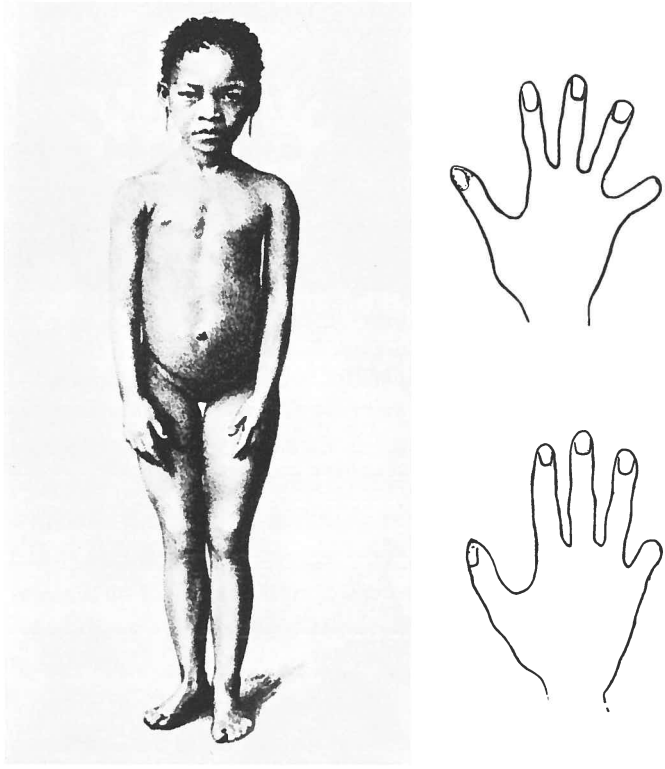


1.17 Finger formulas of the Gargas cave. The figures indicate their frequency, in a total of 92 that were readable (slashed formulas are not found). Conclusion: the commonest configurations are also among the easiest to mimic by bending fingers.

1.18 Occasional fingers of the Gargas hands seem to have been retouched off: another blow to the amputation hypothesis.



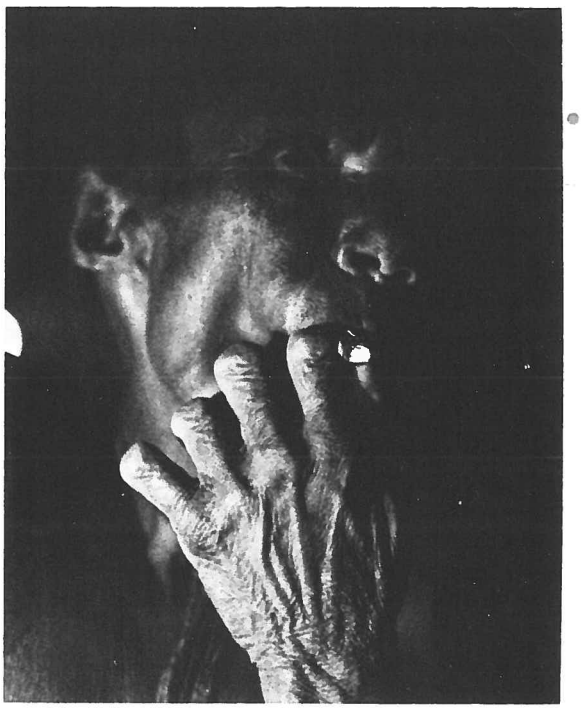
1.19 Four highly suggestive "hand-words" used by hunting Bushmen: "scrub hare," "giraffe," "bat-eared fox," "lion." This sign language may be a clue to the "amputated" fingers of the Gargas cave.



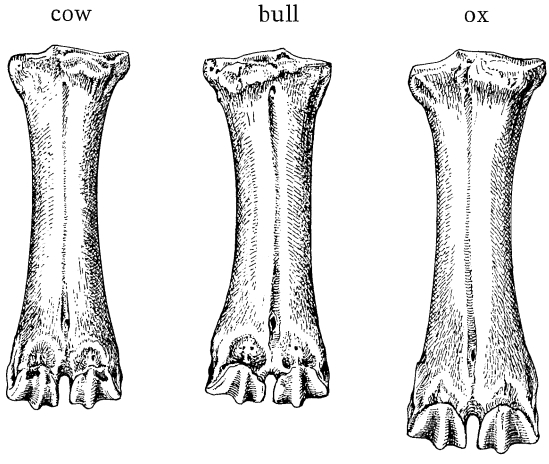
1.20 N'Aissi, child of a Bushman family that was exhibited in Berlin in 1886. In four of the six members of the family, one or more fingers were stunted, as shown on right. "In every sickness of what kind soever it is usual with them to take off extreme joints of the fingers, beginning with the little finger of the left hand."

1.21 New Guinea, 1961: these little Dani girls just lost one or two fingers under a stone adze, as a sacrifice, with no more anesthesia than a hard rap on the elbow. The wounds were dressed in ashes and clay, then the remaining fingers were bent into a fist and wrapped in leaves. Blood ran for several hours; the brave little creatures soaked it up in a handful of grass held under the elbow. They knew they would heal, and that it might happen again.

1.22 Grown-up Dani women, like this one, fondle their children "with hands that are mostly thumbs." Their fingers went to placate the ghosts, together with pigs and shell goods. Infection must have taken place, but it does not seem to have caused much trouble. (Now that the Dani have been civilized, they have traded ritual amputation for cigarettes.)



And when did *Homo sapiens* discover the peaceful use of wounds that we call surgery? The priority is usually assigned to the man who had the idea of making a hole in the head. But before giving him credit, I would like to place on record another possible claim, for the unsung genius who castrated a bull and thereby invented the ox. His case must ultimately hinge on discovery of the proper fossil. Although the bones of an ox are not quite the same as those of a bull (Fig. 1.23), the difference, unfortunately, is relatively small, and the distinction is even more difficult in the presence of female bones. To sort out the three kinds of skeletons would thus be a matter of statistics and would require a large heap of bones.[75] To date, prehistoric sites have not been so generous. However, it is not impossible that archeologists will some day come up with the homely discovery that the first gesture of surgery to leave its mark was castration.[76] The domestication of animals could have started in the neighborhood of 8000 B.C.,[77] but so far it has been impossible to decide just when man discovered that castration was more efficient than persuasion.[78]

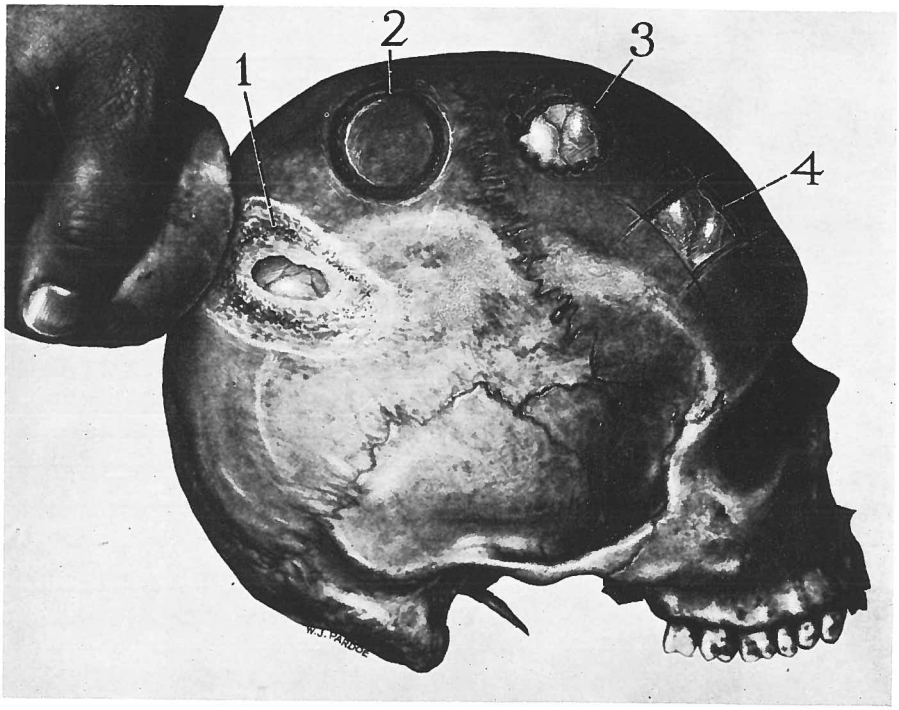


1.23 Marks of castration that could defy millennia: metacarpal bones of a cow, bull, and ox. Contemporary.

As for trepanation of the skull, an operation to remove a portion of the bone, it may have been performed as far back as 10,000 B.C.[79] Examples have been found all over the world, and they never cease to astonish: the several thousand papers on the subject probably exceed the number of specimens. Some of the perforated skulls have nothing to do with surgery: a few may have represented birth defects; many more were worn through by tumors or infections; others were gnawed by rats and mice, or even sanded down by the wind.[80] But those that bear the marks of carving instruments must be the work of man. As far as I know, these are the oldest traces of a surgical act, and of a bold one too, if not a logical one by today's standards.

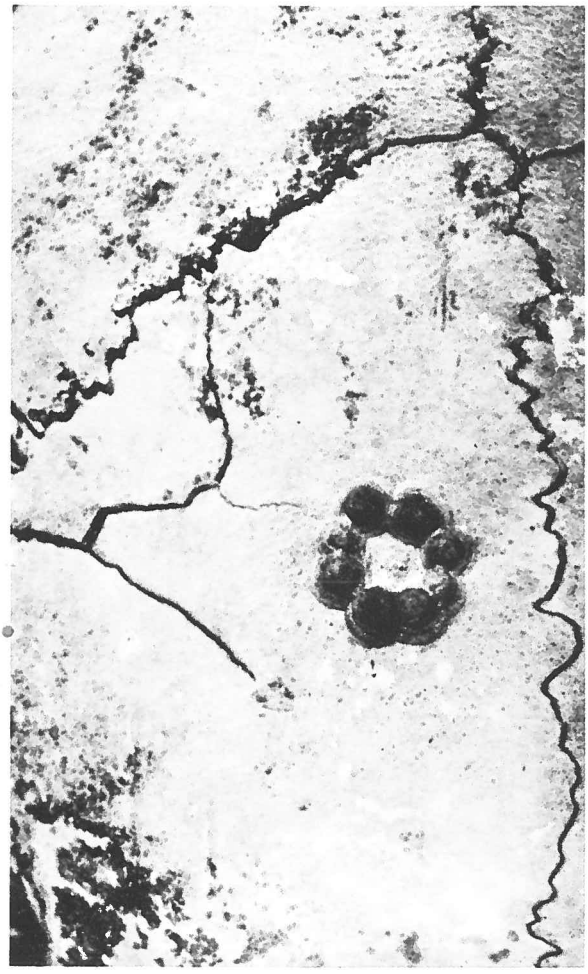
When the patient died soon after the operation, which was by no means the rule, the marks of the instrument are often so clear that it has been

possible to reconstruct the four basic techniques (Fig. 1.24). In a number of skulls the hole is over or near a recent crack, so that the plan of the operator was probably to "relieve" the effect of a fracture. This is certainly true for many, perhaps most, of the skulls from Peru,[81] where the ancient Incas were masters in the art of trepanning (Figs. 1.25–1.26). As the Incas fought with



1.24 Different methods of trepanation: (1) scraping, (2) grooving, (3) boring and cutting, (4) rectangular intersecting incisions. From Lisowski 1967; courtesy of Charles C Thomas, Publisher, Springfield, Illinois.

1.25 Traces of violence and mercy on the skull of a young Inca woman. This is one case in which trepanation was performed for a recognizable purpose: relieving the effect of trauma. The two surgical openings are clearly placed along a crack. Marks of the instrument are visible on the specimen. Incas were all-time masters at trepanation, but this patient must have died of her fracture.



1.26 Frontal bone of another prehistoric Inca woman. Between two recent cracks, trepanation was accomplished by the rare method of drilling. The operator was probably planning to remove the central disk of bone, but left it in place for unknown reasons. The smooth edges of the drill holes suggest some survival. Patients with bad fractures like this one were doomed from the start.

great clubs and sling stones,[82] most of the injuries and trepanations are found on the left side of the skull.[83] In one collection of 273 skulls from Peru, 47 had been trepanned one to five times.[84]

Another specimen comes from prehistoric Sardinia. Its four operations must have been performed about one thousand years before Hippocrates. Three openings have smooth edges indicative of bone healing; the fourth and largest (Fig. 1.27) seems freshly cut and may have been fatal, unless death was related to the fracture that is visible.

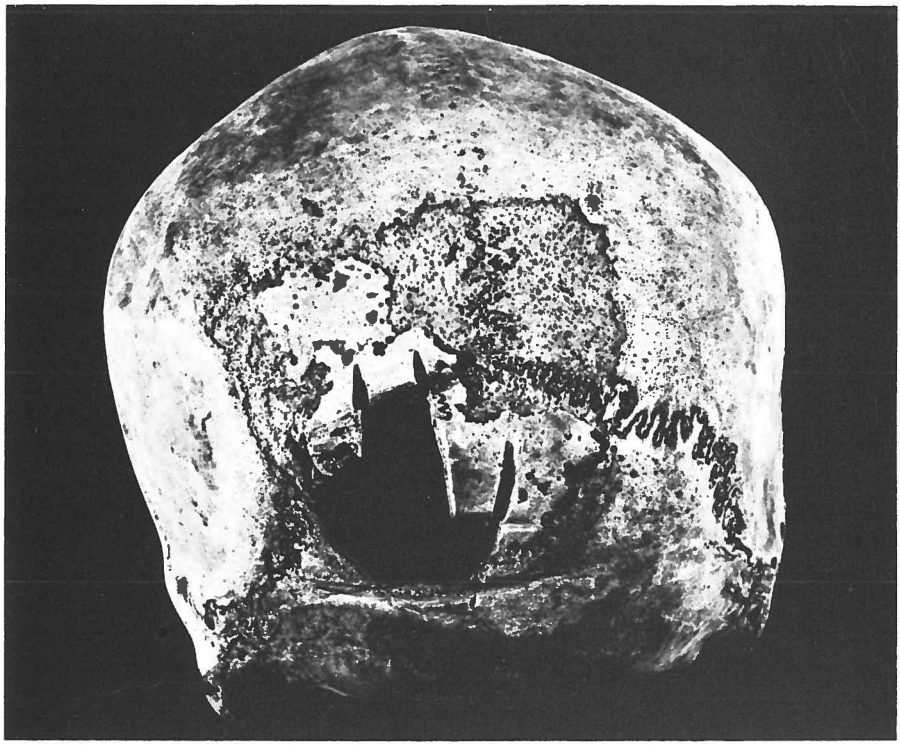
When a prehistoric skull shows a man-made hole but no crack, rather than speculating about the reasons that made the patient ask for (or stand for) a vent in his head, we can go into the brush and ask. Trepanning is an ongoing practice among primitive and not-so-primitive tribes. A British anthropologist who worked in the mountains of Algeria between 1913 and 1921 gave the following account:

The scar of the trepan is very frequently to be found upon the living natives . . . The removal of bone from the skull is, certainly, the most important operation which the Shawiya surgeon attempts, and is the one in which he glories above all others; he therefore, performs it with remarkable frequency. The operation, though believed to require care, is certainly not regarded . . . as critical or even dangerous, indeed . . . Shawiya women . . . have been known to undergo trepanation in order to support fictitious charges of assault against husbands from whom they were seeking grounds for a divorce . . . The native surgeons . . . are unanimous in declaring that injuries resulting from a blow are the sole cause of the favourite operation . . . all . . . agreed that on no account must the *dura mater* be disturbed, as death will inevitably result should this be done, and that the sutures, which are believed to be the patient's destiny written by the hand of Allah [*they are indeed very wiggly*] must be left untouched.[85]

In modern Algeria, then, skulls were trepanned only after local injuries. Historically, magic certainly played a role. In the words of Dr. Margetts, a Canadian psychiatrist who interviewed both operators and operated in East Central Africa, the reasons for operating could be "practically everything relating to the head."[86]

The rate of survival from primitive trepanning, indicated by healing processes at the edges of the bone, is astonishing in practically all the series that have been studied: it can come close to 100 percent. One modern operator interviewed by Dr. Margetts boasted of over one hundred operations with no casualties. One of his patients had given up thirty square inches of skull in a series of sittings, with no complications except a very soft head. Doubtless men who undertook these operations with stone or bronze tools

1.27 Traces of prehistoric surgery in a skull from Nuraxi Figu in southwest Sardinia, 2000–1500 B.C. At that time southern France was a major center for trepanation. This subject was operated on in four places (two on the opposite side). The crack (center) is probably a fracture caused by a blow just before death; the last, large trepanation (right) may have been a treatment for this blow.

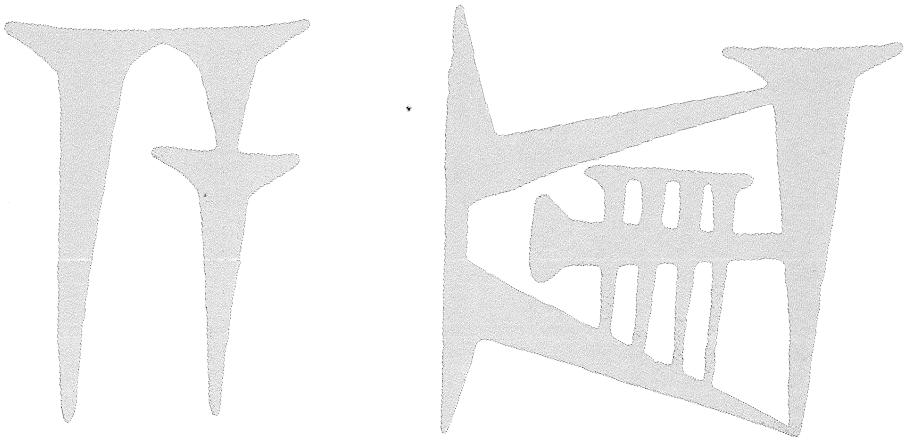


1.28 Not all prehistoric surgeons got away without infection, even in Peru. The abnormal surface around this trepanation hole betrays osteomyelitis; its angular outline probably corresponds to the extent of the surgical scalping. The surgical technique is uncommonly rough, which may well have had something to do with the poor result.

were encouraged by previous "success." This is not to say that prehistoric patients were never plagued by infection; but in most cases the outer surface of the skull around the operated site is smooth, indicating that bacteria caused no major complication. In only a few cases did osteomyelitis leave its marks (Fig. 1.28).[87]

On the whole, therefore, skull trepanning in the brush has always been, and still is, a substantially safe procedure. So we have here the paradox of primitive cultures obtaining a survival rate approaching 100 percent for the same operation that in highly differentiated cultures—during the first half of the 1800s—caused a mortality rate approaching 100 percent. By then, trepanation was so dangerous that the first requirement for the operation, wrote one authority, was "dass der Wundarzt selbst auf den Kopf gefallen sein müsse"—"that the wound surgeon himself must have fallen on his head."[88]

And here lies a partial answer, short of delirium, to the question of early man's resistance to infection. Stone Age man—whatever other worries he may have had—was safer from wound infection than many of his successors on three counts at least: there were no attending physicians to carry embattled staphylococci from one patient to the next; crowding in cities and hospitals had not yet led to the breeding of virulent strains; and man-made complications, which will occupy a large part of this book, were at a minimum.



2 The Asu

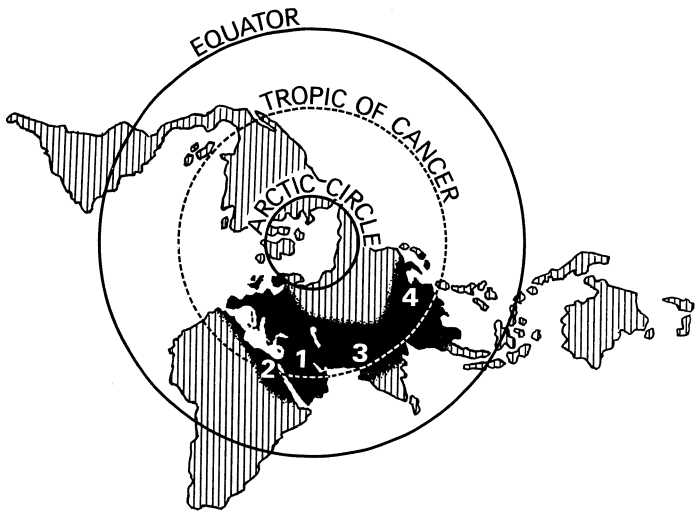
Homo sapiens threw another switch, and History was turned on. That was the invention of writing.

Where did it happen? Most likely in southern Mesopotamia, now Iraq, where the Sumerians were writing around 3100 B.C.[1] Hence, the Sumerians deserve to come next on the stage, after the fossils.

Mesopotamia: A Tale of Mud

A miraculous combination took place in Mesopotamia: rivers carrying the right kind of mud, and people knowing exactly what to do with it. Of course, the Sumerians were not alone in doing great deeds in the Bronze Age world; other great civilizations were being nourished by the Nile, the Hindus, the Yellow River (Fig. 2.1). But when the days of Mesopotamia were over, after more than three millennia, it could be said that nowhere else had men and mud done more for each other.

Surely it was not an easy land to live on. Its scorching winds, its torrential rains were unknown in Egypt. Two rivers, the Tigris and the Euphrates, gave it life, but theirs were unruly waters (Fig. 2.2), prone to rise fitfully,[2] and quite unlike those of the majestic and predictable Nile. They had to be tamed by a precarious system of canals that was a constant worry, and they carried silt at such a rate that the Sumerian beaches on the Persian gulf are now perhaps one hundred miles inland (Fig. 2.3).[3] Marshes offered plenty of reeds—called in Akkadian *qanū*, related to the English *cane*[4]—but timber and stone were scarce.



2.1 The four main river-valley civilizations of the ancient world: (1) Mesopotamian, (2) Egyptian, (3) Indian, (4) Chinese. Areas where bronze was used are shown in black.

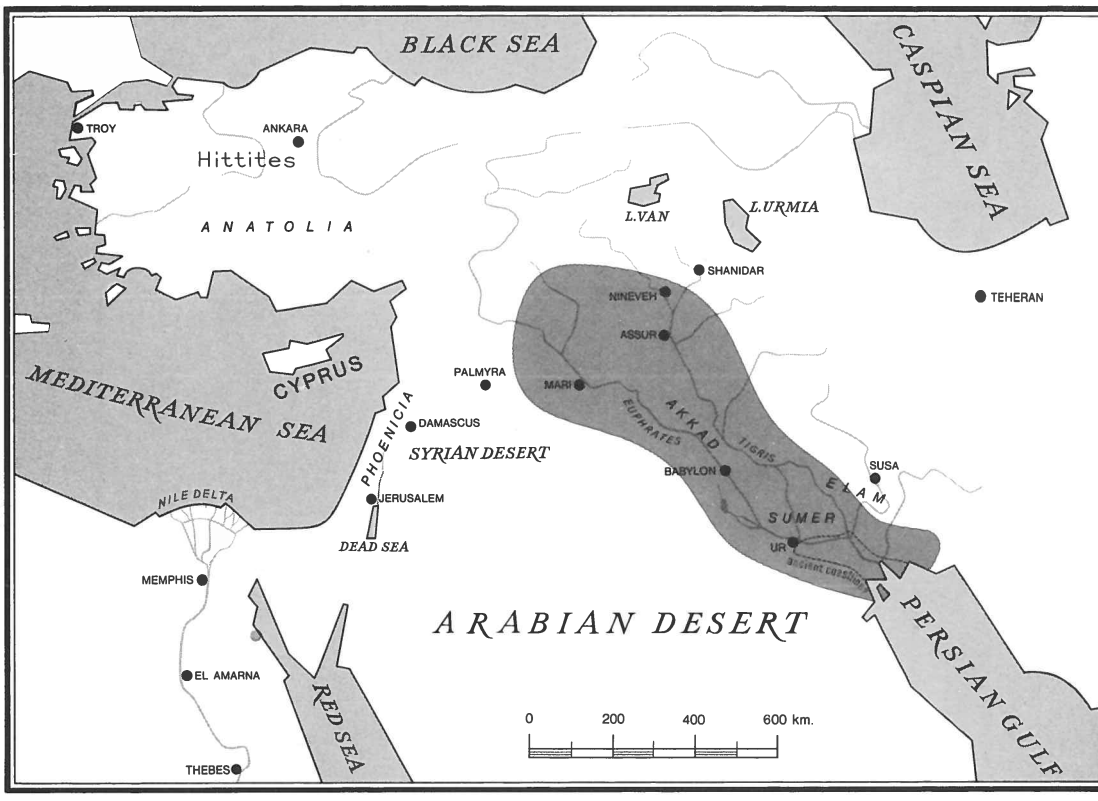
The houses were built of sun-dried bricks, hidden behind an extra layer of mud.[5] When a house became obsolete, its walls were pushed over and a new one was built over the fill, a foot or two higher. Slowly the cities became perched on mounds of clay. The clay, of course, was also shaped into pottery; then the pottery was turned on wheels; and later the wheels were applied to carts, a step that the Egyptians were unable to make on their own.[6]

Wheel and clay were also combined to produce legal documents. Strung around their neck, worthy citizens carried a little cylinder of stone or other hard material, engraved all around. Whenever they were called upon to sign their name on legal documents, which must have been often in that highly bureaucratic society, they rolled their cylinder over the wet clay tablet (Fig. 2.4). And finally, not long after the invention of the wheel—perhaps only a few centuries later—the men of the lowlands turned mud and reeds into writing materials.

The first Sumerian writings were not cuneiform at all: they were drawings of objects (pictograms), traced in clay, probably with a pointed reed. Later the continuous line-drawing was replaced with many bits of short, wedge-shaped ("cuneiform") lines, obtained by pressing the tip of the reed, held sideways, into the clay. Thus, the Sumerians put together a set of about 350 signs, mostly ideograms, well suited to their monosyllabic language (Fig. 2.5).

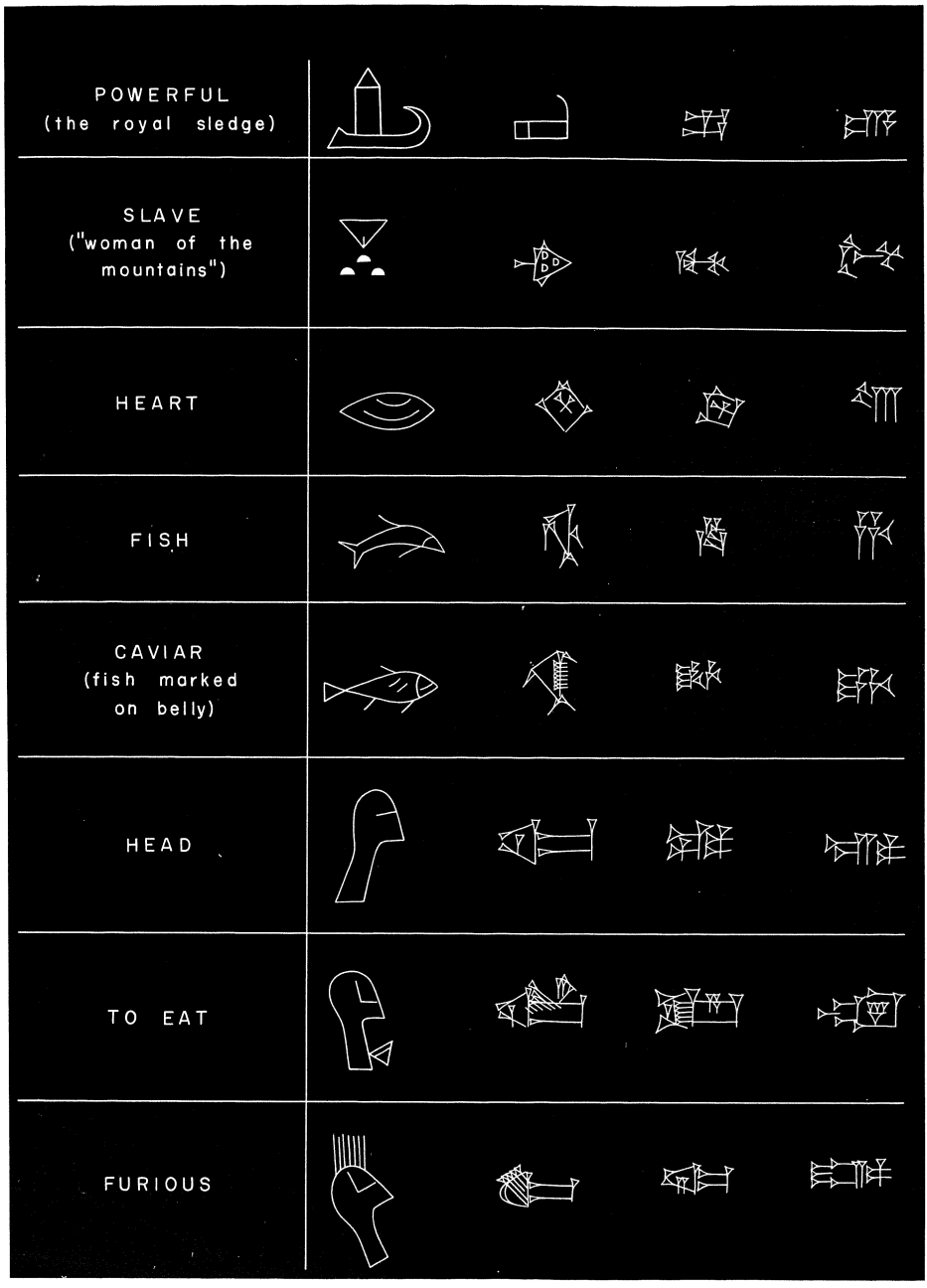
Around 2600 B.C. these inventive people were overrun by the Akkadians, who spoke an entirely different, Semitic language. The newcomers borrowed the Sumerian written signs (somewhat as the Japanese borrowed Chinese signs), while Sumerian itself survived as Mesopotamia's classical language, just as Greek and Latin survive today. In fact, the single continuous thread that runs through all of Mesopotamia's turbulent history, apart from the mud, is its Sumerian heritage.

2.2 Rivers, floods, and silt were at the heart of Mesopotamian life. The sacred city of Dur-Untash (bottom center) was built around 1250 B.C. with clay carried from the banks of the treacherous river above.



2.3 Mesopotamia (darkly shaded) and its neighbors.

2.4 Cylinder seal in action: a winged dragon trying to bite off a man's head; the offering of a goat to Shamash, the sun-god; and Ishtar, goddess of both love and war. The scene might possibly tell the gratitude of a patient after a narrow escape. Circa 1700 B.C.; almost twice actual size.



2.5 The development of writing from Sumerian pictograms (first column) to late Assyrian and Babylonian cuneiform (fourth column). At an early stage (second column) the symbols were turned 90 degrees counterclockwise (probably for convenience, as the clay tablet was held in the left hand) and drawn with cuneiform signs; then the drawings were progressively simplified. The Sumerian signs have a charm of their own, but lack the beauty of Egyptian hieroglyphs; for example, compare the symbol for *heart* with the corresponding Egyptian sign (Fig. 3.6).

2.6 Closer view of Dur-Untash, silted up and scarred by rainwater, as time had left it. The temple-tower or *Ziggurat* (center) is barely distinguishable from any other hill. Ziggurats were made of large, sun-dried clay bricks, covered with a thin shell of baked brick. When this facing was gone, the whole tower was exposed to erosion.

As kingdoms came and went, and Akkadian dialects took shape—Assyrian, Babylonian, Chaldean—the number of cuneiform signs grew tremendously and then settled to about 600, a number that only an elite of scribes could master. The man in the street continued to sign the clay with his cylinder seal or, if he had none, with the hem of his garment, or even with his fingernails.[7] This cumbersome way of writing in clay lasted more than three thousand years and spread over much of western Asia, while the civilization that had produced it reached its peak around 1600 B.C., then began to decline. It was already dying in 547 B.C. when Cyrus the Persian conquered Babylon.[8] Cuneiform writing lingered on, despite wave after wave of new invaders and competition from the far simpler alphabetic systems, until finally it flickered out around 75 A.D.[9] As the writing sank into oblivion, it carried with it most of its messages. All the rest vanished too: the cities melted back into the ground (Fig. 2.6); silt erased the network of canals; the huge temple-towers of biblical fame—one was the Tower of Babel[10]—crumbled into mounds to match those of the countryside. Time did its job so

2.7 Dur-Untash begins to reappear. The three walls enclosed the clergy (inner square), the king and nobles (middle ring), and the people (outer square).

thoroughly that in the year 1800 anyone interested in Mesopotamian history would have to rely, primarily, on a few paragraphs in the Bible.

The resurrection began in 1802, when the first few words of cuneiform script were deciphered.[11] Today, Assyriology—the study of all the Mesopotamian civilizations—is a world of its own, so sophisticated that the translations of cuneiform tablets include, quite routinely, a list of scribal errors. The mounds that were Mesopotamian cities, gigantic crystals laid down by dozens of generations of busy people, are now the archeologist's dream. A typical mound contained fourteen periods layered within one hundred feet[12] (Fig. 2.7).

The Sumerians, whose name had been lost, were rediscovered less than a century ago.[13] It turned out that their civilization had never died at all: some of their myths were echoed in the Bible. Even the Biblical Deluge was a reality of Sumerian history.[14] Babylonians listed their kings as "before the Deluge" and after. They even had a Noah, complete with ark and dove, whose name was Ut-Napishtim in Sumerian, Atra-ḫasīs in Akkadian.[15]

Mesopotamian Medicine: The Sources

Cuneiform writing is practically the only source of information about Mesopotamian medicine. No instruments, no artistic representations are known, and skeletal remains are minimal.[16] The literature of neighboring countries is almost silent; the Greeks could have little to tell us about it anyway, since the greatest period of Mesopotamian civilization, the centuries around 1600 B.C., came long before Homer.

The texts of medical interest amount to no more than a thousand tablets or fragments. Consider that we are exploring a period that ranges—roughly—from 3000 B.C. all the way to the beginning of the Christian era. All along this path the "medical" tablets are sprinkled sparingly, a couple here, a fragment there, with huge time gaps in between. The great bulk occurs very near the end and derives from one single treasure-trove: the library of Assurbanipal, the last great king of Assyria.[17] This collection was buried with the palace when Nineveh was destroyed in 612 B.C., and it reappeared in 1853 as a ditch full of tablets: about 20,000 in a layer five feet deep. The king had been so systematic that his archives are a near-complete fossil of the literature in his day.[18] It was already late, of course; but not too late, because the scribes were in the habit of copying and recopying ancient tablets, so that many of the texts are actually much older than Assurbanipal's reign, perhaps by as much as a millennium[19].

Out of this mass of material, Campbell Thompson of Oxford collected 660 tablets of a medical nature.[20] The vast majority contain prescriptions. Real medical books with flowing text do not exist; however, certain series of tablets with similar entries are often referred to as treatises,[21] such as the "Treatise on Prescriptions for Diseases of the Head."[22]

The largest collection of this kind is the "Treatise of Medical Diagnoses and Prognoses,"[23] a group of three thousand entries on forty tablets, whereby the future of patients could be foretold, depending on certain signs, bodily, natural, or other. Here, too, most of the tablets were actually written a millennium or more after the peak of Akkadian civilization. The patience and knowledge required to reassemble these forty tablets is hard to conceive. Labat inherited the problem as a transcendental puzzle in cuneiform, with bits of different editions that had been written centuries apart in various parts of Mesopotamia, and are now scattered among the museums of two continents. The text is both interesting and entertaining despite the large number of incomplete lines. It is a list of diseases arranged from head to foot. In fact, many are not true diseases but "situations" of prognostic significance, like the number of openings on the nipple of an expectant mother (5 and 6 are bad, 7 to 10 are good). The actual prognostic significance of the work, in the modern sense, is about nil. Its value is more general, for many of the symptoms described are real (like *amurriqânu*, "jaundice"), and some relationships, like venereal infection, are correctly observed. However, the treatise is essentially a handbook of the sorcerer,[24] not a manual of medicine.

The remaining sources are marginal: allusions in laws, letters, and

literary texts. Not much, if you wish; but how dangerous. The non-Assyriologist who tries to explore this material is bound to make a fool of himself unless an expert leads him step by step. Translations and books with all the outward appearance of classics are painfully outdated and misleading; recent reviews of the medical material are almost nonexistent;[25] whole volumes of new material are being "published," but in cuneiform;[26] much else is still in the form of tablets.[27] As if this were not enough, one also has to contend with a shattering truth, so obvious to every Assyriologist that it is not spelled out anywhere: Akkadian does not handle like Greek or Latin. The translation of many words still carries a *probability tag,* which is well known to the professional and may or may not keep changing with time, so that the printed translation has no absolute value. This is a fact of life; nothing much can be done to help the outsider. It follows that no text can be quoted, let alone interpreted in medical terms, without consulting first an Assyriologist. Roses may have become mustard; cress may have become a bush with thorns.[28] A beautiful charm that begins "The Sieve, the Sieve, the Red Sieve"[29] read in an earlier translation "O Willow, Willow, dark Willow."[30]

Without the help and understanding of some of the world's leading Assyriologists, this chapter would have been a comedy of errors.

Searching for Mesopotamian Wounds

Since the wound came before the surgeon, we shall begin by searching the cuneiform texts for the word *wound.* Please note that this is much more significant than looking up an entry in a dictionary: until that time, the wound had been a fact in the flesh; from then on it was also a concept inscribed in clay.

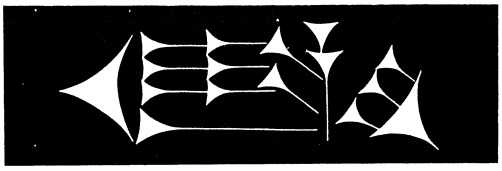
Surprisingly, there seems to have been no single, precise Akkadian equivalent for our term *wound.* I was looking forward to some telling Sumerian pictogram, but none with this meaning has come down to us. In most cases the text has the rather loose word *murṣu* (Fig. 2.8), which meant "disease" as well as "diseased part," so that the idea of wound must be guessed from the context, as in the following examples:

pān	*murṣi*	*takappar. . .*
the surface	of the sick part	you shall clean . . .

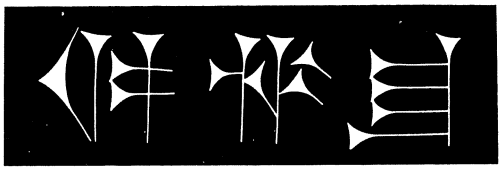
pān	*murṣi*	*ḫimēta*	*tapasshash . . .*
the surface	of the sick part	with butter	you shall anoint . . .

ana	*libbi*	*murṣi*	*tashakkan.*
into	the inside	of the sick part [*wound?*]	you shall put [*it*].[31]

Other words come closer to *wound* but have a special connotation: *niksu,* "cut"; *liptu,* "blow"; *shimittu,* "bruise"; and *dikshu* (Fig. 2.9), "piercing pain" or "wound caused by piercing," but a German dictionary translates it as "swelling."[32] A host of words are tentatively translated as "abscess," "pustule," "eczema," and other kinds of skin lesions. If the Assyriolo-



2.8 An Akkadian ideogram: *murṣu,* "the sick place"—sometimes a wound.



2.9 Another Akkadian ideogram: *dikshu,* written here *di-ik-shu,* as it might have appeared around 1000 B.C.; meaning either "piercing wound" or "piercing pain".

gist called to become a diagnostician is sometimes puzzled, the layman is outright bewildered to find that holes and bumps are thrown together, since the *Reallexikon der Assyriologie* registers a single entry for *Geschwulst* and *Geschwür,* "tumor" and "ulcer."[33] Perhaps each Akkadian term had a reasonably precise clinical equivalent in its day; but now, I suspect that most could be translated just as well by "sore."

With medical art at such a primitive stage, we cannot expect to find much evidence of a correlation between wounds and symptoms. However, it would be unfair not to recall two bas-reliefs which are almost textbook evidence of anatomo-clinical correlations: the famous lioness wounded in the spinal cord, showing the expected paralysis of the rear end (Fig. 2.10), and a lion wounded in the chest, demonstrating that torn lungs cause bleeding by the mouth (Fig. 2.11).

Two Ways To Treat

Given this ample supply of *liptu* and *dikshu,* it remains to be seen what a citizen could do about them. The tablets offer a choice of remedies, which seem to fall into two broad categories: primitive first aid and outright sorcery. The choice was real, for it is well established that injuries, in the days of Babylon, could be treated in two different but complementary ways, like any other disease.[34] Here is one method:

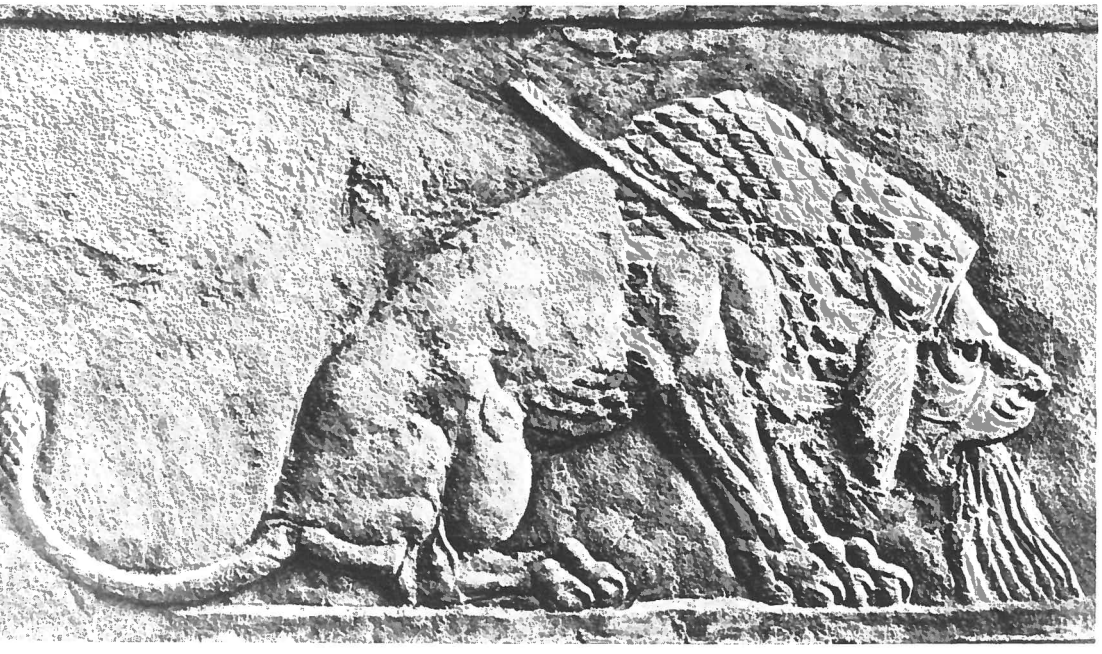
Incantation. If a man has a blow on the cheek, practical prescription for this: Bray [*a plant*] in water from the well of Marduk, collect therein dust from four crossroads . . . Seven and seven times cleanse his mouth.[35]

Here is the other method, prescribed for the same injury:

If a man is sick with a blow on the cheek: pound together fir-turpentine, pine-turpentine, tamarisk, daisy, flour of *Inninnu.* Strain; mix in milk and beer in a small copper pan; spread on skin, bind on him, and he shall recover.[36]

2.10 Clinical observation in art: an injury to the spinal cord (top arrow) paralyzes the rear end.

2.11 Another clinical observation in art: a wound in the lungs brings blood to the mouth.



The first remedy is from the *áshipu* or "sorcerer," the second from the *asu* or "physician" (pronounced *ah'zoo*).[37] In the mind of the scribes these two forms of therapy must have had similar value, because they were recorded pell-mell on the same tablets.[38] Kings certainly used both; their correspondence with royal physicians is preserved in several court archives, together with whole volumes of general advice from sorcerers.[39] The two types of healers were probably collaborators rather than competitors: the sorcerer used drugs, and occasionally the asu used charms.[40]

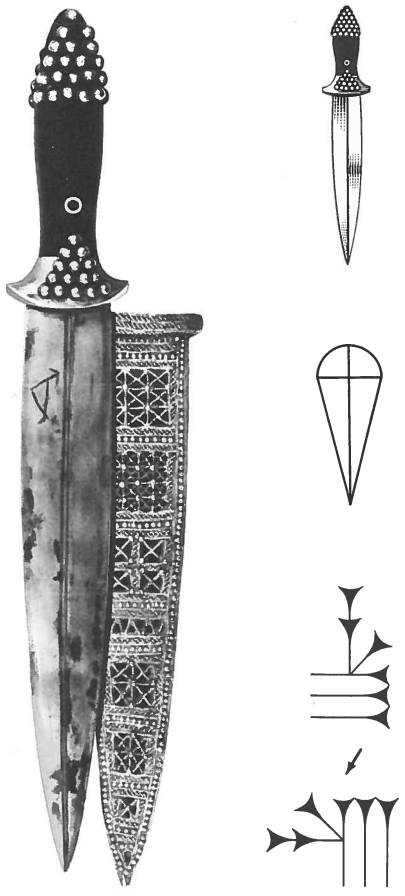
With time, as the Akkadian world declined, the asu ceased to be mentioned and the sorcerer took over; a retreat of physic before magic that we shall find in another ultraconservative society, the Egyptian.[41] It is therefore not surprising that the only medical event recorded by art, as far as is known, was treatment by magic: several amulets show the patient lying on a bed, arms raised, between masked sorcerers who are chasing away Lamashtu, a fierce, lion-headed goddess who specialized in persecuting pregnant women (Fig. 2.12).[42]

How the sick Akkadians chose between the asu and áshipu we do not know. One factor may have been that the sorcerer was a member of the clergy.[43] Today we equate drugs and magic with good and bad, respectively. Given the drugs of the time, we might well have preferred magic. But whatever the choice, one point is clear: both men filled a need; *both practiced medicine.*

The name of the asu has survived in the Biblical name of King Asa, which was probably short for Asa-El, "God-Heals" (another way to say God-Heals was Rapha-El, which gave the name Raphael).[44] There was no particular term for surgeon, probably because the asu himself took to the knife when necessary. This he definitely did. The word for knife was the same as for "barber's razor," *naglabu.*[45] Two of the signs used to write it derive from the Sumerian pictograms for dagger and hand (Figs. 2.13–2.14). In the Royal Library at Nineveh the medical tablets bear an official stamp, in which King Assurbanipal boasts of having registered on tablets the three ways to health: "the art of healing with drugs" (*bultítu*), "the way of operating with the brass knife" (*šipir bêl imti*), and "the prescriptions of the sorcerers" (*urti mashmashē*).[46] Perhaps he did, but somehow the brass knife has left few written traces, as we shall see.[47] And not a single tablet describes what was done about war wounds on the battlefield.

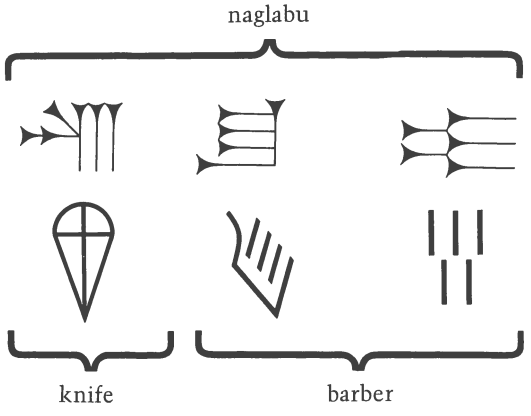
This scarcity of surgical literature might be, of course, a matter of chance. Labat suggests a different explanation.[48] The scribes did not try to record all existing knowledge. They concentrated only on those traditions that required an *aide-mémoire,* a written guide, leaving the rest to oral transmission. So they never bothered to describe the daily tasks of most artisans. They did make an exception for the perfume makers and the glass makers; apparently these craftsmen thought enough of their work, or thought that there was enough theory about it, to have it explained in writing.[49] But the simple ways of Mesopotamian surgery may not have been worth explaining in the clay.

2.12 Amulet depicting the "other way" of treating disease: two sorcerers disguised as fish try to induce Lamashtu (the lion-headed goddess) to retreat from the patient, cross the Bitter River, and go back to the world below. Slightly enlarged.



2.13 Sumerian dagger of solid gold, c.2500 B.C. From daggers such as this came the Sumerian pictogram (middle right), and finally the cuneiform ideogram (bottom right), for the surgeon's knife, *naglabu*. In this figure and in following ones, the oblique arrow indicates the 90-degree turn incurred by the cuneiform symbols.

2.14 The connection between barbers and surgeons goes a long way back. The Assyrian word for the surgeon's knife, *naglabu*, could also be written with three signs that originally meant "knife [of] barber." In the original Sumerian pictograms (bottom) the barber's hand is quite obvious (the meaning of the last sign is not clear).



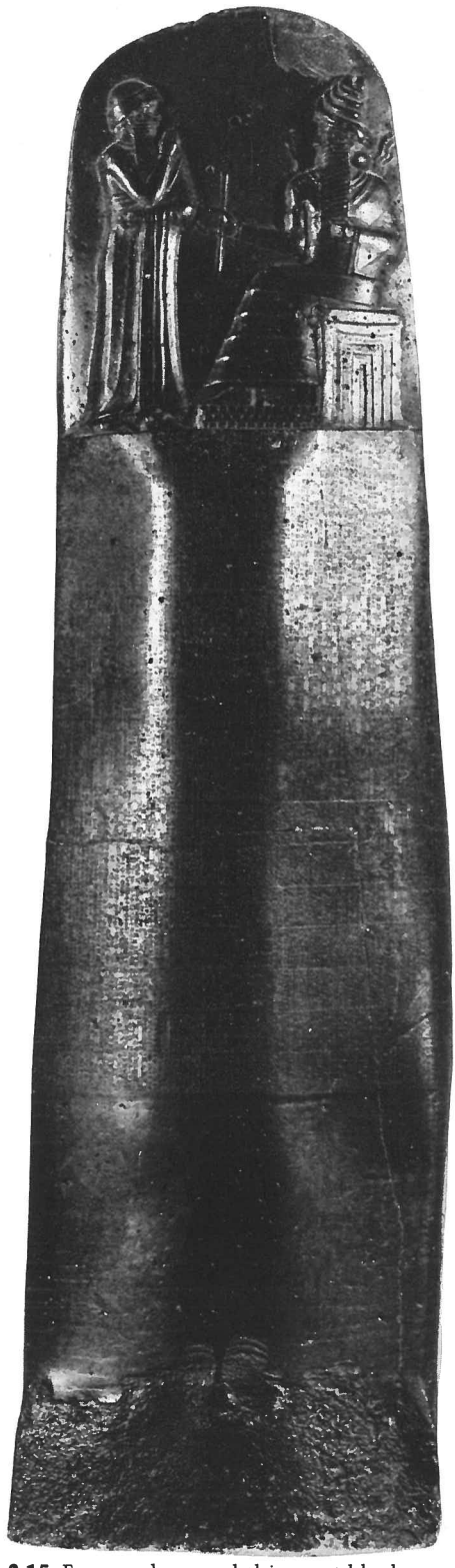
Surgery As Seen by the Law

The proudest document of Akkadian surgery, and one of the oldest, is not a tablet but a huge black stone; a block of polished diorite, eight feet high, engraved with the 282 laws of King Hammurabi's Code, about 1700 B.C. It was found—broken—in 1901–1902 by a French expedition, reassembled, photographed, translated, and published in a superb volume, all within eleven months.[50] As one of the outstanding documents of humanity, this stone deserved the haste. It is now at the Louvre (Fig. 2.15).

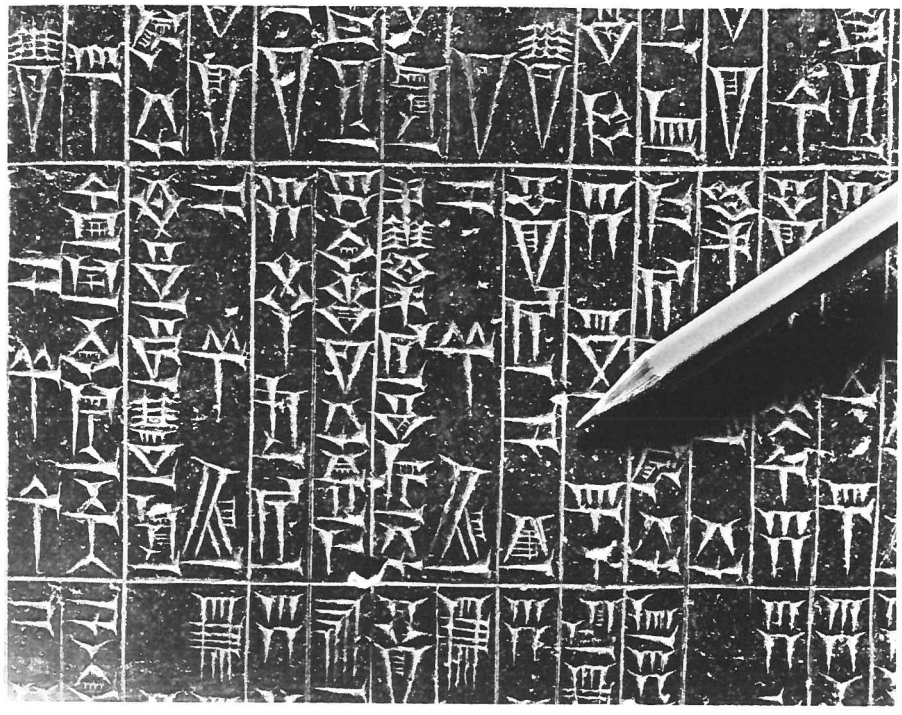
The stone will speak for itself; but notice, to begin, that the laws concerning the surgeon follow those that deal with assault and battery:

204: If a commoner has struck the cheek of a[*nother*] commoner, he shall pay ten shekels of silver.
206: If a seignior has struck a[*nother*] seignior in a brawl and has inflicted an injury on him, that seignior shall swear "I did not strike him deliberately," and he shall also pay for the physician.
215: If a physician performed a major operation on a seignior with a bronze lancet and has saved the seignior's life, or he opened the eye-socket [*nakkaptu*] of a seignior with a bronze lancet and has saved the seignior's eye, he shall receive ten shekels of silver.
216: If it was a member of the commonalty, he shall receive five shekels.
217: If it was a seignior's slave, the owner of the slave shall give two shekels of silver to the physician.
218: If a physician performed a major operation on a seignior with a bronze lancet and has caused the seignior's death, or he opened the eye-socket [*nakkaptu*] of a seignior and has destroyed the seignior's eye, they shall cut off his hand.
219: If a physician performed a major operation on a commoner's slave with a bronze lancet and caused [*his*] death, he shall make good slave for slave.
220: If he opened up his eye-socket [*nakkaptu*] with a bronze lancet and has destroyed his eye, he shall pay one-half his value in silver.
221: If a physician has set a seignior's broken bone, or has healed a sprained tendon, the patient [*lit. "the owner of the injury"*] shall give five shekels of silver to the physician.
222: If it was a member of the commonalty, he shall give three shekels of silver.
223: If it was a seignior's slave, the owner of the slave shall give two shekels of silver to the physician.
226: If a brander cut off the slave-mark of a slave not his own without the consent of the owner of the slave, they shall cut off the hand of that brander.[51]

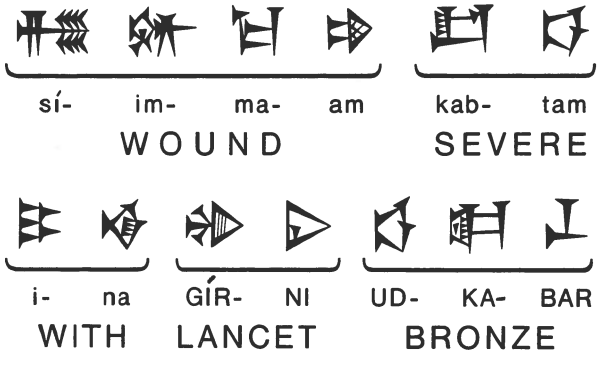
These entries are all that may be considered to have any reference to medical practice: which means that *the Code did not hold the physician responsible unless he used his knife,* as in law 215. Other translations of that particular law are actually phrased, "If a physician . . . operates a man of a severe wound"[52] or "makes a deep incision."[53] Any other condition, treated by nonsurgical means, was not subject to the penalty of malpractice. This was in keeping with the Akkadian concept of disease: if someone became ill, it was either his own fault for having committed a sin, or he had become the victim of outside agents, such as an evil spirit, a god, cold, dust, or a bad smell.[54] The physician could not be held responsible for any of these causes.



2.15 Engraved around this great black stone, nearly eight feet tall, are the laws of Hammurabi, c. 1700 B.C. At the top is the king himself, receiving the word from Shamash, the Sun-god.



2.16 Hammurabi's law 215, which refers to the surgeon's knife. The pencil, shown for scale, points to the letter 𒀀 *A* of *asu*, "physician."



2.17 Locating the *wound* and the *lancet* in the text of Fig. 2.16, tipped to the left so that the lines read horizontally.

In contrast, a wound wilfully caused by a man, physician or not, had to be the responsibility of that man (Figs. 2.16–2.17).

The cutting of the *nakkaptu* has given rise to half a dozen translations, mostly centered on the notion that the asu was operating for a cataract, as was surely done in ancient India. A close look at the word itself rather suggests some operation around the eye.[55] Even less is known about the nature of the other surgical operations, except that the surgeon's fees appear to have been as stiff as the punishments mentioned in the Code. The fee for a "deep incision on a seignior" was ten shekels of silver: enough to cover the labor for a substantial house or to pay a carpenter for 450 working days (that was when the Code was written; now, 85 grams of silver are worth just 9 dollars[56]). However, it is not at all sure that the asu really made a fortune on his surgery,

or that he staked both his hands at it, because ancient codes did not necessarily correspond to real life. Judges did not feel bound by the written law. Of the legal documents that have been found, none refers to a law of Hammurabi's Code.[57]

Two laws in the Code mention the *asu alpim u lu imērim*, "physician of an ox or an ass":

> 224: If a veterinary surgeon [*lit. "a physician of an ox or an ass"*] performed a major operation on either an ox or an ass and has saved [*its*] life, the owner of the ox or ass shall give to the surgeon one-sixth [*shekel*] of silver as his fee.
> 225: If he performed a major operation on an ox or an ass and has caused [*its*] death, he shall give to the owner of the ox or ass one-fourth its value.

Of this veterinary surgery there are no other records, but it certainly included castration, at least of animals. And if the asu alpim did not practice castration on people, somebody else certainly did,[58] because it was a form of punishment[59] and possibly a form of "domestication." Court employees were distinguished as either "bearded" or "eunuchs."[60]

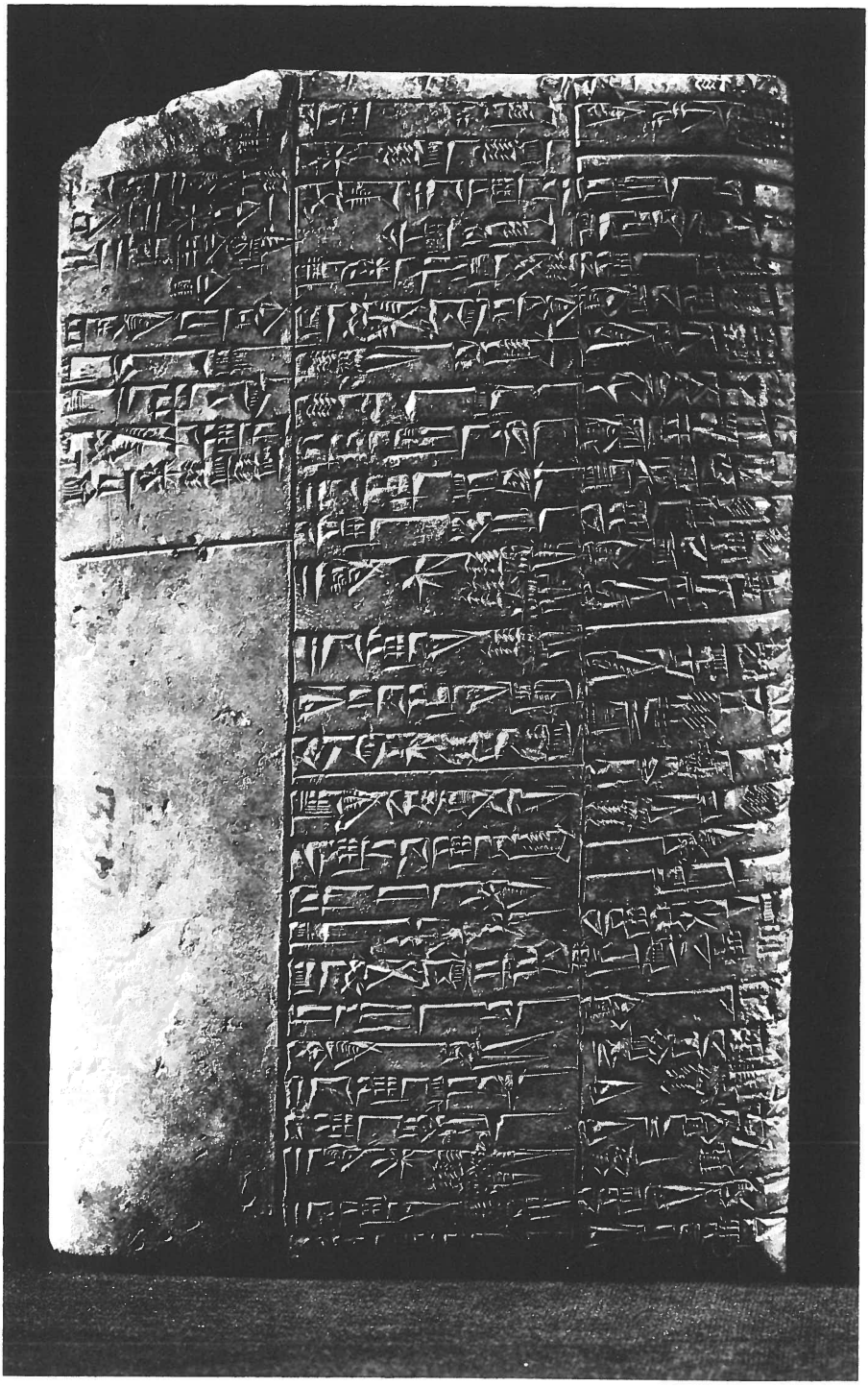
To sum up, if it were not for Hammurabi's Code of Laws, all memory of surgical deeds in Babylon around 1700 B.C. would have been lost. Note that surgery as a craft was barely worth mentioning in clay; but *when it became an object of the law, it was engraved in stone.* Such was the scale of values in the Land Between the Rivers. The Sumerians alone left us at least 150,000 legal and administrative documents,[61] but only two medical tablets.[62] I take this to mean that—in those days at least—wrong was considered worse than disease.

Three Healing Gestures

In the treatment of wounds, there are three gestures that must be practically as old as writing: washing (which is surprisingly not mentioned in Egyptian medicine), making plasters, and bandaging. This we know for sure, because all three appear in the world's oldest medical manuscript: a small clay tablet carefully written in Sumerian around 2100 B.C. (Fig. 2.18). In a sense this precious document is disappointing, because it carries only prescriptions with no mention of diseases. However, of the fifteen prescriptions, twelve are for external use, and eight of these are plasters, which suggests that they may have been intended for local diseases or injuries.

The text is difficult; it was tackled several times,[63] and the translation may have to be retouched in years to come, but the unknown author's selection of drugs comes through quite clearly. There is no real difference between his pharmacy and that of much later texts.[64] For example, one prescription reads:

> Pound together: dried wine dregs, juniper and prunes; pour beer on the mixture. Then rub [*the diseased part*] with oil, and bind on [*as a plaster*].[65]



2.18 The world's oldest poultices are described in this famous Sumerian tablet, which is also the world's oldest medical text. The style of writing dates it from the Third Dynasty of Ur, c.2158–2008 B.C. or a little earlier. The oldest Egyptian papyrus, the Kahun papyrus, was written around 1850 B.C.

The Sumerians were great beer lovers: they brewed at least nineteen brands—there is a whole book on the subject.[66] The alcoholic content of beer is much too low to have any significance as an antiseptic. However, as the antiseptic properties of wine depend on components other than alcohol, it is possible that beer too contains such antibacterial substances. As to juniper, under the name of *burashu* it later became the most used ingredient of Akkadian pharmacy.

The following prescription is more ambitious:

> Pass through a sieve and then knead together: turtle shell, naga-si plant, salt and mustard. Then wash the diseased part with beer of good quality and hot water, and rub with the mixture. Then friction and rub again with oil, and put on [*a plaster of?*] pounded pine." [67]

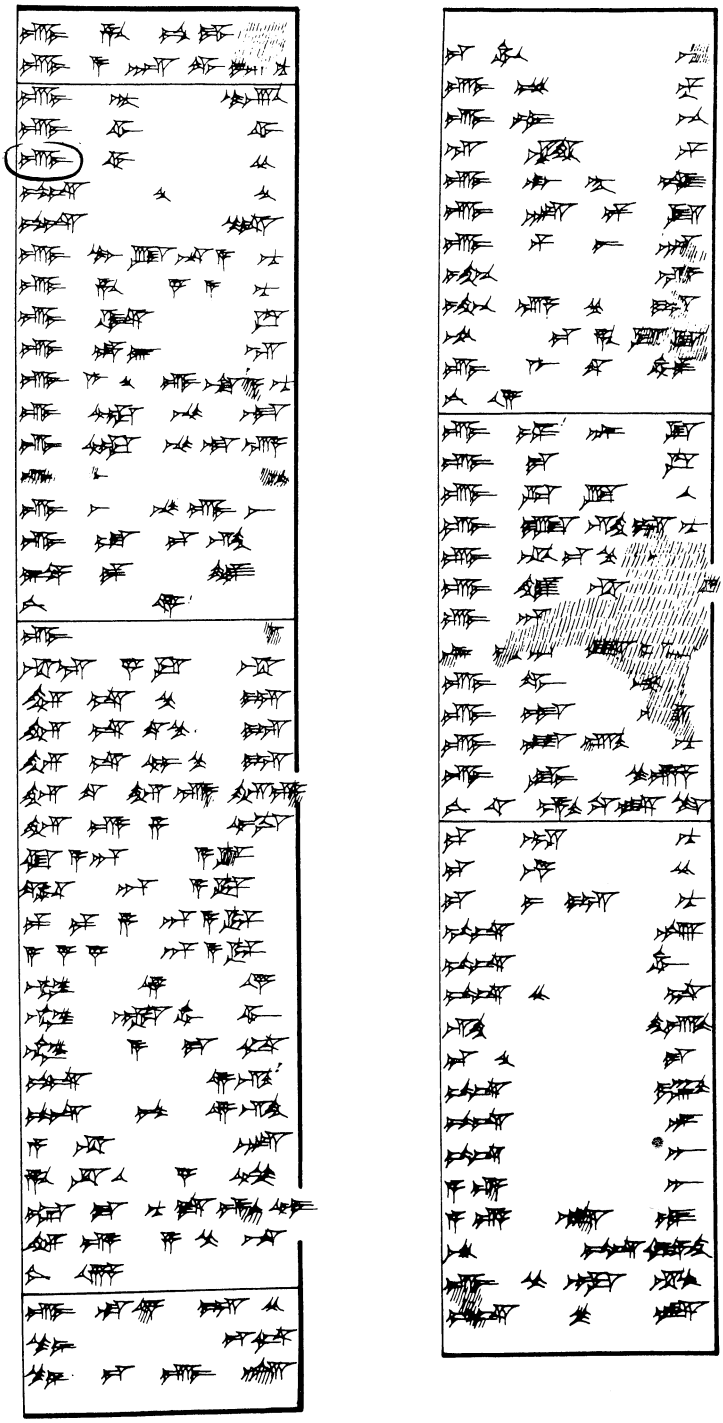
Note that the diseased part is first washed with beer and hot water. A Sumerian could scarcely have chosen a better wound-wash, though a kind of liquid soap was also already available.[68] The first rubbing, with a mixture including salt and mustard, may have been intended to cause stinging; perhaps by then the patient already felt that if the medicine stings, it really works. Another prescription reads:

> Take some river sediment, pound it, knead it with water; then rub the diseased part with mineral oil, and bind on as a plaster.[69]

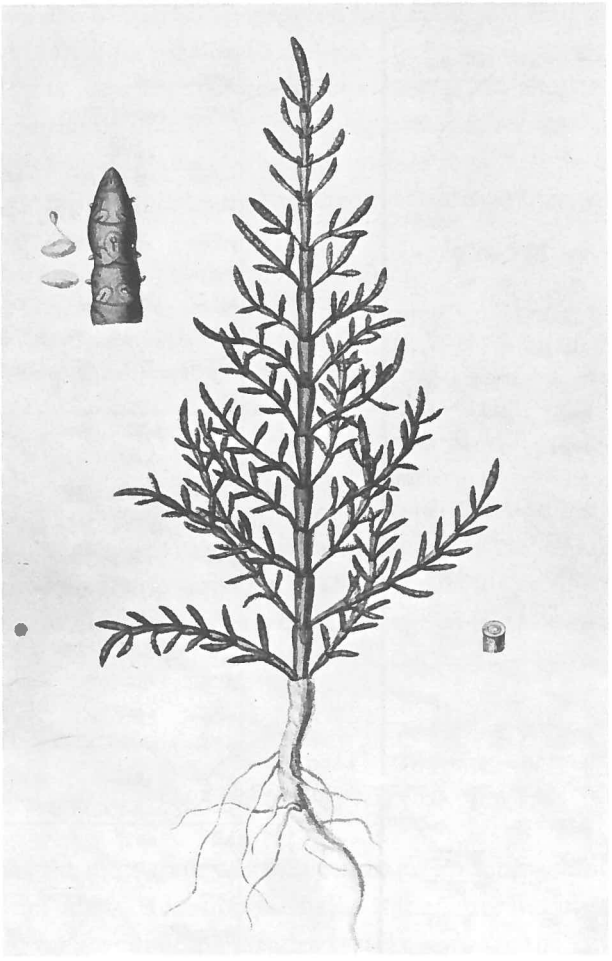
There goes the mud again. If it was meant for an aching joint, the main difference with twentieth century medicine is that our mud plasters are hot. If it was meant for a wound, the practice is still current in the same land: an archeologist returning from Iraq told me that his native diggers treated their wounds with clay (sometimes also with eggwhite and chicken feathers).

So much for Sumerian plasters. If we now skip fifteen centuries and roam through the archives of Assurbanipal in search of more attractive stuff to put on wounds, we will find one such item—sesame oil—though drowned among so many other Sumerian-sounding drugs that the overall impression is scarcely one of progress.

The asu, alas, never knew very much. His knowledge of anatomy remained at the level of butchery. His physiology was about nil: the heart was the site of intelligence; liver harbored anger; strength was in the kidneys, and the brain was more or less forgotten.[70] Of sutures, of ligatures of bleeding vessels, apparently also of cauteries, he had no inkling. The crux of his art, *bultítu*, lay in concocting for each case just the right kind of *bultu:* a sort of mush made of herbs and other ingredients, usually pounded, cooked, and strained.[71] You would swallow your bultu or apply it externally, take it as an enema or even inhale it.[72] Two bultu would probably never be the same, because the amounts were not stated and probably not measured, and the choice of ingredients was large—including such imaginative items as dung of lizard and marrow of long bone.[73] In the remains of a drugstore of the first millennium, tablets were found listing all the drugs on the shelves, about 230 in all (Fig. 2.19).[74]



2.19 Part of the inventory of an Assyrian pharmacy. The repeated sign along the left margin (see circle) reads *shammu*, literally "herb" (also "drug"). Listed were some 230 items, almost the entire Assyrian pharmacopoeia. First half of the first millennium B.C.

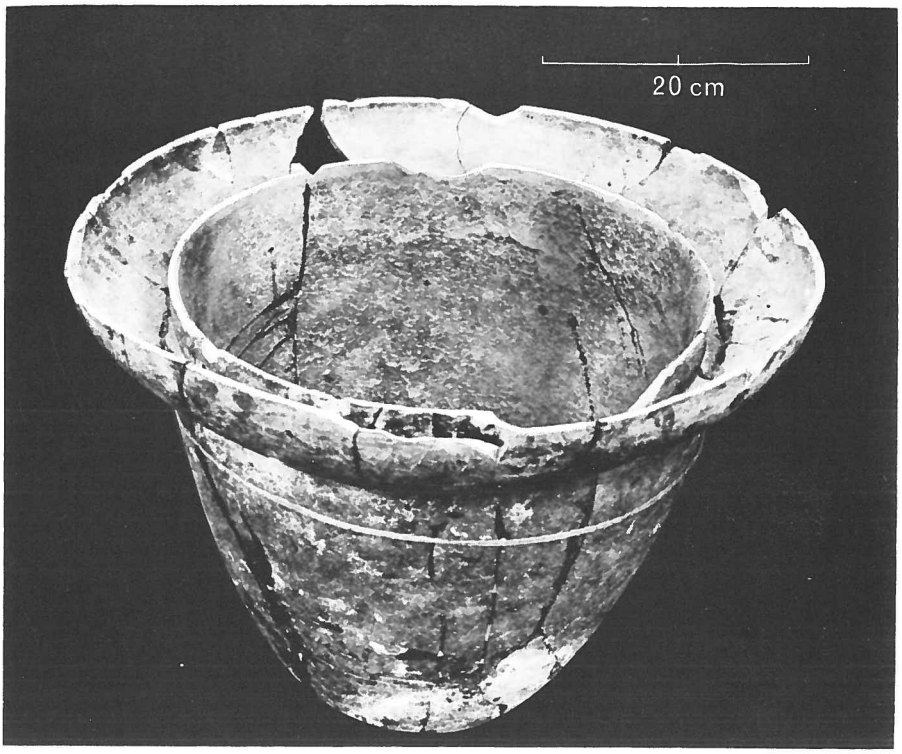


2.20 *Salicornia herbacea L.*, a kind of glasswort common in Mesopotamia. Glasswort was the general name for plants that gave ashes rich in alkali, later used for glass making (*kâlati*, "burned," gave the Arabic *al-quali*, "the [plant] ash," hence *alkali*).

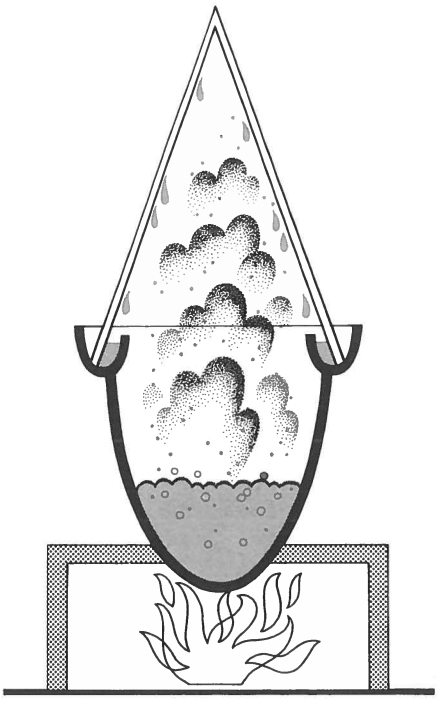
However, the asu seems to have known two procedures that qualify—for his time—as advanced technology. Some of the plasters required the heating of resin or fat with alkali, which yields soap. The alkali was obtained by burning certain plants, like *Salicornia* (Fig. 2.20). Coniferous resins contain abietic acids, which also form excellent soaps with alkali; many modern soaps are prepared from a mixture of fats with resins. Perhaps these prescriptions aimed at a detergent effect, although the resulting soap is never mentioned.[75]

Then, a "wrapping for the head" includes pine, spruce, myrrh, gum of aleppo pine, honey, fat from the kidney of a male sheep (so far a standard mixture), but also "essence" of cedar.[76] Thus, the asu must have had at his service the process of distillation, once thought to be much later invention.[77] Suitable pots have actually been found (Fig. 2.21).

Both procedures, the "soap" and the "essence," were already hinted at in the famous Sumerian medical tablet discussed above.[78] We are free to choose how to conclude: either progress was very slow, or the starting level was relatively high . . .



2.21 Akkadian drugs included distillates, which could have been prepared with vessels like this one (above), about 5500 years old. According to a chemist-Assyriologist, it would be possible to obtain a distillate with the pot, as shown below: the raw material is placed on the bottom and heated gently; vapors, such as volatile oils, condense against the cooler lid and trickle into the rim, where they are wiped up with a rag.



Three Surgical Wounds

Definite, bona fide wounds are mentioned in relation to the bronze knife, which makes, by the latest count, four appearances in the clay tablets—thanks to the archives of Assurbanipal. Each one of these is an exercise in frustration: "You shall take the knife . . ." and the rest is broken off.[79] In one tablet, although the text is damaged, these intriguing words stand out: "three ribs . . . fourth rib cut open . . . fluid . . ." a strong suggestion that the asu was cutting his way into the chest.[80] In principle this operation would not be anything extraordinary: a collection of pus in the pleura, or even in the liver (where amoebae are able to carve out large abscesses), can bulge under the skin and open out spontaneously, so that the knife would just help the natural process. But in either case the cut would need to be much lower than the third rib.

To rescue the sense, Labat proposed that the Akkadians may have counted the ribs backward, that is, upward, which is actually more natural.[81] In this way the cut would fall just where it should. In fact, I was elated to find that Labat's idea is borne out by ancient Greek medicine. The Hippocratic treatise *On Internal Diseases* describes the incision of the chest for pleural empyema as follows: "Having established this, incise over the third rib, beginning from the last."[82]

The two remaining operations referred to are in the collection of "Prescriptions for Diseases of the Head."[83] In one case the knife goes as far as scraping the skull, which was to become a favorite occupation of Greek medicine.[84] This patient seems to suffer from an abscess under the scalp.

> If the ailment mentioned above [*the text above is lost*] is painless, and the very surface of the flesh is intact; if, when you open, [pus squirts out and] keeps flowing: the name of this disease is "little she-fly" [*meaning unclear*]. If the wind has blown onto the patient, it is a case of Pabil-sag [the god]: you can operate it [*lit. "you can make a prescription." In other cases the physician is advised not to intervene*[85]]. To remove it, attack this disease with the point [of the knife. After cutting it open] grind: boiled plaster, salt of ammonia and powder of . . . [*a mineral, possibly belemnite*]. Apply all this onto the diseased surface and make a dressing of it. If the disease [has reached] into the bone, cut all around, scrape and remove [*that is, scrape off and remove the sick bone*[86]].

The other fragment preserves in some detail the postoperative care of the wound. If the top of this tablet had been broken off, it would have been impossible to appreciate its treasure, because the wound of the scalp is referred to literally as "the sick place." Here it is, the best of three surgical dressings to represent one hundred generations of Mesopotamian practice:

> Wash a fine linen in water, soak it in oil, and put it on the wound.
>
> Bray powder of acacia and ammonia salt, and put it on the wound; let the dressing stand for three days. When [*you remove it*] wash a fine linen in water, soak it in oil, put it on the wound, and knot a bandage over it.
>
> Leave the dressing three more days . . .
>
> Thus continue the dressing until healing ensues.[87]

This is essentially a dressing with oil. Now it may seem delirious to discuss this single dressing, one of millions that were lost; but no statistician could argue that where there is a leaf, there was at least a tree. And then we can check this lone tablet against one other source on Mesopotamia, the Bible:

> O sinful nation, people loaded with iniquity . . .
> from head to foot there is not a sound spot in you—
> nothing but bruises and weals and raw wounds
> which have not felt compress or bandage
> or soothing oil.[88]

So this *was* a common dressing; presumably with sesame oil in Mesopotamia, olive oil in Palestine. Oil and grease cannot do much harm on raw flesh, and they also serve the useful purpose of preventing the bandage from sticking to the wound, like today's first-aid creams. Bacteria do not grow in oil. In fact, we tested the survival of staphylococci in sesame oil and found that they were rapidly killed.[89] Beyond these practical facts, oil had very special connotations. To us it means salad dressing and lubrication; in the ancient Near East it was a basic need of life; it was the main source of light, a ritual offering, a measure of wealth, and a spritual symbol in the many anointing ceremonies.[90] When the asu applied it to a wound, he certainly felt that he was doing something basically good, and so did his patient.

Traces of Medical Theory

While the tablets are fairly explicit about what the physician did, they do not explain why he did it. This we have to read between the lines. The single exception is a startling letter in which Arad-Nana, the *rab asi* or "chief physician" to King Esharaddon (680–669 B.C.), explains a mechanism—not for the sake of science, but to straighten out an ignorant colleague before the king.[91] This is also the one and only reference to a treatment for bleeding:

> To the King my lord, your servant Arad-Nana. May it be surpassingly well with the King my lord. May Ninurta and Gula grant health of mind and body to the King my lord.
>
> It is exceedingly well with the son of the King. The treatment that we had planned for him, we gave it for five-sixths of a double hour [*100 minutes*]. He has walked, he has felt better and regained strength. However, he has not yet gone out . . .
>
> In regard to the patient who had a hemorrhage from the nose, the Rab-Mugi [*a high official charged with the care of horses and chariots, possibly the Rabmag of Jeremiah 39:3*[92]] reported to me: "Yesterday toward evening much blood ran." That is because the dressings [*that I had*] prescribed are applied without knowledge. They are placed over the nostrils, [*so that*] they [*only*] obstruct the breathing [*but*] come off when there is hemorrhage. They should be placed within the nostril: [*then*] they will stop the breath and hold back the blood. If it is agreeable to the King, I will go tomorrow and give instructions. Now [*meantime*] let me hear of his condition.

Arad-Nana was absolutely right: dressings placed over the nose are of little help; they must be stuffed inside. Except for the Rab-Mugi, this letter could

have been written yesterday. (Arad-Nana sounds less cocky in another letter, after the king had rebuffed him for being unable to diagnose and cure a royal disease.[93])

Let us now shift to that colorful text, the "Treatise of Prognoses."[94] Your eye will be caught by statements such as these, the first two being for *ambiance:*

If [*the sorcerer*] sees pigs which keep lifting up their tails, [*as to*] that sick man, anxiety will not come near him.

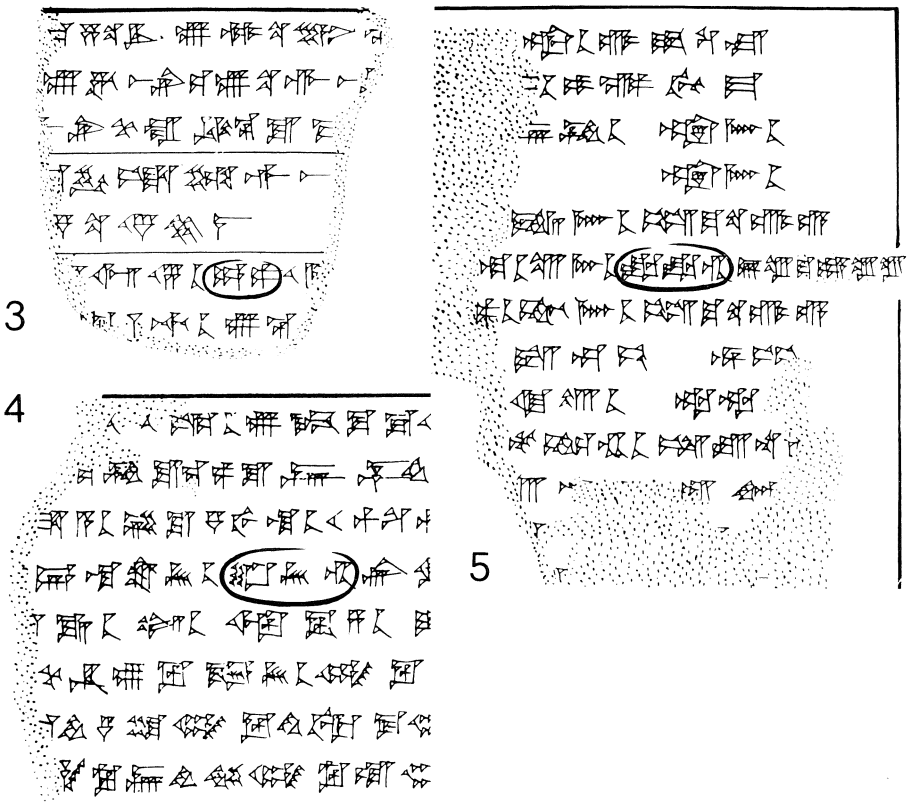
If a snake falls on the sick man's bed, that sick man will get well.

If blood flows out of his penis, it is the hand of Shamash [*the Sun-god*]; sign of Land-of-no-Return [*The Underworld*].

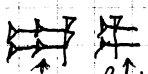
If his penis and his testicles are inflamed, the hand of the goddess Dilbat [*equivalent to Venus*] has reached him in his bed.

If his testicles are inflamed, if his penis is covered with sores, he has gone in to the High Priestess of his god.[95]

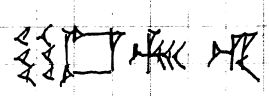
Disregard the comment on the high priestess: she was only a short step beyond the line of duty (ritual prostitution was the lot of the *Qadishtu,* other women of the temple community).[96] What is most remarkable here is the use of the word *inflammation,* one of the key terms and key concepts of modern medicine.



2.22 "Inflammation" is mentioned in these three tablets from Assurbanipal's library. They read: (3) "If a man, his right eye is inflamed . . ."; (4–5) ". . . his guts are inflamed . . ." The word *inflamed* (in circles) is written differently in each case.

Dans le n° 3 : 

naḫ-ḫât : "est enflammée" (œil est féminin)
le mot (forme verbale) est écrit phonétiquement ; c.-à-d. que les deux signes ont une valeur syllabique (celle du son prononcé)

Dans le n°4 :  = innaḫḫahu "sont enflammées"
(sujet : "ses entrailles")
le mot (3e pers. pl. présent du verbe naḫāḫu) est ici écrit idéographiquement (c'est à dire que le signe exprime, non plus un son, mais une idée).

Ce signe est  (en sumérien : MÚ) : il est suivi d'un déterminatif () qui indique le pluriel, et d'un complément phonétique (: hu), qui précise la prononciation de la syllabe finale du mot (innaḫḫahu).

Dans le n° 5 :
nous retrouvons la même expression que dans le n° 4 :
"ses entrailles sont enflammées" irrē-šu innaḫḫahu
Pour innaḫḫahu, il s'agit du même signe, mais, ici, dans l'écriture assyrienne () et non plus dans l'écriture babylonienne ().
D'autre part, l'idée du pluriel est marquée, non par l'emploi d'un déterminatif spécifique (), mais par le redoublement de l'idéogramme ().

Suit, enfin, le même complément phonétique (hu :) précisant la prononciation de la syllabe finale du mot.

2.23 Part of a letter from Prof. René Labat, explaining how it can be that the three different sets of signs in the preceding figure may all read "inflamed."

The appearance of this term is indeed a great event, worth exploring in detail. My first reaction was to find out if it was true. The word *inflammation* comes up also in Campbell Thompson's translations. I compared these with the cuneiform originals, sign by sign (Fig. 2.22). No set of signs seemed to recur. Perhaps the scholar of Merton College had been taking liberties? The first Assyriologist I consulted threw up his arms in despair, and advised me to have faith in Campbell Thompson. The second was too busy (there are far too many tablets around for the number of Assyriologists available), but would I please not rely on Campbell Thompson's translations, notoriously outdated. I wound up at the Collège de France, knocking at the door of René Labat. It was like turning on the light. In the first place, there are several words that can be rendered as "inflammation." Second, even if the same word were repeated, it might take on very different looks by being spelled either ideographically or phonetically (just like 5 or *five*, + or *plus*) and with either Assyrian or Babylonian signs (Fig. 2.23). Third, in this instance Thompson had been right. The commonest expression for "burning," "inflamed," is *nappaḫu;* and oddly enough it comes from a verb, *napāḫu,* which means "to blow." To us, accustomed as we are to matches, blowing is connected rather with extinguishing. We blow our fires *off.* It was quite otherwise for people who had to start their fires by friction: they blew their fires *on* and must have puffed a lot to kindle them. In fact, the Akkadian way of saying "to light a fire" was "to blow a fire." The blacksmith was called *nappâḫu,* and if the accent is removed, the word becomes his bellows.[97] So, when the asu said "inflammation," to his patient it must have sounded like something between "the burning thing" and "the blown thing."[98]

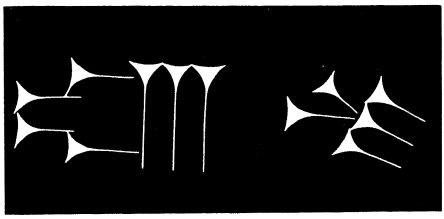
There is also a term for the "hot thing," *ummu.* More often it causes all the body to burn, in which case it must be fever; but when the burning is local, the most likely equivalent is inflammation. Take the following example:

Shumma	*amīlu*	*ina*	*sili´tishu*	*ummu*	*ina*	*libbi*
If	a man	during	his disease	inflammation	into	the inside

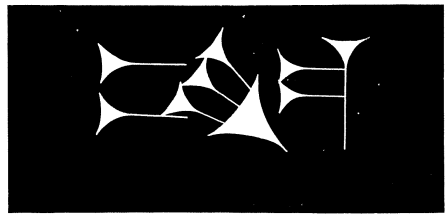
uznēshu	*ippushma . . .*
of his ears	spreads . . .[99]

The word *ummu* can be written phonetically, *um* + *mu,* or with an ideogram (Fig. 2.24). And when the ideogram is traced back to the original Sumerian pictogram, perhaps two thousand years older, one ends up with a flaming brazier[100] (Fig. 2.25).

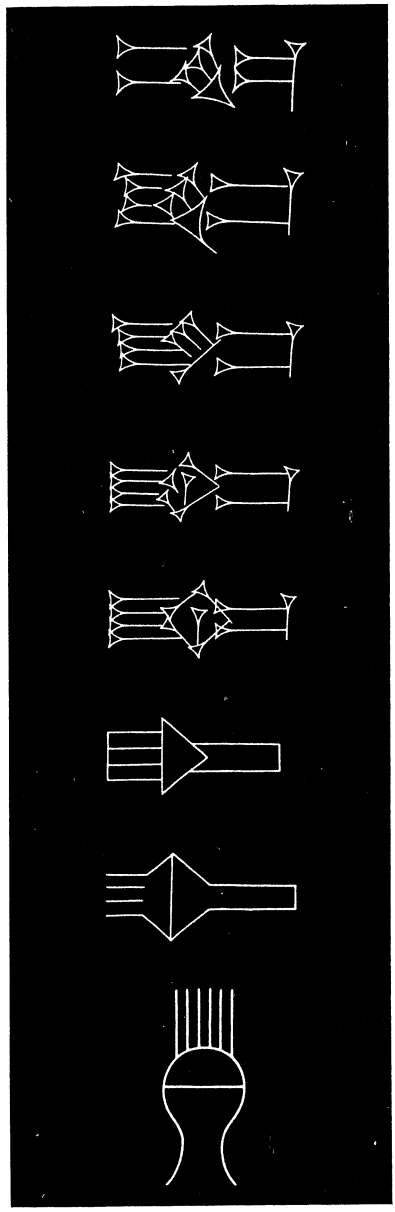
The next step in my investigation of *ummu* failed. I tried to find a real Sumerian brazier, to make sure that it looked like the pictogram, but none seems to exist. Contenau pointed out a flaming brazier in the reproduction of a Sumerian bas-relief; I had to drop it when I discovered that in an earlier work he called it a flowerpot[101] (Fig. 2.26).



2.24 *Ummu,* one of the Akkadian words meaning "fever" and "inflammation," here written phonetically, with two syllables: *um* + *mu.*



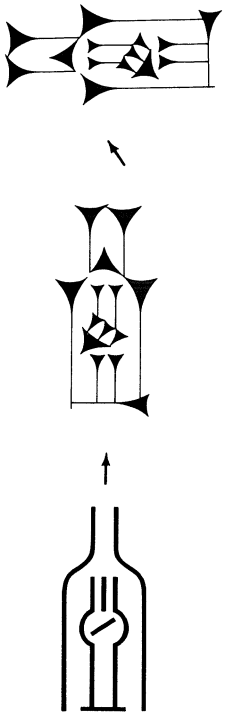
The same word, *ummu,* written with a single ideogram. For the origin of this sign, which to a layman does not appear to suggest anything hot, see next figure.



2.25 *Top:* the final writing of *ummu,* c.500 B.C. *Below:* progressively earlier forms, until the earliest one (bottom) turns out to be a Sumerian pictogram for *brazier* (rotated 90 degrees).

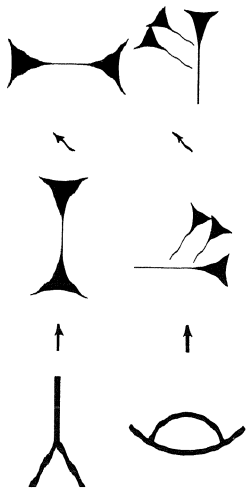
2.26 Dilemmas of interpretation: the flowerpot that became a brazier.

Anyway, it would be unreasonable to doubt the translations of "fever" and "inflammation." And surely none of my readers could afford a shadow of doubt after having shared my last bit of evidence (which is also evidence of phenomenal ingenuity on the part of the Assyriologists). At the top of Fig. 2.27 is a Sumerian word representing a nonclinical type of inflammation; the symbol for inflammation or fever, *ummu*, appears inside a sort of frame. Trace this cuneiform word back to the Sumerian pictogram: it turns out to be the same old brazier, but inside a thorax. "Inflammation inside the chest": what else but *love?*



2.27 A timeless Sumerian word, too obvious to require explanation . . .

As to the treatment of inflammation (or infection), I must disregard all plasters except to say that they qualify as either horrible, indifferent, or incomprehensible. But buried among them is one procedure that belongs to modern medicine. It is mentioned once only, in the last and longest surgical



2.28 Akkadian word for "pus," *sharku* (top). Its two signs derive from Sumerian pictograms (bottom) meaning "blood" (a branching vein?) and "white" (a sunrise). This is not a prophetic reference to white blood cells, but rather has the general meaning of "white sap."

fragment.[102] The patient seems to suffer from a boil or abscess of the scalp; he is the same one whose wound was being dressed with oil:

> If a man, his skull contains some fluid, with your thumb press several times at the place where the fluid is found. If the swelling gives way [*under your finger*], and [*pus*] is squeezed out of the skull, you shall incise, scrape the bone and [*remove*] its fluid . . .
>
> If [*instead*] when you press [*the diseased part*], the swelling does not give way [*under the finger*], you will make all around his head an application of hot stones [*lit. "a fire of stones"*].

I read the line of thought as follows: "If you can feel a collection of pus, then cut: if the abscess is not yet ripe, bring it out with heat." The asu seems to have realized the helpful effect of heat in speeding up the formation of an abscess. The process, empirically referred to as maturation, is not an old wives' tale but a fairly precise biological fact. It is the last stage in a sequence of events whereby a focus of infection is first surrounded by white blood cells (pus), then walled off, cut off, and finally digested by the enzymes contained in the pus; at this stage it is "ripe" and ready to be let out. Heat tends to speed up this process by increasing the flow of blood, hence the supply of white blood cells. The word for pus, incidentally, was *sharku*, "white sap" (Fig. 2.28).

What was thought about the cause of inflammation? When the wounds of his operated patients became all red and hot and began to throw pus, it could not dawn upon the asu that it might be his own fault. Note that he did work out one basic mechanism of man-made infection, venereal disease: but then, he could hardly be expected to realize that the high priestess and an inflamed penis stood in the same relationship as a dirty surgical knife and a wound. If inflammation was not his fault (as in many cases it certainly was not), there were two other possibilities: the gods, and the patient himself.

Inflammation was blamed on gods and ghosts quite freely:

If there is a red swelling on the man's body . . . it is the Hand of Sin [*the Moon god*] . . .

If there is a white swelling on the man's body, it is the Hand of Shamash . . .[103]

If a sick man, his face, his guts, his hands, his feet are inflamed. . . Hand of Shamash.

If his guts are severely inflamed: Hand of Kubû[104] [*a demon arising from the stillborn fetus, which could turn into a wicked ghost, like the dead left without burial*[105]].

This "hand" is very Mesopotamian. Diagnoses were often expressed with the pat formula: if a man shows such and such a symptom, "Hand of Shamash" or "hand" of some other entity, the oddest being the "Hand-of-the-power-of-an-oath." The wording recurs with such automatism, that one comes to wonder whether it had any real medical significance; that is, whether it literally meant that the god was the sole cause of the disease.[106] In some cases a natural cause was mentioned at the same time, as in the following: "If a baby, his bowels are stopped, and his body is yellow, he has been seized by the bad smell; Hand of Gula."[107] Perhaps this "hand" was more like a ritual statement, such as one might expect from a people who did not make a clearcut distinction between the natural and the supernatural.[108]

But the patient also had to look for causes within himself: he might have committed a sin. Perhaps in such cases the cure was confession to a priest, since confession[109] was an established part of Akkadian religion. In one extremely interesting letter Nabu-nasir blames the king's *ṣarāḫu* "on his teeth." *Ṣarāḫu* is another word for "burning," so we can picture old King Esharaddon with a bad case of caries and high fever. Here is one translation:

[*To the King my lord, your servant Nabu-nasir*] . . . Regarding that which the King my lord has written, saying "According to your [*usual*] integrity, send" I have spoken the truth with the King my lord. The burning of his head, his hands, his feet wherewith he burns is because of his teeth. His teeth should be drawn, his residence should be sprinkled. He has been brought low. Now he will be well exceedingly.[110]

Another translation reads that "the King's teeth are coming out [*to come out*]: that is why he burns."[111]

Whichever reading is right, the fact remains that Nabu-nasir connected tooth problems with fever, which is a perfectly sound idea. I doubt that he had in mind to pull good teeth for stamping out the fever; but even if he had, he was again anticipating a twentieth century practice. In certain febrile diseases one suspects a hidden focus of infection, and physicians take a close look at the teeth. This is the theory of *focal infection*. In my student days it was carried to extremes, especially in Great Britain, where if the blame could not be pinned on a visibly carious tooth, all the teeth were pulled out, good or bad!

By the way, notice that Nabu-nasir saw fit to blame the king's aches and

pains on his teeth, not on the gods. Disease was not always a matter of sins, gods, or devils.[112] In fact, religion had little impact on the daily life of the Akkadian. The religious attitudes of Akkadians in general have been greatly overemphasized, probably reflecting the bias of historians who, consciously or unconsciously, felt that they were writing about the land of the Bible.[113]

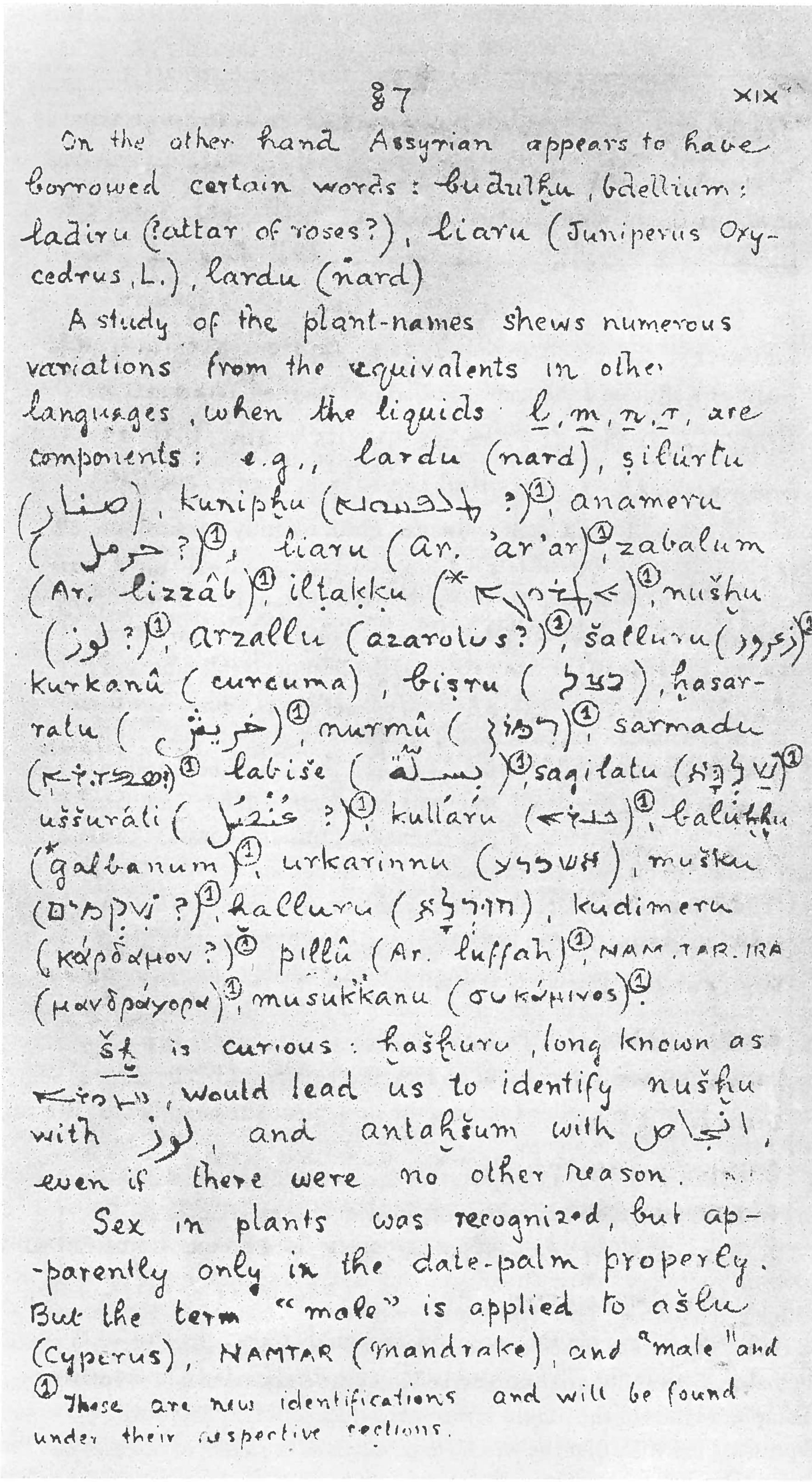
These are the few specks of pathology that I could gather from the clay tablets. Now for the pharmacology.

The Problem of Ancient Drugs

Did any of those dubious plasters help, or was it all nonsense? The question holds for all of antiquity; and the answer must be gleaned in two stages. First the philologist must tell us exactly what he reads in the text.

The identity of some drugs, like milk, beer, or honey, poses no problem; Akkadian botany is quite another matter. Until recently the authority on drug identifications was the late R. Campbell Thompson, who spent years assembling all possible data on the present and ancient flora of Mesopotamia and on its minerals, including the distance in miles from Nineveh, the frequency with which the names occurred, the conceivable affinities in Arabic, Syrian, and Hebrew, not to mention Latin and Greek. The result was a labor of love but an impossible challenge for any printer: the *Assyrian Herbal*[114] has an index in nine languages and seven alphabets, and each page is a mosaic of these (Fig. 2.29); the front page is printed, but Thompson wrote all the rest in longhand and mimeographed it himself. Today's scholars, alas, have chilled Thompson's enthusiasts. The comparison between languages is dangerous (just recall that the Spanish *aceite* means "oil," the Italian *aceto* is "vinegar," yet both are Latin languages) and even literal translation of Akkadian has its traps: *lion's fat*, for instance, probably means opium, *human sperm* is a kind of gum, and *human excrements* is a plant.[115] What the Germans call *Dreckapotheke*, "filth-drugstore," is not as rich as it looks. As matters now stand: for plants, no identification is absolutely certain. Some are likely; some are possible (*perhaps* the sleep-plant was poppy); *burashu*, on August 1, 1972, was juniper.

Next comes the physician, who looks over the list of identifiable drugs and wonders why they were used and what were their effects, real or expected. It is now certain that some herbs were used, and not only in Mesopotamia, for reasons purely linguistic: that is, because their name punned with a given disease. This is, of course *our* view. At that time, "the name of an object was part of the essence of the object. What we regard as a *play* on the name . . . was . . . an indication of what the thing itself is."[116] For example, a tablet of the Maklû series lists a number of incantations, expressing the wish that the witch (to be taken as the agent of disease) be pierced, bound, lacerated, etc., by different plants. In each case the name of the plant puns with the verb:



§7 XIX

On the other hand Assyrian appears to have borrowed certain words: buduḫu, bdellium: ladiru (?attar of roses?), liaru (Juniperus Oxycedrus, L.), lardu (nard)

A study of the plant-names shews numerous variations from the equivalents in other languages, when the liquids l, m, n, r, are components: e.g., lardu (nard), ṣilurtu (صنار), kuniphu (… ?)(1), anameru (حرمل ?)(1), liaru (Ar. 'ar'ar)(1), zabalum (Ar. lizzâb)(1), iltakku (…)(1), nušḫu (لوز ?)(1), arzallu (azarolus?)(1), šalluru (زعرور)(1), kurkanû (curcuma), biṣru (בצר), ḫasarratu (خريق)(1), nurmû (…)(1), sarmadu (…)(1), labiše (بسلة)(1), sagilatu (…)(1), uššurâti (شنبل ?)(1), kullâru (…)(1), baluḫḫu (*galbanum)(1), urkarinnu (…), mušku (… ?)(1), halluru (…), kudimeru (κάρδαμον ?)(1), pillû (Ar. luffah)(1), NAM.TAR.IRA (μανδραγόρα)(1), musukkanu (συκάμινος)(1).

šḫ is curious: ḫašḫuru, long known as …, would lead us to identify nušḫu with لوز, and antaḫšum with انجاص, even if there were no other reason.

Sex in plants was recognized, but apparently only in the date-palm properly. But the term "male" is applied to ašlu (Cyperus), NAMTAR (mandrake), and "male" and

(1) These are new identifications and will be found under their respective sections.

2.29 A sample of the effort and knowledge that went into Campbell Thompson's *Assyrian Herbal* (1924).

Like the *shiklu* plant [*a thorny plant*]
may her enchantment *likshulu* her [*pierce her*] . . .
Like the *sammu* plant
may her enchantment *lisammu* her [*blind her*] . . .
Like the *sammu* plant
may her enchantment *liruru* her [*curse her*] . . .[117]

In most cases the reasons that prompted the choice of one drug or another (if there were any) are entirely lost to us; and even guessing is difficult. Read this, for instance, in the typical Akkadian construction:

If a man, his head is full of sores: dissolve boiled dung in hot water, shave . . . cleanse until blood issues.[118]

Now I am not going to support the surgical use of dung, boiled or not. However, I do wish to make it clear that even a plaster like this one—dung on sores—cannot be branded as "irrational" because our point of view is so terribly different. People who depended on dung for several daily needs would have a much friendlier disposition toward it. To us it means outdoors, manure, and pollution; Akkadians spread rubble as fertilizer, of all things,[119] and brought their dung indoors as fuel. After burning it, they probably extracted ammonium salt from its soot.[120] Another important use of dung was strictly chemical, as an infusion for the bating of hides prior to tanning (perhaps the reason that the tanners were made to live apart).[121] In the bating process "as we now know it today, proteolytic enzymes act upon a hide or skin to reduce its swollen state."[122] *To reduce the swelling:* it is quite possible that the asu had this in mind when he chose this particular plaster.

Thoughts on Mesopotamian Wound Drugs

Luckily for the asu and for mankind, it is not easy to prevent a wound from healing, except by infecting it. In the normal process a wound heals under a layer of dead material, the scab. Injurious chemicals might kill an extra layer of superficial cells, but granulation tissue will push up anyway from beneath it. This being said, for most Akkadian plasters it is impossible to guess whether they were good, bad, or indifferent because one or more drugs are not identified; it is more feasible to judge some of the ingredients. Fats are fairly safe and mechanically soothing; for the patients this may be good enough. Inorganic salts in high concentrations make life uncomfortable for bacteria (and also for tissues).[123] Their antiseptic effect was known in antiquity, but Akkadian formulae preferred vegetable drugs. Here is a typical example from Campbell Thompson's *Assyrian Prescriptions for Bruises and Swellings;* it illustrates well his botanical acrobatics:

[*If*] . . . his flesh has poison and lassitude, and shrinking of the flesh . . . *Artemisia,* *balsam, **sagapenum,* sumach . . . hellebore, cedar, cypress, juniper, **Acorus calamus,* cypress of the cemeteries . . . box (?), fir-turpentine, pine-turpentine,

oleander(?), myrtle, tamarisk . . . *Conium maculatum, shredded[2] daisy, date-palm, juice(tops) of *lemon, juice(tops) of plane . . . juice(tops) of fig, juice(tops) of apple, juice(tops) of medlar, juice(tops) of *TIL.LA karani,*[3] juice(tops) of fir . . . [pist]achio(?), all orchard-fruit, all plant-drugs, all aromatics . . . thou shalt put, boil in a small copper pan, wash him therewith.[124]

As in this formula, most Akkadian drug ingredients fall into two groups: plant extracts, and resins and spices (Thompson's turpentine really means resin). As to plant extracts and decoctions, nothing is known of their possible effects on wounds, with one interesting exception. Many higher plants, perhaps all, contain antibacterial substances, and under the proper circumstances these might play a role in a wound plaster. A large-scale screening of green plants for antibacterial activity was undertaken for the first time in Oxford in 1943, about the time that penicillin was being born. It turned out that 2300 species, belonging to 166 families, gave a positive result. Plants of 28 families were active against *Staphylococcus aureus, E. coli,* or both.[125] This study also brought out several facts that complicate the interpretation of ancient plasters. In some cases the plant begins to lose its inhibitory power within two days of being picked, and loses it altogether when dried; in other cases, even drying for a year will not affect it. Moreover, the inhibitory substance may be distributed throughout the plant or restricted to one part only. In the continuing quest for new antibiotics, many more species have since been studied. In 1959, a review of 2222 plants reported some antibiotic activity in 1362, none in 860.[126] As to the meaning of this antibiotic effect, plants seem to use it for their own protection. Antifungal agents may well explain the resistance to decay of certain trees, like cedar.[127] Insects appear to take advantage of plant antibiotics to protect themselves against their own bacterial enemies.[128] We have not yet seen them on the market because those tested were found to be too toxic. Raphanine, for instance, the potent antibiotic of radish seeds, kills mice in the dose of 7–10 mg given intravenously.[129] But the fact is that they are there. They might surprise us some day.

Resins and spices, the other main category of Akkadian drugs, were part of a cultural passion that started in prehistoric days and still runs strong. Resins of pine, fur, and cedar were common ingredients in Akkadian medicine; and if we can believe the translations, so were cassia, frankincense, myrrh (*murru*), and even turpentine—of course not the distillate now understood by that name, but the resin of *Pistacia terebinthus* (Fig. 2.30), one of the most persistent drugs in history.[130] *Some* of these fragrant substances have *some* antiseptic value; they made the patient's malodorous sores smell better; and their toxicity was practically nil. In this respect, it was safer to have one's wound dressed by the asu than by a sophisticated Greek physician, whose multicolored salves were loaded with arsenic, mercury, and lead.

2.30 *Pistacia terebinthus*, the original source of turpentine (resin), a tree or shrub common on the islands and shores of the Mediterranean and in the Near East.

Aquim-Addu and Itûr-Asdu

Nobody alive can guess whether the asu's dressings worked. But somewhere in the dust that blows over Iraq are the remains of two men who knew. Chance preserved two letters that the king of Mari on the Euphrates received around 1800 B.C. and kept in his archives. Here is one:

To my Lord say this: thus speaks I Aquim-Addu, thy servant. A child who is with me is ill. From beneath his ear, an abscess is discharging. Two physicians of mine are tending him but his disease does not change. Would my Lord, now, dispatch his physician to me . . . or an expert physician, that he may examine the disease of the child, and treat him . . .[131]

So there was still hope in *asûtu*, the medical art, even where two physicians had already failed. In this particular case, however, no royal asu could have lived up to the call: the disease was either tuberculosis of the

2.31 The sling-stone was a typical Akkadian weapon.

lymph glands or a middle ear infection that had spread to the bone, the dreaded mastoiditis.

The other letter is a touching tribute to the asu as a healer of wounds. It came from a remote military outpost. Sling-stones were flying (Fig. 2.31), ramparts were crumbling.[132] A message went out to the king:

> To my Lord say this:
> thus speaks Itûr-Asdu, thy servant.
> There is no physician, no mason.
> The wall is crumbling,
> and there is no one to rebuild it.
> And if a sling-stone . . .
> wounds a man,
> there is not
> a single physician.
> If it please my lord,
> may my lord send me
> a physician and a mason . . .[133]

My portrait of the Mesopotamian healing art will have to end here, because we have run out of documents. More will surely appear, but those at hand tell us that the asu practiced a humble folk medicine,[134] a step or two

below that of his Egyptian colleagues. His flashes of insight were not enough to outshine the competition and discourage the sorcerer. Even that clean, logical, effective treatment with "a fire of hot stones" is offered in competition with another approach, for just below it is a charm designed to help the same patient: a marvellous opportunity to compare once again the procedures of the asu with those of the sorcerer, who could be filthy at times, but also had a touch of the poet:

CHARM.

The sieve, the sieve
The red sieve hath come
  And masked the red cloud
The red rain hath come
  And deluged the red wastes
The red flood hath come
  And filled the red river
The red gardener hath come
  And brought spade and *tupsikku*-board
  That he may dam back the red waters
Red door forsooth, red bolt forsooth
  Their gateway is shut [*?*]
But that which shall open you
[*Is*] planting and watering,
  Planting and watering.

End of the charm.[135]

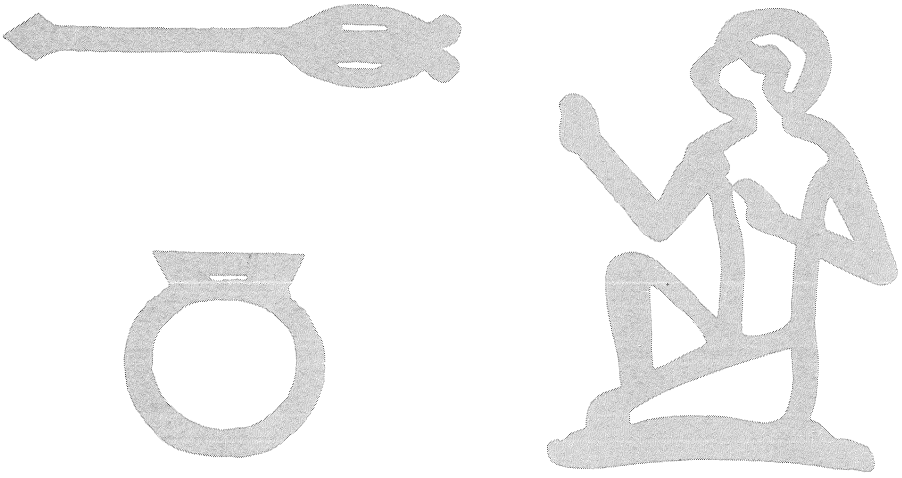
It is obvious, says Campbell Thompson, that this is a sympathetic charm, describing the disease of the head in the previous section, and that the pus is symbolized in the "red rain," "red wastes," "red flood," and so on: "As usual, the charm begins with the beginning of things, in this case the rain-clouds which bring the flood ultimately to be dammed back by the Red Gardener."[136]

I am not aware that pus ever rose to higher poetry.

Assurbanipal, the maniac collector of texts, came just in time. The great culture of his land was already on its way to break up into collector's items. A couple of centuries later a foreigner—Herodotos, the Father of History—seems to have found nothing left of the asu. His remark about Babylonian medicine, whether true or not, must be understood as reflecting only the situation of his day, for he himself was as remote from the Sumerian physicians as we are from Julius Caesar: "They bring out the sick to the market place; for they do not use physicians. People who walk by, and have suffered the same ill as the sick man's, or seen others in like case, come near and advise him about his disease and comfort him, telling him by what means they have themselves recovered of it, or seen others to recover. None may pass by the sick man without speaking and asking what is his sickness."[137]

So the asu faded away. Whether or not he paved the way for Greek medicine, or laid down a few cobblestones—the evidence is meager[138]—it is a fact that commoners and kings begged for his help. Should he appear before us today half-naked, his hair shaved off, carrying a bag of herbs, a libation jar, a censer with coals ablaze,[139] and a barber's knife, he would scarcely qualify as a physician. We would have to remember that what makes a physician is not only what he knows, or what he does, or even how he does it—much of the time, *just that he does it.*

Babylon falls suddenly and is broken.
  Howl over her,
fetch balm for her wound;
  perhaps she will be healed.[140]



3 The Swnw

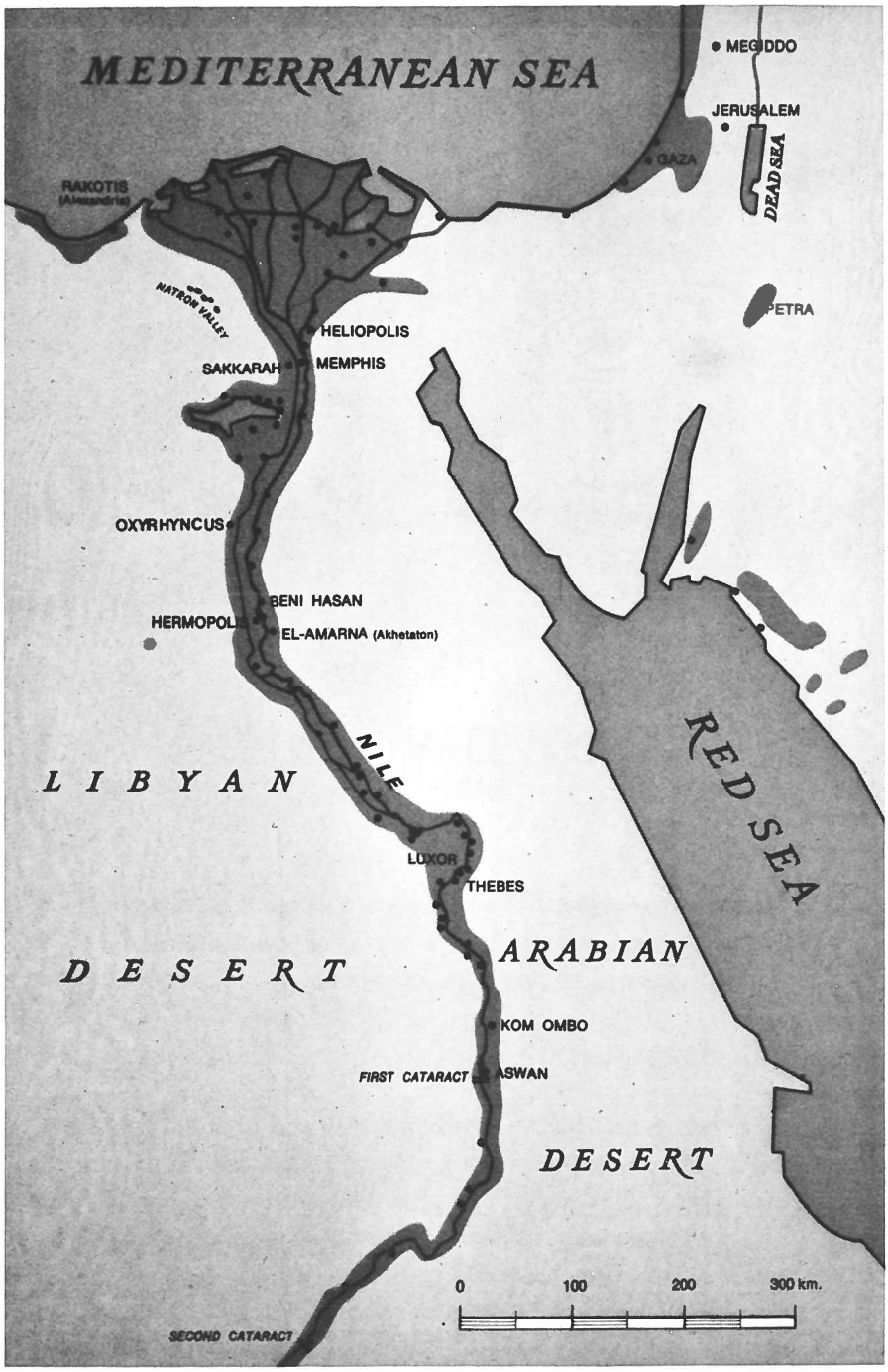
Soo-noo, perhaps; we may never know. Egyptian words came down to us mummified: consonants only, with a few shreds of vowels attached.

The *swnw* was the physician in the land of the pyramids.

The Setting

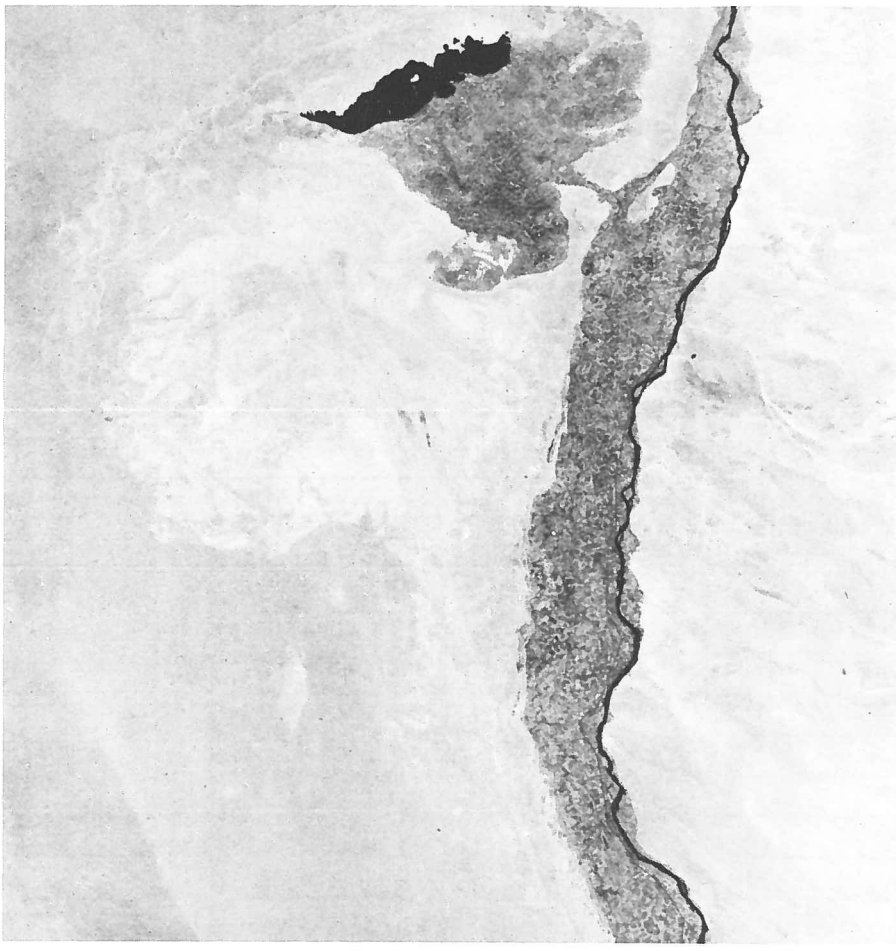
From Babylon to the Nile we have come only a thousand miles as the crow flies (Fig. 2.3), but we are in a different, separate world: so separate that we can discuss Egyptian medicine almost without referring to Mesopotamia. The fact is that Egypt is, really, nobody's neighbor; Egypt was and still is a peculiar sort of island, a greenhouse in the desert (Fig. 3.1).

The live part of the country amounts essentially to the Nile Valley, the Nile Delta, and a few oases. The Nile Valley itself is no more than "a gorge between the cliffs forming the escarpment, on the one side of the Arabian, on the other of the Libyan, desert. This valley is quite narrow; its maximum breadth is about fourteen miles, but in Middle Egypt the average width is more like nine miles, and in Upper Egypt it shrinks to a mile or two, in some places to no more than a narrow strip of cultivation on one bank only of the river. Egypt is in shape like a tadpole with a very long tail. The length of this tail, from Cairo . . . to Aswan, where for long periods . . . ancient Egypt really ended, is rather less than 550 miles."[1] The habitable surface is only 3.5 percent, about the size of Switzerland,[2] and surrounded by formidable



3.1 Egypt is a green island (dark shading), a gash in the desert.

deserts. In this rainless, self-contained, symmetric world, the Egyptians depended for survival on the Nile that rose and fell once a year like clockwork; they could hardly afford to look beyond the desert. Their name for the land of Egypt was *earth*, their word for north was *downstream*, their hieroglyph for foreign country was *desert* 𓈙 and the word *people* meant "Egyptians"; foreigners were nonpeople (Fig. 3.2).[3]



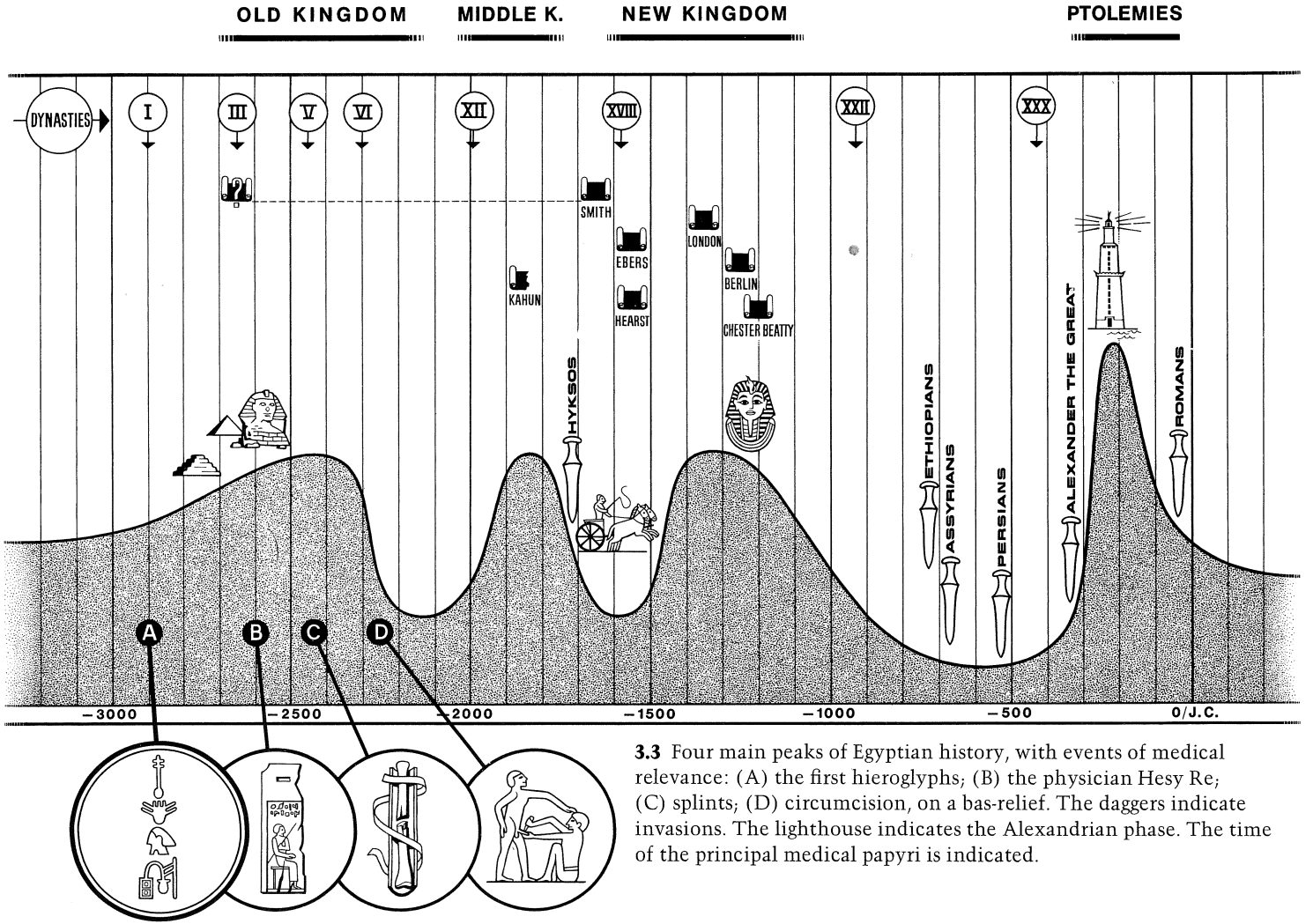
3.2 The geography of the Nile Valley and the precise timing of the floods left their special mark on Egyptian civilization. Compare this view, taken from a satellite, with the aerial view of untidy Mesopotamian rivers (Fig. 2.2).

Somehow this environment favored the cult of medicine. Whatever contacts it may have had with Mesopotamia,[4] the Egyptian art of healing flourished as a national glory, acquiring fame throughout antiquity and beyond. It outlasted the Pharaohs and merged with Greek medicine. Herodotos, who seems to have found nothing left of the asu, wrote about Egypt that "physicians are all over the place."[5]

Egyptian Medicine: The Sources

A museum exhibit of Akkadian medicine would have little more to show than cuneiform writings. Egyptian soil has been more generous: with the writings it preserved some of the patients and several artistic works related to medicine (Fig. 3.3). The first samples of writing appeared a little later than in Mesopotamia, around 2900 B.C., when the hieroglyphs seem to have sprung up readymade;[6] papyri from this time—medical or otherwise—have not been found.

The first known practitioner of the medical art survives as a stately profile:



3.3 Four main peaks of Egyptian history, with events of medical relevance: (A) the first hieroglyphs; (B) the physician Hesy Re; (C) splints; (D) circumcision, on a bas-relief. The daggers indicate invasions. The lighthouse indicates the Alexandrian phase. The time of the principal medical papyri is indicated.

Hesy Re, Chief of Dentists and Physicians to the pyramid builders of the Third Dynasty around 2600 B.C.[7] (Fig. 3.4). What he did for royal toothaches the inscription does not tell. Surely he did not drill teeth, but some say that he may have drilled bones to drain dental abscesses. The evidence is a much photographed Old Kingdom mandible, with bad teeth, an abscess, and two little holes draining it.[8] The truth is probably the reverse (or  , "upside down," as Hesy Re might have written): the holes are better interpreted as sinuses dug by the pus itself, which had to find its own way out,[9] because the dentists of the time had not discovered the simple device of pulling a bad tooth in order to drain the abscess around its root.[10]

Foolproof signs of surgical activity from this period were found on two bodies from tombs of the Fifth Dynasty: fractured limbs set by means of splints and bandages, with the world's oldest bloodstains (Fig. 3.5).[11]

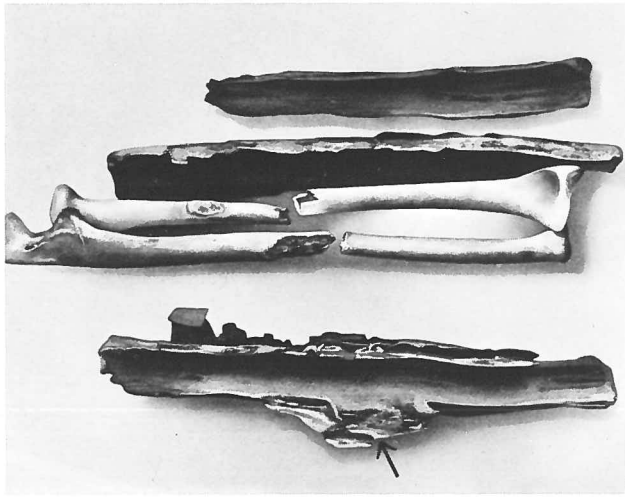
The first known medical text, the battered Kahun papyrus, appears in the Middle Kingdom around 1900 B.C.; it is followed by half a dozen others. Egyptian history is so long that on a chart the medical papyri appear to be clustered together, but actually they are spread out over 800 years or so (Fig. 3.3). Translated and printed, they would amount to less than 200 pages. Their text, reminiscent of the Akkadian tablets, consists of short paragraphs that are either prescriptions, spells against a given disease, or diagnoses, that is, short descriptions of a disease. There are roughly 1200 such paragraphs, of which 900 are prescriptions[12]—which amounts to saying that the Egyptian papyri read on the whole like catalogs.

There is one major exception. Anyone in search of a treat should procure and read the Smith papyrus in its magnificant Breasted edition of 1930; it is especially satisfying to the uninitiated, because the translation of each word is explained and critically analyzed in such a way that even a layman can grasp the essentials. As to the Ebers papyrus (the longest: over twenty meters), its English version could be fun to read if one did not feel at the mercy of an over-enthusiastic translator—B. Ebbell, a Norwegian county medical officer—without the benefit of critical comments.[13] In general, a comparison of the oldest papyri with the more recent ones reveals a trend for magic spells to replace down-to-earth medicine; hence, the number of papyri defined as medical varies from five to ten, according to the writer's indulgence toward witchcraft.

To the outsider, this literature is far more available and less treacherous than the cuneiform medical texts. Egyptology is an older science than Assyriology and more stabilized; in fact, its progress is now much slower. As for the language itself, Sir Alan Gardiner's *Egyptian Grammar,* which unveils the mystery of the hieroglyphs, is probably the world's only fascinating grammar.

For those who can trade hieroglyphs for German, all Egyptian medicine comes incredibly packaged in the ten volumes of a German *Handbuch,* Grapow's *Grundriss der Medizin der alten Ägypter,* in which every single word is spelled out, catalogued, analyzed, and cross-filed in every possible way as the philologist sees it. This magnificent opus is, in a sense, the gravestone of Egyptian medicine: it implies that the sources are drying up.

3.4 Hesy Re; the first known Egyptian physician, about 2600 B.C. The three signs  (swallow, tusk, arrow) read *wr, ibkh, swn*—the most concise possible way to write "chief," "tooth," "physician." A learned man, Hesy Re wore the scribe's palette and reed holder.



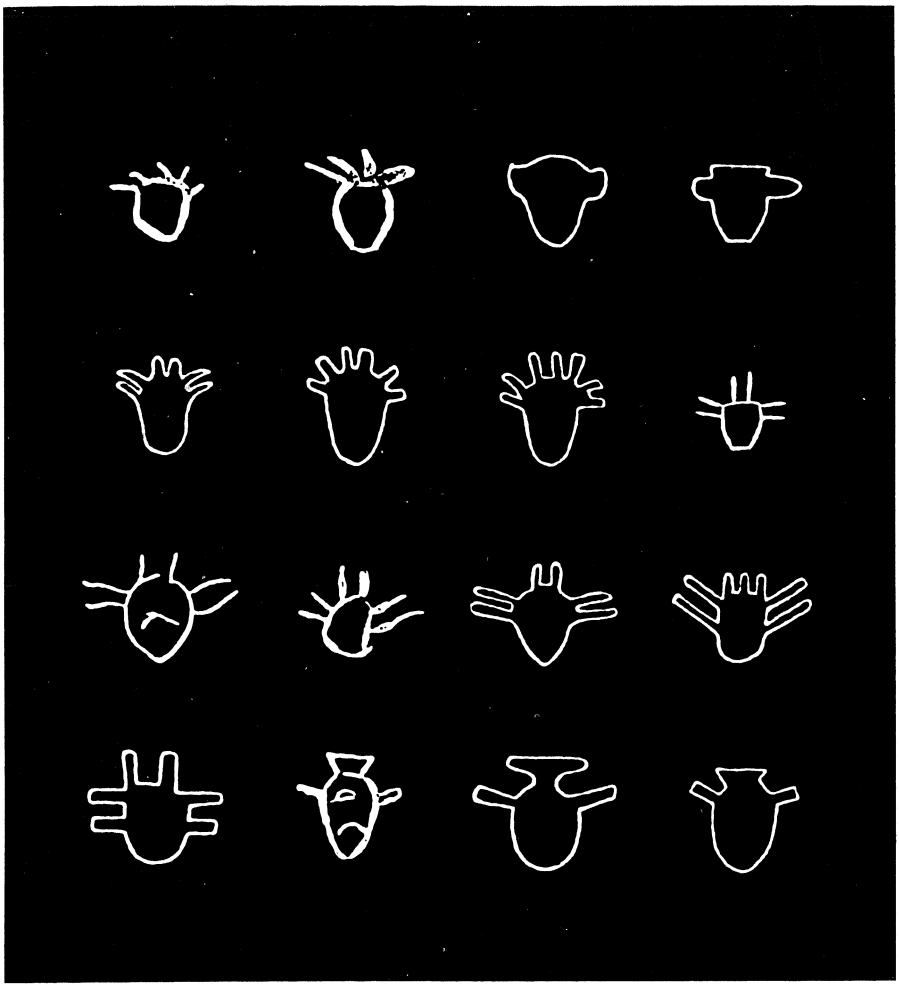
3.5 Fracture of the forearm set with bark splints, c.2450 B.C. The blood-stained lint (arrow), perhaps made of palm fiber, may be the *ftt* mentioned in the Smith papyrus.

How To Write "Swnw"

To understand Egyptian views on wounds, it is essential to grasp the principles of hieroglyphic writing. The total number of hieroglyphs is of the order of 1000, but the standard list used by modern scholars, which includes only the commonest, comes to 743.[14] Quite unlike the cuneiform signs, which gradually changed shape and lost all resemblance to the original pictograms, the commonest hieroglyphs acquired their shape very early and then retained it with astonishingly little change for about 3500 years (Fig. 3.6).[15]

The first thing to know about Egyptian hieroglyphs is that they represent consonants, or groups of consonants. Signs for vowels did not exist, but four guttural sounds come close to them and are known as semivowels or weak consonants (Fig. 3.7, first five hieroglyphs). This means that from the writing itself we have no clue as to the actual sound of the words. Luckily, the vowels of some Egyptian words left traces in other languages, mainly Coptic. Thus, it is possible to make informed guesses as to their position and quantity; their actual quality is much more difficult to ascertain.[16]

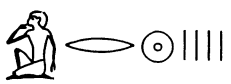
Coptic (probably a corruption of the Greek *Aigyptos*, "Egypt") was the language of the Christian descendants of the Egyptians, in whose churches it is read, though not understood, to the present day. To some extent it is a semiartificial literary language elaborated by native Christian monks about the third century A.D. The vocabulary is part Greek, part Egyptian, and the letters are Greek supplemented by signs derived ultimately from the hieroglyphs.[17] Unfortunately, Coptic came so late that it can throw but a dim light on ancient Egyptian; vowels and even consonants had ample time to change



3.6 Many hieroglyphs acquired their final shape very early. These are the earliest forms of the sign for "heart," from the first two dynasties, about 2900–2700 B.C.; they differ but little from the final form (lower right).

in many words. (The Coptic for "physician," for instance, obviously a derivative of *swnw*, is *saein*.[18] The reading swnw seems to prevail, though some prefer *sinw*.[19])

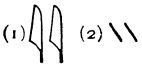
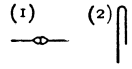
The next most important fact about hieroglyphs is that they can be used in two ways. Sometimes the little figure means just what it shows; that is, it has the function of a pictogram. For instance, if it is written of a drug:



the entire sequence can be guessed: "take in—by mouth—day[s]—four (you are also required to guess that "one sun" means one day).[20]

More often the same sign is used phonetically: it stands not for the object itself, but for its name, which is being used to make up a part of another word. For instance, the "sandal strap"  called *ankh* (ʿnḫ), may stand for the letter-group *ankh*, so it can be used to write part of the name

3.7 The Egyptian alphabet. These are also the commonest signs in hieroglyphic writing, though they represent a fraction of the signs available: 26 of about 1000. From A. Gardiner's *Egyptian Grammar.*

Sign	Trans-Literation	Object Depicted	Approximate Sound-Value
	*ɜ*	Egyptian vulture	glottal stop heard at the commencement of German words beginning with a vowel, ex. *der Adler*
	*i*	flowering reed	usually consonantal *y*; at the beginning of words sometimes identical with *ɜ*
	*y*	(1) two reed-flowers (2) oblique strokes	*y*
	*ʿ*	forearm	guttural sound unknown to English
	*w*	quail chick	*w*
	*b*	foot	*b*
	*p*	stool	*p*
	*f*	horned viper	*f*
	*m*	owl	*m*
	n	water	*n*
	*r*	mouth	*r*
	*h*	reed shelter in fields	*h* as in English
	*ḥ*	wick of twisted flax	emphatic *h*
	*ḫ*	placenta (?)	like *ch* in Scotch *loch*
	*ẖ*	animal's belly with teats	perhaps like *ch* in German *ich*
	*s*	(1) bolt (2) folded cloth	*s*
	*š*	pool	*sh*
	*ḳ*	hill slope	backward *k*, rather like *q* in *queen*
	*k*	basket with handle	*k*
	*g*	stand for jar	hard *g*
	*t*	loaf	*t*
	*ṯ*	tethering rope	originally *tsh* (*č* or *tj*)
	*d*	hand	*d*
	*ḏ*	snake	originally *dj*; also a dull emphatic *s* (Hebrew ס)

Tut*ankh*amun.[21] When the hieroglyphs are used phonetically, they represent either one, two, or three consonants:

 a loaf of bread = *t*

 a house = *pr*

 a windpipe attached to the heart = *nfr*

It follows that Egyptian words, read in their unvoweled state, feel like a mouthful of bones:

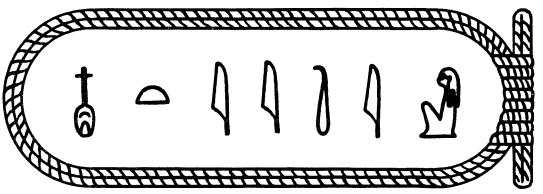
	f		y	pr	p		n	n	
nfr	*	w							s
	r			**	n		n	k	t

* The repetition *nfr+f+r* will be explained further.

** The vertical stroke below  means: "the preceding sign (in this case 'a house') stands for exactly what it looks like; it is not part of a rebus." One must therefore read the word as "house," which is pronounced *pr*.

Read consecutively, this passage comes to: *"nfr.wy pr pn nn n.k st,"* which stands for: "How beautiful this house! It does not belong to thee."[22]

To make the words more readable, it has been agreed to refill them with as many vowels as necessary, usually *e*'s. This is how the beautiful Queen N*e*fertiti came about. All anyone knows for sure is *Nfr-t-yy-t-y* ("beautiful-she-has-arrived"):



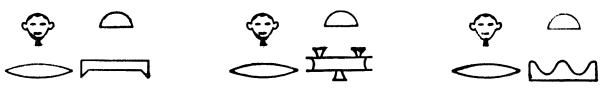
Nfr t y y t y (det. "woman")

A major drawback to writing without vowels is that a number of unrelated words look alike. Consider the problem that would arise if we were to write just *rt* for the English words *art, rat, rite, riot, rot, rut,* and *root.* To guide the reader, the Egyptian scribe used a device known also in Mesopotamia: that of adding after the word a *determinative* (abbreviated in our examples as "det."). This symbol was not to be pronounced; its only function was to suggest the general idea or classification of the preceding word.

Something to do with air or wind would be determined with  "a sail"—even the word for shortness of breath, *y-t-tm-m-w* or *ytmw*:[23]

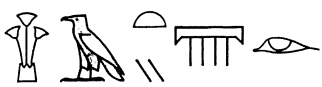
t
y m w (det.)
tm

The sign  suggests "garden";  "lifting, carrying";  "high, rejoice, support";  "weary, weak"; and so on. Thus, it no longer mattered that the letters *ḥrt*  (a head, a mouth, a loaf of bread) could mean "sky" as well as "road" or "tomb"; in each case the meaning was decided by an appropriate determinative: the ideogram for "sky"  (when used as a determinative) conveyed the notion "high, above"; a little segment of road bordered by shrubs  suggested "road, distance"; and the dunes of the desert  indicated "foreign land," including the Great Yonder, as required to give the idea of "tomb." Hence, each of the three words acquired its own identity:[24]



"sky" "road" "tomb"

Or if a patient suffered from *ḥaty*, whatever that may have been—



t
h a (det.) (det.)
y

it was likely that *water was raining* from his *eye*.

Sometimes two and even three determinatives were tagged onto a single word. About one hundred determinatives were in common use, and they have been of great help in deciphering texts. Often the name of a drug is not understood, but the determinative retains the principal notion:  suggests "grains" or "mineral,"  "plant," and  "weed."

Another basic notion about hieroglyphs is that the same word could be written in several ways, because the list of signs offered a vast number of alternatives. One way was to break the word into bits and choose signs to represent the necessary consonants, singly or in groups. According to this principle, which is the same as a rebus, one can write CATERPILLAR by

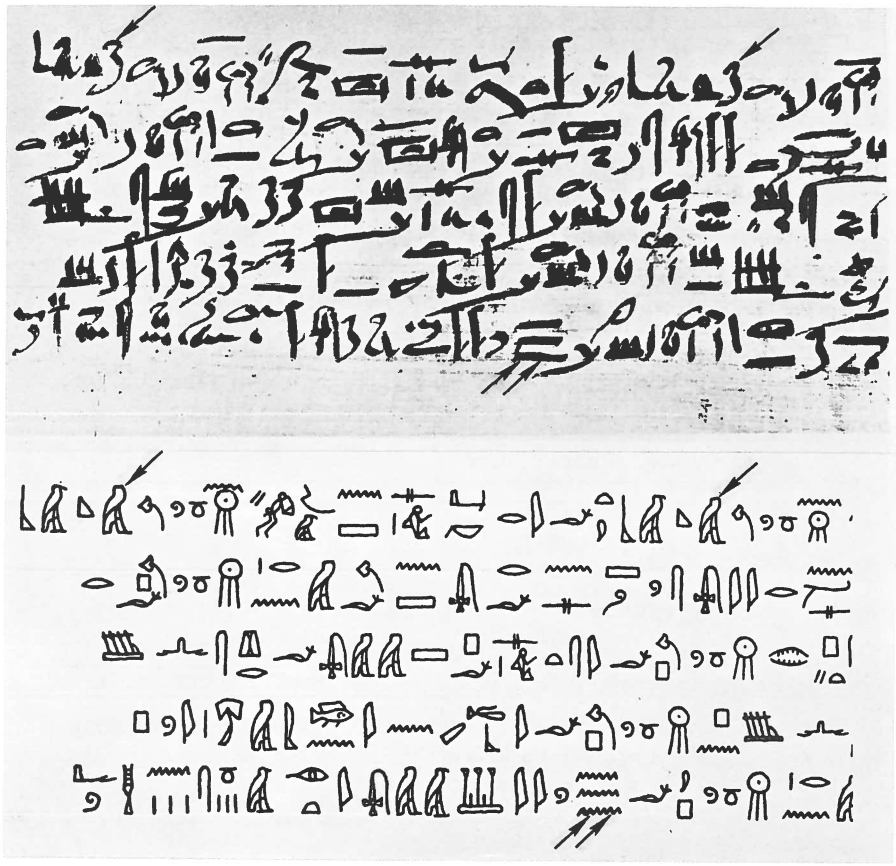
suggesting either CATER + PILLAR, or CAT + TAR + PILLAR, or CATER + PILL + R, plus one feature of hieroglyphs that in modern rebuses would be considered unfair: suggesting the same sound twice in a row (for safety, as it were), but meaning it only once. To keep the example of CATERPILLAR, we might get something like C + CAT + TAR + R + PILL + PILLAR.

Take a deep breath, you are not through. There was the added possibility of *drawing* a caterpillar.

And of spelling it out letter by letter.[26] Yes, letter by letter: this is one of the most puzzling features of Egyptian writing. Sprinkled among the hieroglyphs is a respectable alphabet of twenty-four letters at least. Why did the scribes continue to use signs for combined letters, when the alphabet would have been so much simpler? Why were they so pig-headed about using  for *nfr*, or even wild spellings like  *nfr f r*, or  *n nfr f r*,[27] instead of writing alphabetically  *n*,  *f*, *r*, and throwing out the  *nfr* with hundreds and thousands of other signs? Could it be that, like Molière's character who wrote prose without even realizing it, they invented the alphabet but never noticed it? It seems likely that they knew what they had, but for a number of reasons (religion, aesthetics, secrecy) the more involved system suited them better.[28] I might add that the difficulties I listed here may not be as great as they sound. A professional Egyptologist reminded me at this point that learning  and  is no worse than learning *a* and *A*; and it is certainly easier to teach *r* to a pupil when one can also say "r is drawn like your mouth *ra*."

These few indications should make clear that reading an Egyptian text is similar to deciphering a puzzle. Does each particular sign, in each particular instance, stand for the object it represents, or does it stand for a part of a word, as in a rebus? Or does it happen to function as a determinative? And where does each sentence, each word, begin or end? This last detail did not seem to matter in any ancient language; nor did it worry the Egyptian scribes, whose only concern was to space the signs aesthetically in imaginary squares or rectangles, so as not to leave unsightly gaps. No matter to them if two words had to flow together.[29] As if these difficulties were not enough, when the scribes wrote on papyrus, they did not use the classical hieroglyphs but simplified versions known as *hieratic* writing, so that the Egyptologist has to work by stages:[30] first he transcribes the cursive signs into hieroglyphs, then he proceeds to decipher these (Fig. 3.8).

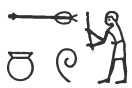
Despite the forbidding sound of the word *hieroglyphs*, decoding a few words requires no magic. To begin, look at the animals: they will tell you which way to read, which can be right or left. The rule of thumb is to read head to tail (or front to back for the people). And if, within one line, two hieroglyphs are written one above the other, read the top one first.



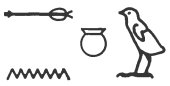
3.8 Hieratic writing (top) is made of simplified hieroglyphs: a passage of the Smith papyrus, with Breasted's hieroglyphic transcription below. Equivalent signs are marked: "water," the letter *n* (double arrow); the owl, which stands for *m* (single arrow). The simplified version of the owl looks intriguingly similar to the Phoenician *m* and to our *m*.

Now for the *swnw*. The ordinary spelling was the first one in the following series; the others are some of the variants:[31]

swn
(det. "profession")
nw "one"(?)



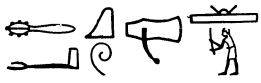
swn
(det. "effort")
nw w



swn
nw w (no det.)
n

s n
w (no det.)
wn nw

The determinative of swnw is ordinarily the sitting man as it is for male occupations in general. In a few cases the scribe chose instead the sign for "abstraction" (the papyrus scroll tied up with a knot); in others, a man or just a forearm striking with a stick which means "force, effort." I had hoped that the latter symbols might carry the connotations, respectively, of "scholarship" and "struggle with disease," but I doubt that the scribe intended to convey these flattering concepts, because he used the same determinatives for the word *barber* (something like *ḥaḳu*):[32]



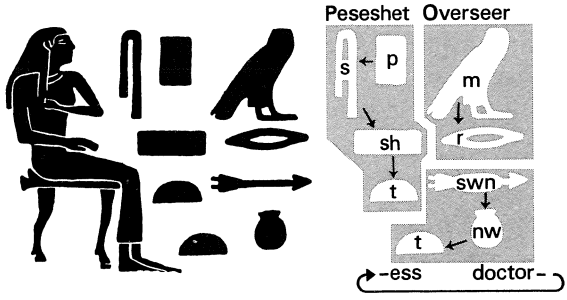
ḥ	k	(det.)
	(det.)	
a	w	(det.)

Note, in fact, the simultaneous use of three determinatives (the first is a razor).

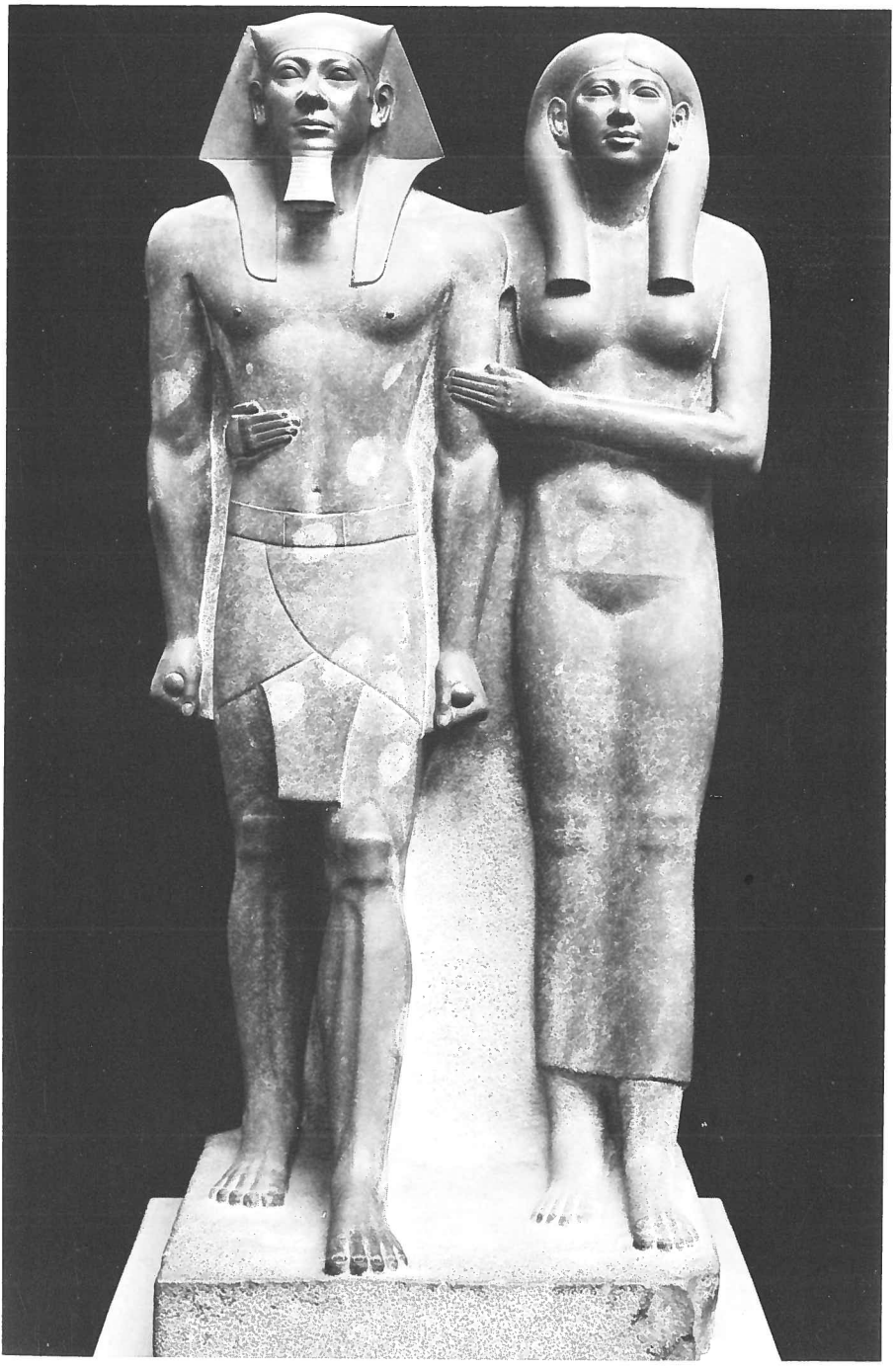
The determinative "man with a stick" is rather deceptive, because it is also used when the expenditure of energy is quite small, as in the case of a haircut. This leaves us in the dark as to the expenditure of energy involved in teaching, for the verb *sba*, "to teach," was also determined with .[33] May the reader decide for himself, taking into account that the Egyptians used the stick rather freely, and that among the fragments preserved on papyrus are the following: "The young man has a back, he listens to him who strikes," and "The ear of the young man is on his back."[34]

Some royal physicians attached to their title the drawing of a tired-looking man leaning on a cane . This is taken to be the hieroglyphic equivalent of "dean," *semsu* (*śmśw*).[35] In two cases the name of the swnw is contaminated by a "loaf of bread" or *t*, which seems to make no sense; Jonckheere listed it with the scribal errors.[36] However, the ending *t*, probably vocalized as *-at*,[37] also indicates the feminine gender. Since one of these aberrant *t*'s appears on the stele of Peseshet, Chief Woman Physician (Fig. 3.9) *swnw-t* must have been the feminine version of swnw.[38]

3.9 One of the eminent ladies of antiquity: "Peseshet (*P-s-sh-t*), overseer (*mr*) woman-doctor (*swn-nw-t*)."



If this spelling is unusual, it is even more unusual to find an ancient woman in this profession, and in so eminent a position. Yet the social status of women in Egypt was quite powerful even before Cleopatra.[39] A subtle sign of this power is the possessive, almost protective attitude of women in many Egyptian sculptures of couples, in which the wife holds the husband with both hands (Fig. 3.10).[40]



3.10 This lady's protective gesture tells a lot about women's role in her day, in her country. Pharaoh Mn-ka-re and his queen, Fourth Dynasty.

It was lucky for Peseshet that she was born in Egypt. The combined records of ancient Mesopotamia, Greece, and Rome preserved the names of perhaps ten women physicians, and none was a "Chief." And trust the male-oriented Greeks: the word for physician, *iatrós,* was masculine; it could be twisted into a feminine form, like *iatráina,* but probably lost breadth in the process and came to mean "midwife."[41]

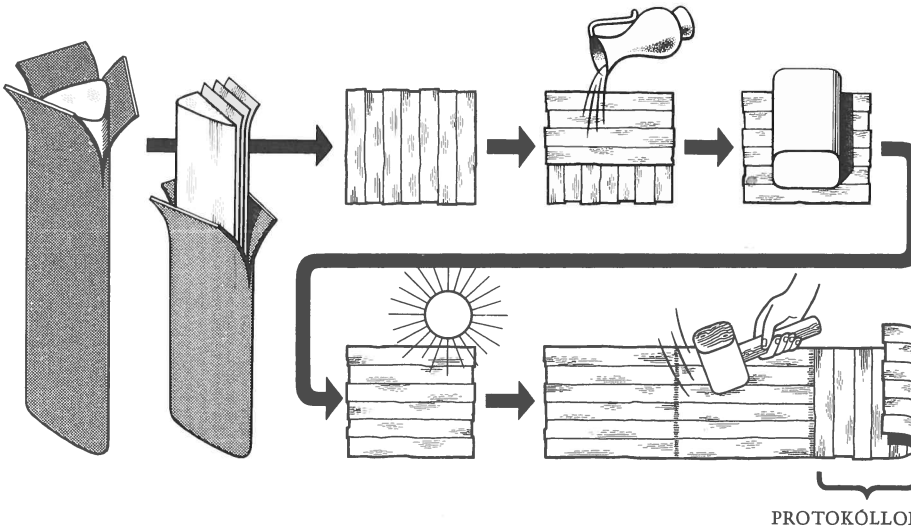
Wounds Without Surgeons

Despite the splendid isolation of Egypt, its citizens were not immune from the trauma of warfare. War injuries are dramatically shown in a mass grave of about 2000 B.C., in which the bodies of sixty soldiers are preserved well enough to show mace injuries, gaping wounds, and arrows still infixed.[42] The lot of the soldier is well described in this fragment written around 1200 B.C.: "I will instruct thee concerning the condition of the soldier . . . He is taken to be a soldier as a child of a reed's length . . . He rises in the morning only to receive castigation, and will be wounded with bloody wounds. He is accoutred with weapons in his hand, and stands on the battle-field every day. A lacerating blow is dealt his body, a double blow descends on his skull. A blow that knocks him head over heels is dealt his eyes, and a shattering blow falls on his nose . . . He leaves off work beaten like a papyrus and battered with castigations."[43] To be "beaten like a papyrus" was the equivalent of being "beaten to a pulp" (Fig. 3.11).

The scribes were better off. A favorite theme of Egyptian literature is to extoll their comfortable way of life: "Be a scribe. It will save thee from taxation, and will protect thee from all labours . . . It stoppeth thee from hardships . . . Be a scribe, that thy limbs may be sleek, and thy hands become soft."[44]

In a survey of 6000 skeletons it was found that one of every 32 individuals had suffered a fracture;[45] today we break many more bones than that, at least in skiing countries. The Swiss National Accident Insurance informed me that in the period 1966–1968 there were about 2.6 fractures per 100 insured persons *per year* (if the data on the ancient skeletons are reliable, only 3 percent of the Egyptians broke a bone in their whole lives). In contrast, today we have fewer encounters with angry jaws. The Egyptians had enough mishaps of this kind to fill a whole *Book of Bites.*[46] This book is now lost, but many prescriptions of the time refer to human bites (the most common kind), hippopotamus bites, and lion bites, the latter perhaps from the tame lions (a Ptolemaic queen, Berenice, had her face licked by a lion to improve her complexion[47]). And crocodile bites. The effect of a crocodile on an army officer is described in a letter: "He jumps into a thorny bush; his legs are chewed by the reptile, his heel is pierced."[48]

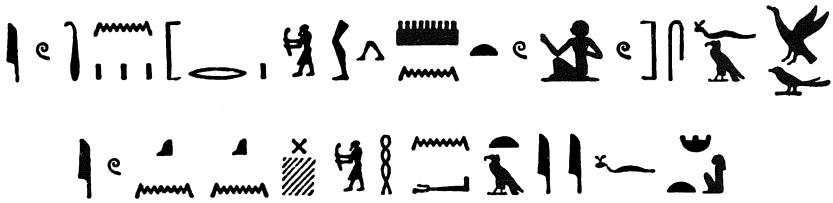
Other accidents were recorded by the foremen who kept track of the absentees on the pharaoh's building sites. These efficient bureaucrats kept records on slabs of stone, including date, name of absentee, and justification.



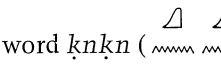
3.11 *Below:* "Beaten like a papyrus" refers to the flattening of papyrus sheets with mallets, the last step in making a papyrus scroll. Here is the whole process, beginning with the papyrus stems (left). *Protokóllon* is the name given by the Greeks to the special end-sheet or *kóllema*, bearing the official authentication of the scroll (hence our *protocol*). Its outer strips ran lengthwise, to avoid fraying. *Above:* The flowering tops of two papyrus reeds, about eight feet high.

One example: "Fourth month of the flood day 27 Nbnfr was ill was stung by the scorpion."[49]

Life had other dangers too in that matriarcal society:



First month of winter day 21 Tlmntw was absent had a fight with his wife[50]

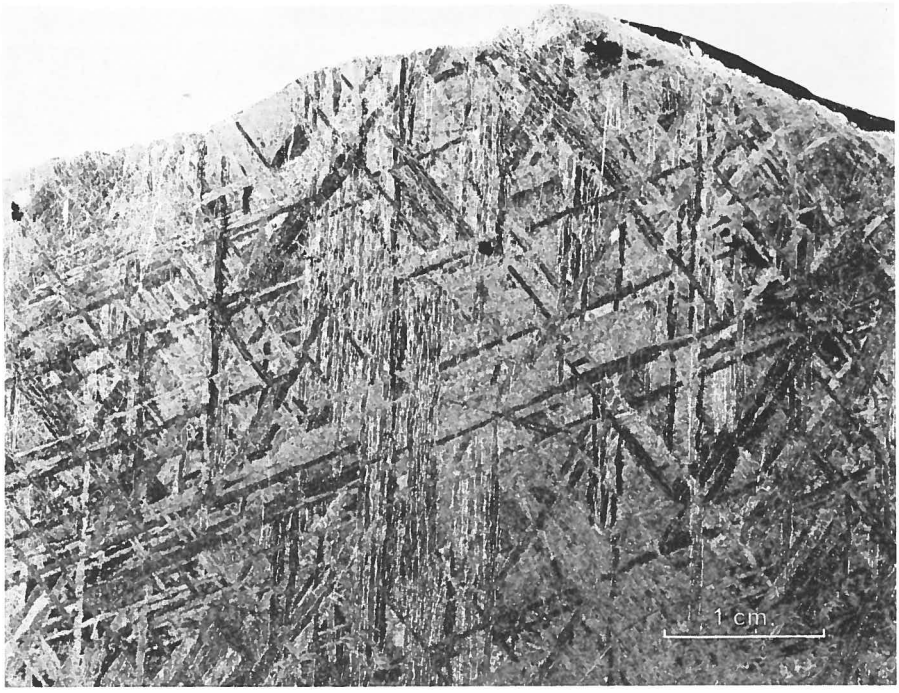
Poor Tlmntw must have been in bad shape. His predicament is described with the word *ḳnḳn* ( or), which was also used for "grinding up" a drug in a mortar.[51] Note, incidentally, the *l* in Tlmntw: it is written by combining *n* + *r* and other signs, and indicates a foreign name.

Who took care of all these wounds? In a country of specialists like Egypt it would have been reasonable to expect a guild of wound surgeons. There were doctors for the eyes, the teeth, the belly, the "hidden diseases."[52] The narrowest field, but certainly one in great demand, was that of the famous Shepherd of the Anus[53] (a title that should perhaps be toned down to Custodian of the Bottom). Yet there seem to have been no specialized surgeons. Wounds were probably treated by general practitioners, that is, by the lay swnw and the priests of the goddess Sekhmet.[54] It may be that surgeons were unnecessary because the operations performed were few and not too complex: the primary concern of surgery was the dressing of accidental wounds, as described in the great Smith surgical papyrus.

When Blades Fell from Heaven

In the Smith surgical papyrus, odd as it may seem, the surgical knife is never mentioned; the wounds were already made. Seeing those lovely pages neatly written in black and red, it is hard to imagine that they are so old that some of the injuries were caused by flint weapons and probably none by iron. There is a bas-relief with a scene of circumcision about 2250 B.C., in which the blade is probably of stone (Fig. 3.3). Bronze and iron, like the wheel, came to Egypt from the East and relatively late: bronze, definitely an Asiatic discovery, had to trickle in through Mesopotamia, so that the Egyptian Bronze Age did not begin until the Middle Kingdom, sometime after 2000 B.C. Although the beginning of the Iron Age in Egypt is a classical subject of dispute, iron knives could scarcely have been used at the time of the two great papyri, Smith and Ebers (1650 and 1550 B.C).[55]

The beginnings of Egyptian iron make for a story literally out of this world. In 1911, G. A. Wainwright found two groups of iron beads in pre-



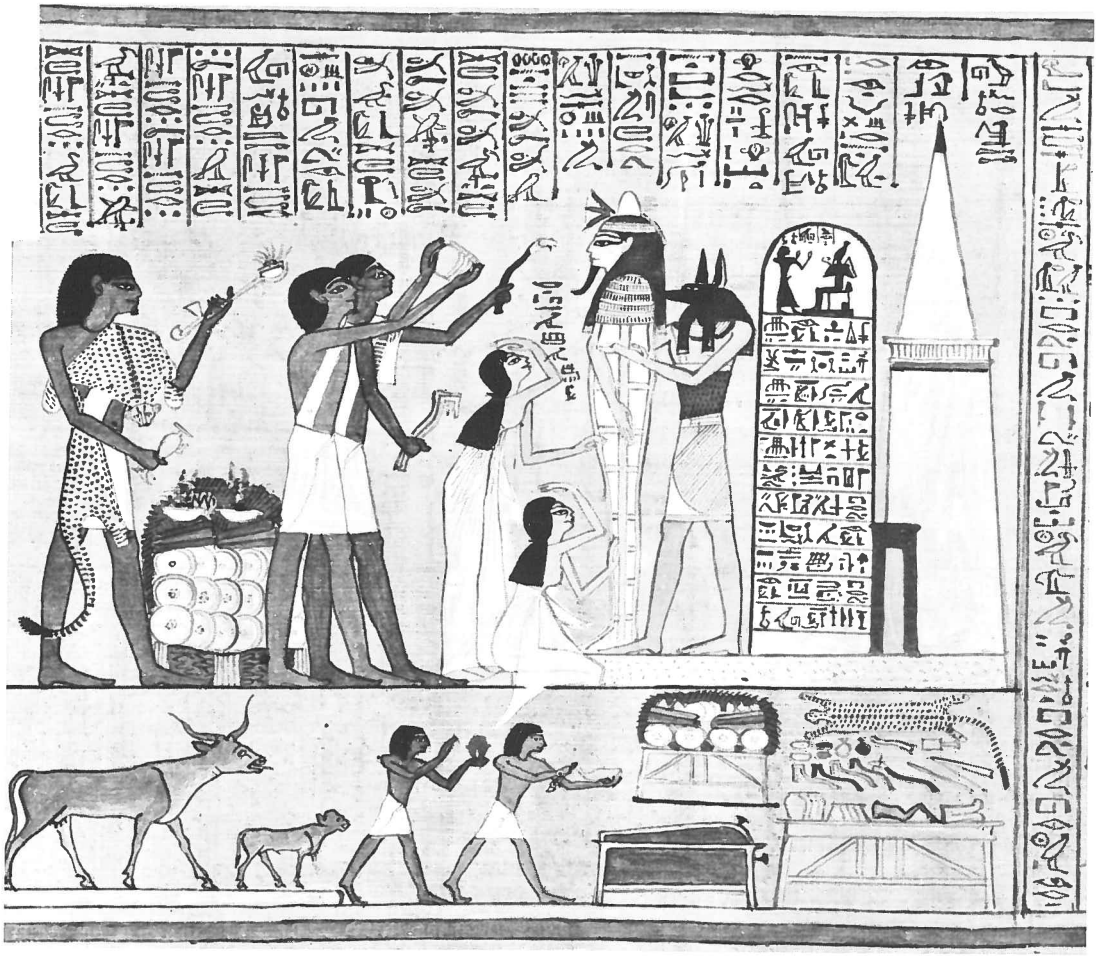
3.12 "Bya of Heaven": a polished section through a meteorite consisting of pure iron and nickel (octahedrite). The outer surface was somewhat rusty.

dynastic graves south of Cairo. At that time the Egyptians were using flint implements; bronze was unknown, copper objects were few and small. Chemical analysis of the beads showed that they consisted of 92.5 percent iron and 7.5 percent nickel, a sure indication that the metal had been taken from a meteorite, for terrestrial iron rarely contains nickel (Fig. 3.12).[56]

The ancient Egyptians, says Wainwright, were doing nothing unusual in obtaining scraps of iron from falling stars. The Sumerians, the Aztecs, the Eskimos, the American Indians did the same. This world-wide use of celestial iron is surely embedded in the present name for "iron science," *siderurgy*, which really means "the work on the stars."[57] Nor are meteorites so rare: up to 1932, those known and mapped were 634, of which 261 contained iron; and the rate of new arrivals actually seen as they were falling amounted to several per year.

The ancient Egyptians took bits of iron from meteorites, shaped them into blades, and used these for one of their most important ceremonies: the 75-step ritual of the Opening of the Mouth.[58] This was surgery at the mystical level: it meant "cutting open" the closed mouth of a mummy or statue and allowing new life to flow in (Fig. 3.13).

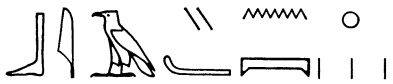
The name for iron was  *b-y-a*. See how much we can learn from the word itself. In the first place, bya meant "iron" as well as "firmament"—surely no coincidence. It was written with the hieroglyph  "a thing full of water" (the sky). When it meant iron, the spelling *bya* was usually



3.13 Metaphysical surgery: the ceremony of the Opening of the Mouth, performed on the mummy of the royal scribe Hunefer around 1300 B.C. Among the "opening" tools (lower right) are several shaped like the Big Dipper. Another object on the table is the foreleg of a bull, closely resembling the Big Dipper. The ritual amputation of the bull shown here is not as cruel as that in Fig. 3.19: the pedestal under the cattle at left suggests that live animals have been replaced by cheaper models.

reinforced with the letter *b*  and determined with a block or something like it:

But bya could also be written with this astonishing combination:  namely, a sledge carrying a meteorite and determined with a star;[59] the same ideogram was used to mean "marvel, astonishment." Which tells us that this particular marvel was something to take home (and notice, not yet on a cart, for there was still no wheel). Ultimately bya came to be called *bya-n-pt*, "bya of heaven":



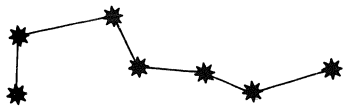
y n (det. "grain")

b y a

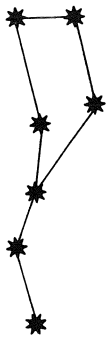
"metal spout" pt plural strokes

This form passed into the Coptic ⲃⲉⲛⲓⲡⲉ benipe, "iron."[60]

So the ancient Egyptians knew perfectly well where the bya came from. Perhaps this explains why some of the little gadgets used for Opening the Mouth were given the celestial shape of the Big Dipper, either this way:

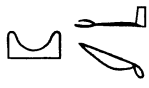


or straight up, as "the Foreleg of the Bull" (see Fig. 3.13):



Clearly, no swnw in his right mind could hope to own a set of iron scalpels. Even in the treasure of Tutankhamun iron objects were few, small, and homely, including a set of paper-thin, symbolic blades (perhaps for Opening his own Mouth).[61]

Iron began to be "discussed fairly freely" in the New Kingdom, after 1500 B.C.[62] But in the meantime, Egyptian surgery had found another source of blades, cheaper than meteorites and almost as imaginative. It is mentioned in the Ebers papyrus, which refers to surgical incisions in this roundabout way:[63] "You shall give him the *dwa* [meaning the cutting treatment] with such-and-such a blade." The word *dwa* is written:

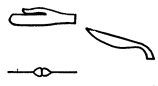


a

dw

(det.)

There were four types of blades: the *ds*, the *shas*, the *khpt*, and the *swt*. Only the first is well known: it was a common household item, often determined with a knife plus a block of stone ▭ and therefore probably made of flint.[64] Now see how the four knives were spelled:[65]



d

(det.)

s

sh a s (det.)

p

kh (det.)

t

t (det.)

swt

plural strokes

Something looks terribly wrong. Three blades are determined, predictably, with a knife; but one with a reed. Mistake?

No: it was a disposable blade. "You shall give him a cutting treatment with the reed that is used to make cutting treatments."[66] Knives of this kind were quite current in antiquity. In the Egyptian "Tale of the Two Brothers," Bata castrates himself with a razor made from a reed.[67] In ancient India, surgeons used bamboo blades under special circumstances. And in the first century A.D. we find even the Romans using sharp reed knives for slitting ripe olives.[68]

Now, given these various kinds of surgical knives, it would be interesting to know what the cutting was about. Probably *not* for boring skulls; it is strange that this practice, so widespread in prehistoric times, encountered no favor in Mesopotamia and Egypt. Although trephined skulls from Egypt are occasionally mentioned in the literature, I have been unable to find an authenticated case.[69] The Ebers papyrus recommends the cutting treatment for three kinds of lumps, none of which can be safely identified; whereas certain "serpentine windings" are *not* to be operated on, because "that would be head on the ground [*upside down? deadly?*]." Perhaps these were varicose veins; but again I prefer to leave the matter open.[70] The difficulty of extracting modern medical terms from a hieroglyphic context is well illustrated by a passage of the Ebers papyrus, where one translator reads "prepuce [?]" and another, "acacia thorn."[71]

The Smith Papyrus, or How To Contend with Wounds

Before turning to read through this magnificent scroll, we should realize how lucky we are to have it. Egyptian papyri, left to their own, seem to navigate through time almost indefinitely; but like the astronauts, they face crucial dangers upon re-entry.

Plate 3.1 Column XI of the Smith papyrus, written about 1650 B.C. A red asterisk (arrow) shows where the scribe had left out the words "Thou shouldst say concerning him." He added them neatly at the top of the page.

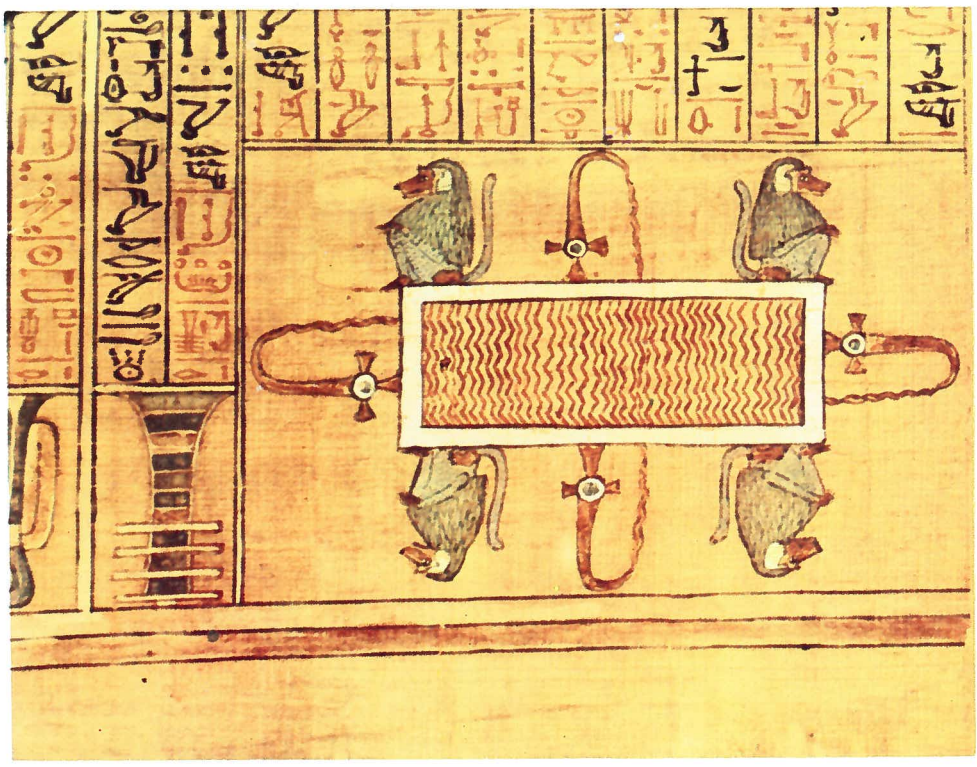


Plate 3.2 The hieroglyph for "hot" was clearly a brazier. Here it appears four times around the hellish Lake of Flames, as illustrated in a papyrus containing the *Book of the Dead.* The jagged lines ⁓ stood conventionally for "water." From the papyrus of Ani, c. 1250 B.C.

On January 20, 1862, in Thebes on the Nile, one Mustapha Aga happened to be the owner of an ancient Egyptian papyrus; that day he sold it to an American scholar, Dr. Edwin Smith. A couple of months later Mustapha Aga turned up with another papyrus. Dr. Smith was still around and bought that one too. The second papyrus, however, was—in the kindly terms of the buyer—"facticious," that is, made up of bits of three papyri, pasted together with glue.[72] Dr. Smith carefully removed the glue and discovered that two fragments were the remnants of a battered page one of the papyrus bought in January.[73] The reassembled scroll came to rest at the New York Historical Society as the Smith papyrus, waiting to be translated.

Finally, in 1920, James Breasted of the Oriental Institute in Chicago agreed to look at it. He was immediately absorbed—and in ten years of labor he produced an absorbing book, in fact the most elegant, thorough, critical version ever given of any ancient text. Thus was reborn the most ancient medical text of mankind.[74]

The text is tightly written. Sometimes a whole paragraph is merely suggested by a few catchwords. Breasted suggested that the original may have been a set of notes "of a lecturer or student."[75]

Through seventeen columns of elegant cursive hieroglyphs, the shadows of three men haunt the reader—three men so far off in time that the first two never even saw the wheel (Fig. 3.3). The first shadow is that of the unknown author, who spoke the language of the Old Kingdom and must have lived roughly between 2600 and 2200 B.C.[76] A man of vast experience and sound logic, he assembled dozens of surgical cases and arranged the descriptions so that they followed from the head downward, in order of severity within each group. He also gave each case one of three labels, depending on the chances of successful treatment:

> An ailment which I will treat.
> An ailment with which I will contend.
> An ailment not to be treated.

The second shadow, several centuries later, is that of the Commentator. By his time several terms of the papyrus had become so obsolete that apparently they could no longer be understood without the help of a scholar; thus, the Commentator inserted sixty-nine short explanations. Little could he guess that many of his glosses would serve their function as long as four thousand years: to Dr. Breasted they were the only clues to the meaning.

Last, the Scribe appears, a rather careless fellow but with a beautiful hand (Plate 3.1), which was about average for Egyptian scribes. He keeps alternating between red and black ink, as was customary, without much method; he corrects in black the mistakes he makes in red, and vice versa; he inserts an asterisk (the world's first) where he forgets a word; but then—and this is a true heartbreak for the historian—halfway through the job, in the middle of a word, he just stops. From the waist down the Smith papyrus remains hopelessly blank. This happened about 1650 B.C.

Of the forty-eight clinical cases that the scribe was willing to copy, we will first consider case 10: a gaping wound of the eyebrow, penetrating to the bone (the subtitles are added by the translator).[77]

TITLE

Instructions concerning a wound in the top of his eyebrow.

EXAMINATION

If thou examinest a man having a wound in the top of his eyebrow, penetrating to the bone, thou shouldst palpate his wound, and draw together for him his gash with stitching,

DIAGNOSIS

Thou shouldst say concerning him: "One having a wound in his eyebrow. An ailment which I will treat."

TREATMENT

Now after thou hast stitched it, thou shouldst bind fresh meat upon it the first day. If thou findst that the stitching of this wound is loose, thou shouldst draw it together for him with two *awy*-strips, and thou shouldst treat it with grease and honey every day until he recovers.

We learn here that the swnw had two distinct techniques for closing a wound. The first is *ydr:*[78]

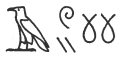

d
y (det. either "ear?" or [?])
r

Ydr can be either a noun or a verb. Breasted's translation is "stitching," which he supports with four pages of argument.[79] If he is right, this is the world première of surgical suture. Breasted has to fight for his translation because, strangely enough, the ordinary Egyptian word for "sewing" has not come down to us; and the ydr itself (besides its thirteen appearances in the Smith papyrus) occurs only once in a very obscure text, then never again in the whole of Egyptian literature.

Here are the facts. In six of the forty-eight cases in the Smith papyrus, the surgeon is advised to "draw together the wound with ydr." So it must be something that would draw together the margins of a wound. A bandage? Probably not, for in one case (alas, its text is imperfect) the ydr is recommended, but with the additional advice "not to put on a bandage"; and in the follow-up of another case the ydr is found "sticking in the two lips of the wound," a wording that suggests some device quite other than a bandage.

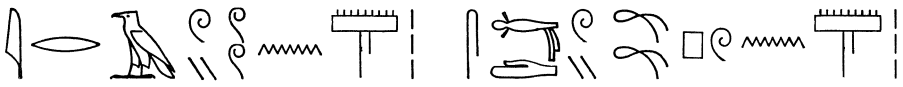
Now, in four of the six cases, the ydr "becomes loose"  *wnkh*. If it is a suture, this makes good surgical sense: stitches in a contaminated wound would cause suppuration and give way. In fact, in case 47 the wound is "inflamed, open, and its ydr loose."[80]

A few years after Breasted, another Egyptologist wiped aside this translation and tried to prove that ydr was rather like a clamp. He was Ebbell, the translator of the Ebers papyrus.[81] It is just possible that both were right. Among primitive people, one of the earliest wound-closing devices is a combination of clamp and suture: a thorn or needle is stuck through both lips of the wound, and the protruding ends are tied together by a thread placed as a figure 8. Maybe this was the ydr. No surgical suture has been preserved in mummies. The oldest known stitches in human flesh are by the hand of the embalmer, and they were threaded about five hundred years later (Fig. 3.14).

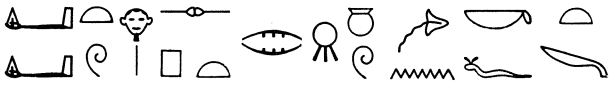
The other technique for closing wounds is by applying  "two awy[-strips]" "of"  "cloth." The last sign  is a strip of cloth with a fringe, combined with  a folded cloth beneath it. The determinatives of the awy-strips vary, but they all imply tying, by either ropes  (repeated, meaning "two") or the bowstring  . The word is unknown outside of the Smith papyrus.

3.14 The world's oldest suture, placed by an embalmer on the belly of a Twenty-first Dynasty mummy about 1100 B.C. Usually embalming wounds were not sutured; sometimes they were covered with a plate of beeswax.

Luckily, the Commentator appended a gloss:



As for "Two strips of linen," it means two bands of linen



which one applies upon the two lips of the gaping wound

in order to cause that one (lip) join to the other.[82]

Breasted's translation, "adhesive strips," seems justified.[83]

Egyptian technology included plenty of adhesives, mainly gum from acacia trees and several types of resin.[84] Herodotos says that the Egyptians used gum, rather than glue, to fasten together the linen bandages in which the mummies were wrapped after embalming. In recent days such bandages were analyzed chemically, and they did in fact contain gum.[85] Its name was *ḳmyt*:[86]

ḳ my y y t (det. "grain") plural strokes

sometimes with this other ending:

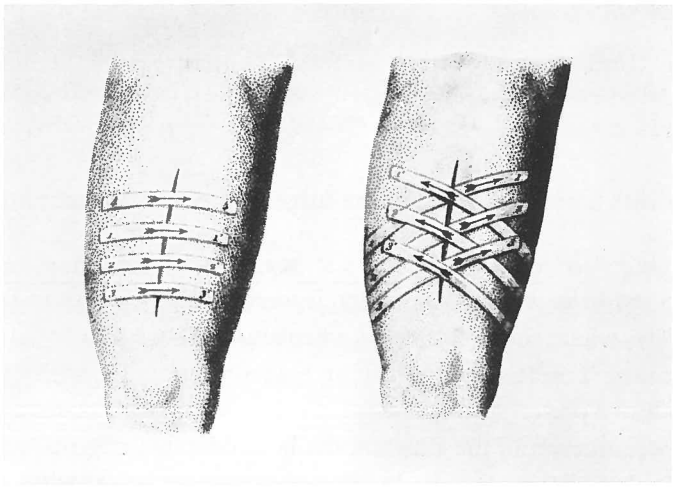
(det. "pot") plural strokes

Note that tapes are better than stitches if the wound is infected: the margins of the wound are held in the right position without barring the exit to any pus that may need to escape; and the tissues are spared the presence of a foreign body (thread or clamp), which somehow favors infection.[87] This is why the technique of closing wounds with tapes became standard once again several millennia later, in the nineteenth century. By that time wound infection had become such a problem that it threatened to choke off surgery altogether; it was almost impossible to close a wound with stitches and hope that they would hold (Fig. 3.15). Another revival of tapes is taking place in this very day, not only because the rate of infection is lower, but because the pain is less, the scar looks better, and it holds just as well.[88]

The following case describes a gaping wound in the head, penetrating to the bone and splitting the skull.[89] It belongs to the category with which the author is willing to "contend," implying an uncertain result:

TITLE

Instructions concerning a gaping wound in his head, penetrating to the bone, (and) splitting his skull.



3.15 Closing wounds with adhesive tape may have been a current practice in ancient Egypt. It was current again, as shown here, in nineteenth century Europe. From a French manual of 1858.

EXAMINATION

If thou examinest a man having a gaping wound in his head, penetrating to the bone, (and) splitting his skull, thou shouldst palpate his wound. Shouldst thou find something disturbing therein under thy fingers, (and) he shudders exceedingly, while the swelling which is over it protrudes, he discharges blood from both his nostrils (and) from both his ears, he suffers with stiffness in his neck, so that he is unable to look at his two shoulders and his breast,

DIAGNOSIS

Thou shouldst say regarding him: "One having a gaping wound in his head, penetrating to the bone, (and) splitting his skull; while he discharges blood from both his nostrils (and) from both his ears, (and) he suffers with stiffness in his neck. An ailment with which I will contend."

TREATMENT

Now when thou findest that the skull of that man is split, thou shouldst not bind him, (but) moor (him) at his mooring stakes until the period of his injury passes by. His treatment is sitting. Make for him two supports of brick, until thou knowest he has reached a decisive point. Thou shouldst apply grease to his head, (and) soften his neck therewith and both his shoulders. Thou shouldst do likewise for every man whom thou findest having a split skull.

GLOSS A

As for: "Splitting his skull," it means separating shell from shell of his skull, while fragments remain sticking in the flesh of his head, and do not come away.

GLOSS B

As for: "The swelling (*tḫb*) which is over it protrudes," it means that the swelling (*šfw t*) which is over this split is large, rising upward.

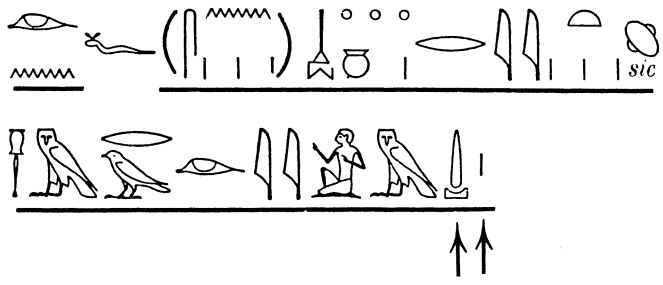
As for: "(Until) thou knowest he has reached a decisive point," it means (until) thou knowest whether he will die or he will live; for he is (a case of) "an ailment with which I will contend."

Faced with a very sick patient, the surgeon chooses to "moor him at his mooring stakes" (here are the mooring stakes). This extraordinary expression would be wholly unintelligible were it not for a gloss to the previous case, where the Commentator explains: "As for: 'Moor [him] at his mooring stakes' it means putting him on his customary diet, without administering to him a prescription."[90]

Now we understand the allusion: the bedridden patient, surrounded by healthy people, is being compared with a boat idling at its moorings, while traffic keeps moving up and down the Nile.[91]

The patient is also propped up with a support of bricks, and he is allowed to "reach the decisive point." What this means is spelled out in gloss C: the swnw is willing to "contend," but nature "decides."

Note also two major omissions, typical of the entire Smith papyrus. Washing the wound is ignored. Perhaps it was too obvious to mention, especially in a text such as this, written in a highly condensed, shorthand style. We are left hoping for a palm-wine rinse such as the embalmers used.[92] Hemorrhage is also ignored, except to note in passing that it happens. A century or so later the Ebers papyrus begins to show definite awareness of surgical bleeding. One paragraph deals with a "lump of ukhedu," described as a pocket full of gum-water: perhaps a cyst or abscess. "You should give it the cutting treatment; beware of the *mt* [*blood vessel*]!"[93] Another disease is described as a "vessel-tumor": "It comes from a wound of the vessel. Then you should give it the cutting treatment. It [*the knife*] should be heated in the fire; the bleeding is not great."[94] This is understood as prescribing the use of a red-hot knife to cut and burn at the same time, in order to check the bleeding. Five paragraphs later another nondescript lump, the *sft* of a vessel, has to be operated on with the reed for cutting treatments: "if it bleeds a lot, you must burn it with fire."[95] Thus the world's first recorded hemostasis was achieved by burning. Now think of a way of doing this *without metal and without a fire*. Case 39 of the Smith papyrus involves "One having tumors with prominent head in his breast, and they produce [pockets] of pus [*boils?*]. An ailment which I will treat with the fire-drill":[96]



Note once again the little vertical stroke at the end: it means "the sign that precedes, the fire-drill *ḏa*, does not stand for the syllable 'ḏa' but for the actual fire drill." The thrifty Egyptians, chronically short of fuel, had found a way to cauterize without having to light a fire.

A Hot Case

Case 47 describes five consecutive examinations of a single patient wounded in the shoulder. It is a very realistic case history, forming a crescendo of complications until the patient is appropriately moored at his mooring stakes, and winding up with final victory:[97]

TITLE

Instructions concerning a gaping wound in his shoulder.

FIRST EXAMINATION

If thou examinest a man having a gaping wound in his shoulder, its flesh being laid back and its sides separated, while he suffers with swelling (in) his shoulder blade, thou shouldst palpate his wound. Shouldst thou find its gash separated from its sides in his wound, as a roll of linen is unrolled, (and) it is painful when he raises his arm on account of it, thou shouldst draw together for him his gash with stitching.

Thou shouldst say concerning him: "One having a gaping wound in his shoulder, its flesh being laid back and its sides separated, while he suffers with swelling in his shoulder blade. An ailment which I will treat."

Thou shouldst bind it with fresh meat the first day.

SECOND EXAMINATION

If thou findest that wound open and its stitching loose, thou shouldst draw together for him its gash with two strips of linen over that gash; thou shouldst treat it afterward [with] grease, honey, (and) lint every day until he recovers.

If thou findest a wound, its flesh laid back, its sides separated, in any member of a man, thou shouldst treat it according to these directions.

THIRD EXAMINATION

If, however, thou findest that his flesh has developed inflammation from that wound which is in his shoulder, while that wound is inflamed, open, and its stitching loose, thou shouldst lay thy hand upon it. Shouldst thou find inflammation issuing from the mouth of his wound at thy touch, and secretions discharging therefrom are cool like *wenesh*-juice,

Thou shouldst say concerning him: "One having a gaping wound in his shoulder, it being inflamed, and he continues to have fever from it. An ailment with which I will contend."

FOURTH EXAMINATION

If then, thou findest that man continuing to have fever, while that wound is inflamed,

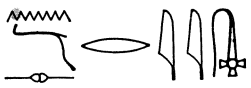
Thou shalt not bind it; thou shalt moor (him) at his mooring stakes, until the period of his injury passes by.

FIFTH EXAMINATION

If, however, his fever abates and the inflammation in the mouth of his wound dissipates entirely,

Thou shouldst treat him afterward [with] grease, honey, (and) lint every day, until he recovers.

The swnw is struggling with infection. First he tries stitching, if Breasted is correct; when this fails, he tries adhesive tapes; when these also fail, he allows the wound to remain open, "until the period of his injury passed by"—actually, until the infection has abated. Note the matter-of-fact use of the term "inflammation;" here is one example, the word being pronounced something like *nesery:*



n
ns r y y (det.)
s

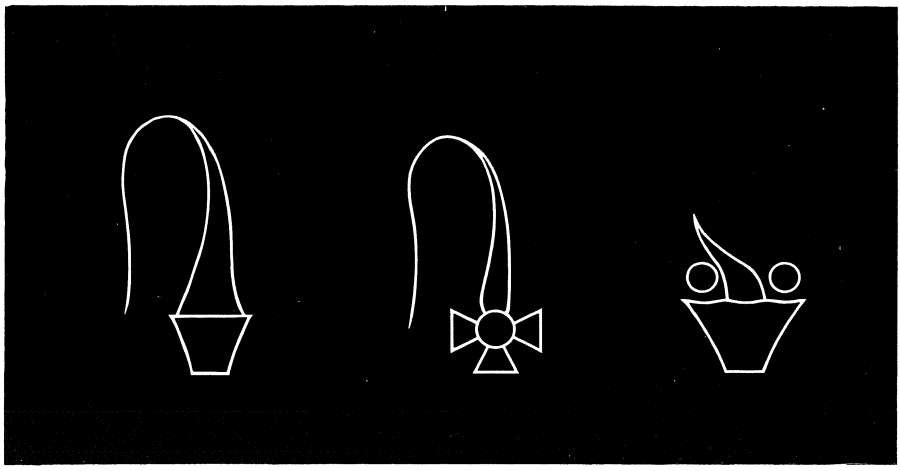
If the reader feels skeptical about the translation, I sympathize. For my part, encouraged by previous experience (the Mesopotamian word for inflammation had turned out really to be something "hot"), I left no stone unturned until it could be proven to my satisfaction that those seven archaic little signs— "water," "ox tongue(?),"  "a bolt,"  "a mouth,"  "two flowering reeds," and  the determinant—could honestly be translated as "inflamed."

Breasted's answer dropped from the majestic heights of competence:  *nsr-y,* "inflamed," is of course derived from the common verb *nsr,* "to burn," with its nouns *nsr* and *nsr-t,* "flame."[98] This, of course, is final.

There is nothing left to do but to take another look at the word itself. See the seventh sign, the determinative, which represents a flaming brazier, with stylized smoke rising from it and curving back to the ground. This was the common determinative for all things hot or flaming. See also the two other words for "pathologic heat", perhaps *shememet* and *seref:*

sh m m t (det.)

r
s (det.)
f



3.16 Three hieroglyphs portraying flames. An incense burner (right) stood for *sntr*, "incense," portrayed by the two grains on either side of the flame. The other two signs were used mainly as determinatives for "hot." One is an older form (left); perhaps this type of pot, full of burning oil, became so hot that later two handles and a foot were added (center).

The last sign is again a brazier. Both these words can be used for local or general heat, that is, inflammation or fever: one has to gather the meaning from the context.[99] Look also at this spelling for remedies that have to be applied to the skin at the

heat of finger[100]

If you are not yet convinced about the identity of the brazier—there were actually two forms of it (Fig. 3.16)—consider the following illustration from one of the many versions of the *Book of the Dead,* the beautifully illustrated papyrus of Ani dating from c.1250 B.C. (Plate 3.2). The theme is the underworld. The jagged lines are the conventional Egyptian way of representing water. This is the Lake of Flames, drawn in red and surrounded by four stylized braziers.[101]

Wounds Right and Wrong

Case 41 of the Smith papyrus is a very sick man with two problems: a wound in the chest, complicated by infection:[102]

INSTRUCTIONS CONCERNING A DISEASED WOUND IN HIS BREAST

If thou examinest a man having a diseased wound in his breast, while that wound is inflamed and a whirl of inflammation continually issues from the mouth of that wound at thy touch; the two lips of that wound are ruddy, while that man continues to be feverish from it; his flesh cannot receive a bandage, that wound

3.17 "A whirl of inflammation is in his wound"—perhaps this idiom referred to the fire-stick. A bow-string was wrapped once around the stick, which twirled under the stone cap held in the left hand.

cannot take a margin of skin; the *p'ys.t*(?) which is in the mouth of that wound is watery, their surface is hot and secretions drop therefrom in an oily state,

Thou shouldst say concerning him: "One having a diseased wound in his breast, it being inflamed, (and) he continues to have fever from it. An ailment which I will treat."

Notice, incidentally, the typical bedside manner: touching the wound.[103]

Here are some of the glosses to this case:

As for: "A diseased wound in his breast, inflamed," it means that the wound which is in his breast is sluggish, without closing up; high fever comes forth from it, its two lips are red, and its mouth is open. The "Treatise on What Pertains to a Wound" [*lost!*] says concerning it: "It means that there is a very great swelling; and 'inflamed' is said concerning the height (of the fever)."

As for: "A whirl of inflammation in his wound," it means a whirl of inflammation which circulates through the interior of his entire wound. [*This does not help to understand the "whirl": Ebbell astutely suggested that the Commentator may have had in mind the twirling effect of the fire-drill* (Fig. 3.17).[104]]

As for: "His flesh cannot receive a bandage," it means that his flesh will not receive the remedies because of the inflammation which is in his flesh.

As for: "While heat continually issues (nšw) from the mouth of his wound at thy touch," (it means) that heat comes forth from the mouth of his wound at thy touch; as it is said that a thing which has come forth entirely, has issued (nšw).

The real nugget of this case lies in the first sentence, "One having a diseased wound in his breast":

Note the little man with blood streaming from his head. He stands for "enemy, death," and serves here as the determinative to the word "diseased," *shmay:*[105]

sh
a y
ma

There can be no doubt about the reading: *shmay wbnw*, "diseased wound."

There are, indeed, two kinds of wounds. The simplest way to describe them is to call them sick and not sick. Today they would be called sterile and infected, that is, healing with and without pus. The clinical difference was noticed around 400 B.C. by Hippocrates, who is generally assigned the priority for the discovery. However, if there is a concept of good and bad wounds, its grandfather was definitely Egyptian. The Smith papyrus clearly states that wounds could become sick, develop  *ḫwa.t*, "the rots" (note the plural strokes),[106] and throw  *ryyt*, "pus."[107] And when a wound took a really bad turn, it was no longer called an *wbnw* but a *bnwt:*

n w
b (det.)
nw t

The wbnw and the bnwt seem to have been a couple of notches lower than our twentieth century concepts of "good" and "bad" wounds. They certainly do not correspond to "wound" and "ulcer"; the wbnw alone appears to cover both, like the Greek *hélkos.*[108] The bnwt applies to particularly bad sores; although it could have no precise meaning, it seems to indicate complicated, perhaps gangrenous or cancerous ulcers.[109] A definition of bnwt comes from a late papyrus: "Bnwt, Brother of Blood, Friend of Pus, Father of the [smelly] Jackal."[110]

It would be interesting to know how much pus the swnw expected to harvest in the ordinary course of wound healing. Following is a relevant passage of the Ebers papyrus.[111] It must be read with special care, for it is a landmark in the history of medicine:

REMEDY FOR A WOUND, THE FIRST DAY

Fat from an ox so that it [*the wound*] may rot, or meat of an ox.

But if the wound rots too much then bind on it spoiled barley-bread, so that it may dry.

This is understood to mean that some pus is desirable as long as it is not excessive.

The text continues:

> But if (the wound) closes over its secretions, thou shouldst bandage it with grease . . . and crushed peas.
>
> If (the wound) beneath breaks open, then powder it with powder of green frit; then bandage it . . .
>
> If thereafter (the wound) has covered itself, then make an ointment to strengthen the blood vessels (*mtw*); therewith bandage it, so that it is cured.
>
> If thereafter it closes up over its secretions, then prepare: grease, [*a plant*]; therewith it is bandaged, so that it opens its mouth, so that it rots.

The thread of thought, from the beginning:

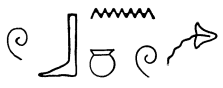
> It is good for a wound to rot a little.
> Some wounds may close too early, while there still is rot inside.
> Therefore, put something on the wound that will get out that rot.

I used the term "landmark" purposely, because if the above reading is correct, we have before us the first known statement of the dirtiest, messiest, most pernicious, and most persistent mistake in the history of surgery: *getting the badness out of the wound.* In practice, it means forcing a wound to suppurate. Though this procedure tends to make matters worse, it has been one of the catchiest concepts in the history of medicine. "Getting rid of something bad" has such a plausible ring, like modern drainage; and in fact there *is* a badness in wounds, only it is the bacteria instead of the pus. Trying to heal a wound by making it throw more pus is about as reasonable as getting more children to stop pregnancies. Yet rivers of pus flowed for another 3500 years, and the dreadful doctrine of good and laudable pus, *pus bonum et laudabile,* has only recently faded out.

Here we must pause briefly and analyze what we have been doing. We have just saddled the Egyptians with a very inglorious priority, and this on the faith of a few lines only, half sentences dropped just once. The reader should realize that I have quoted just about all the pertinent passages. Is this safe, or are we trying to weave a fabric out of a few bits of thread?

This is, I must admit, just what we have been doing, much like the archeologist who tries to squeeze a culture out of bits of pottery. But facts are facts, even if they are few—and I believe that our story is reliable. Besides, if the reader is not yet convinced that the Egyptians did expect some pus to flow in the ordinary course of wound healing, I will propose to dissect the only pertinent witness from ancient Egypt: the word for wound.

"Wound," *wbnw,* could be written in several ways.[112] Even the scribe of the Smith papyrus must have felt that the variations were cumbersome, because as he ground his way through the text, column after column, he gradually switched to the simpler forms:



n
w b (det.)
nw w

nw
w wbn (det.)
w

nw
w b (det.)
w

wbn nw (det.)

wbn (det.)

wbn (a precarious spelling because  *wbn* also stands for "sunshine")

Note the three possible determinatives. One,  "a piece of meat," poses no problem. As to  "fluid issuing from lips," which suggests "effusion," it is used after "vomiting" and "spitting,"[113] and in ancient texts it also indicates putrefaction.[114] Thus, in connection with wounds it might refer to bleeding as well as suppuration. The third determinative  or  is generally used to convey the notion of smell and putrefaction.[115] It is also used alone thus  as a shorthand writing of  *ḥs*, "feces,"[116] or of  *wḥdw*, the basic cause of rotting. Obviously, the scribe's idea of a wound implies corruption.

This third determinative, the strange object with two handles, deserves further study. It can be drawn or with or without the little curl, which appears to suggest "outflow" (by implication, "stinking outflow"); and

indeed, the rare form  is used when the preceding word is a liquid, as in *w s sh t*, "urine." It is also used after  *wt*, "the embalmer." Gardiner interpreted it provisionally as "pustule or gland" and listed it with unclassifiable signs.[117]

The clue to its origin was found by R. Steuer on an old stele from about 2250 B.C.[118] The text reads in part, "A boon given by . . . Anubis, Who-is-on-his-Mountain, Who-is-in-the-place-of-Embalming (*wt*)"; and see the determinative for *embalming:*

So the archaic form of was the pot of the embalmer pouring out the drugs of the trade. Here is where the Scribe came to seek his symbol for corruption.

To exploit the message of the determinatives to the extreme, we might follow Steuer one step further. Assume that we now have two kinds of wounds with two major determinatives:  -wounds, the better kind, with a cleaner type of determinative that stands mainly for "clean outflow" (bleeding); and -wounds, the rotten kind, where the determinative stands for "stinking outflow," hence decay (pus). It might therefore be possible to gauge in a given text the prevalence of infection by the prevalent type of determinative. Now the Smith papyrus, a rational book of surgery dealing mostly with fresh wounds, has mostly or good wounds; the Ebers papyrus, replete with magic and quack-type remedies, has only or bad wounds.[119] Steuer suggested that this is not fanciful spelling but the expression of a real clinical difference.[120] To me, it seems almost too elegant to be true that the scribes were expressing clinical nuances by playing with the determinatives.

And now I feel free to confess one disturbing truth that I have been concealing. The precious, the divine, the life-giving *bya*, "iron," is sometimes spelled with the rotten determinative  . Occasionally it also has two determinatives, both the star  and :

Wainwright, the expert on Egyptian iron, took this to mean that stands for "explosion." I would rather suggest that the ragged meteorites which drop on earth are being viewed as an *excrement* of the *sky:* of .

Lay Thy Hand upon It

The use of the hand in the Smith papyrus is impressive. Sometimes it has a precise purpose, such as searching for a fracture in the skull[121] or feeling a lump: "If thy puttest thy hand upon his breast upon these tumors, and thou

findest them very cool, there being no fever therein when thy hand touches him . . . and they are bulging to thy hand . . . there is no treatment."[122] In another case the swnw's hand may be feeling for the heartbeat: "If . . . any physician puts his hands (or) his fingers upon the head, upon the back of the head, upon the two hands, upon the pulse, upon the two feet . . . he measures . . . the heart."[123] But most of the time the swnw is reaching right into the wound, and he does it so systematically that the world's first description of the human brain is "something throbbing and fluttering under thy fingers."[124] See the fingers (*) in the original text:

Hieratic

Hieroglyphic

On a strictly surgical level, all this touching is of course very bad. The Greeks did away with it by replacing the finger with their all-purpose wound probe, though there is no proof that the one carried less bacteria than the other. How clean *was* the hand? The Egyptians are said to have been rather clean people, but data on their personal hygiene are few.[125] "Washerman's washing water" was used as a drug,[126] so that some kind of washermen must have existed. Soap, however, was unknown to them.[127] As detergents, they used fuller's earth, perhaps also the pounded lupins still used there today,[128] and above all their favorite chemical, *ntry*, a natural soda.[129]

But setting aside these purely hygienic considerations, I believe that we should read a deeper meaning into the gesture of touching the wound. It recurs so often, in a text that gives nothing but essentials, that it suggests an intrinsic value. In case 47, involving an open wound, the wording almost suggests a ritual: "Thy shouldst lay thy hand upon it."[130] Physical contact is reassuring; when a doctor touches the patient, both parties have the feeling that something is being done. Touching also means taking part; it means that matters are being taken in hand. The comfort of physical touch reaches deep down, to ancestral depths far older than mankind. Go back into the jungle with Jane van Lawick-Goodall and see how apes convey the message of re-assurance: sometimes it is just the matter of a hand touching a hand (Fig. 3.18).[131]

Meat, Salt, and Shepenn

"Bind the wound upon fresh meat"—this backward advice is standard for wounds and bites on the first day.[132] One wonders what was expected of it. Were it not for the single passage quoted earlier, in which the meat was

3.18 Reassuring by touch, a very basic gesture. Here it is employed by two chimpanzees in the forest.

supposed to transfer decay to the wound ("meat of an ox, so that the wound may rot"), one would guess the purpose to have been exactly the opposite. A slab of meat may have helped to check the bleeding as a mechanical plug, although nowhere in the Smith papyrus is any reference made to bleeding.[133] Meat, namely muscle, can also act as a clotting agent; crushed tissue in general works very well. An elderly neurosurgeon told me that in his younger days, before safe clotting agents had become available, it was standard practice to check very small hemorrhages on the surface of the brain by applying a tiny bit of muscle taken from the same patient (perfect hemostasis is crucial in brain surgery).

But this is not the wave length of the ancient Egyptians. A likelier rationale would be the simple, basic idea that flesh mends flesh. Lots of people still bind a steak over a black eye; the practice is current among boxers. There is no particular theory about it, except that it is "good."

Now we are much closer to Egyptian thinking. In fact, see what kind of meat they used. The word for meat was *ywf:*

(det. "meat")

y w f

plural strokes

Sometimes a prescription says ywf of cow, or ywf of ox; and as such, the ywf is either *ywf wadj:*

(det. "a hide")

y w f

plural strokes

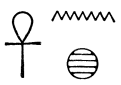
wadj (det. "concept")

or *ywf ankh:*

(det. "a hide")

y w f

plural strokes



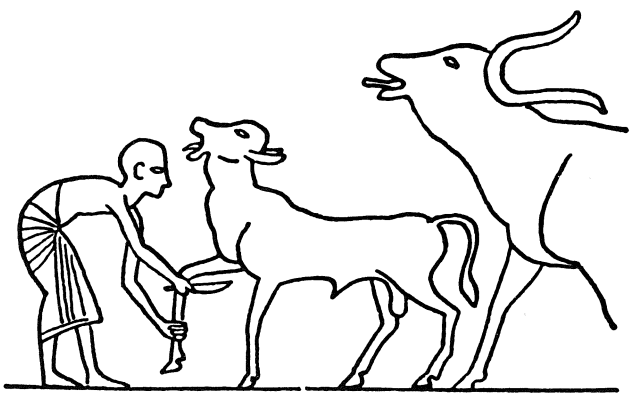
n

ankh

kh

Wadj means "green," but luckily it also means "fresh," so we can assume that *ywf wadj* means "fresh meat." As to *ywf ankh,* everybody nowadays seems to know that ☥ *ankh* stands for "life, alive," but most of the learned translators have found a treatment with "live meat" too bizarre and, somewhat uneasily, have rendered *ywf ankh* as "fresh meat."[134] Others were sufficiently annoyed by the expression to suspect the sacred ankh of meaning, for the occasion, "goat."[135]

But after all, there is nothing wrong with the literal translation: *ywf ankh* = "meat alive," or flesh just cut off a living animal.[136] Inconceivable today, the idea was commonplace in Egypt. Priests were accustomed to cut off the foreleg of a young bull (Fig. 3.19)[137] as part of the ceremony of the Opening of the Mouth, which was precisely a matter of infusing life into mummies or statues. In that case the live meat was a very appropriate "refreshment for the dead."[138] On a wound, it made equally good sense: to heal *ankh* or "live" flesh, use *ankh* or "live" meat.



3.19 Ritual amputation of the foreleg of the bull, which was part of the ceremony of the Opening of the Mouth—perhaps also a way to obtain "live flesh" to put on wounds. From a tomb, c.1300 B.C.

And now for the wound drugs. Put yourself in the place of an Egyptian patient: here comes the swnw and smothers your wound with an unspeakable green mush. Would you not want to know whether the stuff has a fighting chance to do you good?

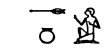
The first question, of course, is to determine whether we have a fighting chance to find an answer. The odds against making any sense of Egyptian pharmacy (or of ancient pharmacy in general) are huge. In the first place, what *did* they use? To choose one item from among the more studied, exactly what was

ka a ka a (det. "shrub")

"kaakaa"?[139] It was obviously a shrub; but was it really *Ricinus* (the plant that gives castor oil) as some of the experts suggest?[140] It is true that the Greeks had a vaguely similar name, *kíki,* for castor berries; but how safe is it to connect two words from texts that were perhaps one thousand years apart? And if we accept that kaakaa is *Ricinus,* what shall we do with the *dgm* plant, which also has very good reasons for being identified with *Ricinus?*[141] And regardless of which plant was *Ricinus,* what part was used, how was it prepared, how much was given, with what, and for what reason? Multiply these questions by some seven hundred "drugs," and the problem grows to such a size that one tends to brush it off by concluding that ancient Egyptian pharmacy was tremendously advanced—whereby what stands proven, rather than ancient wisdom, is modern confusion. Once and for all, beware: *next to nothing is known about the effectiveness of ancient drugs;* and even when the drug itself is known, experimental studies are almost nil.

In view of these dangers, I have chosen to analyze here only a few wound drugs, but those in depth. A good starting point is the series prescribed for the infected chest wound described earlier. It involves a three-phase program:[142]

I) Thou shalt make for him cool applications for drawing out the inflammation from the mouth of the wound:
Leaves of willow, nbs-tree. . . . Apply to it.
Leaves of ym'-tree, dung. . . . Apply to it.



II) Thou shalt make for him applications for drying up the wound:
Powder of green pigment . . . grease. Triturate; bind upon it.
Northern salt, ibex grease. Triturate; bind upon it.

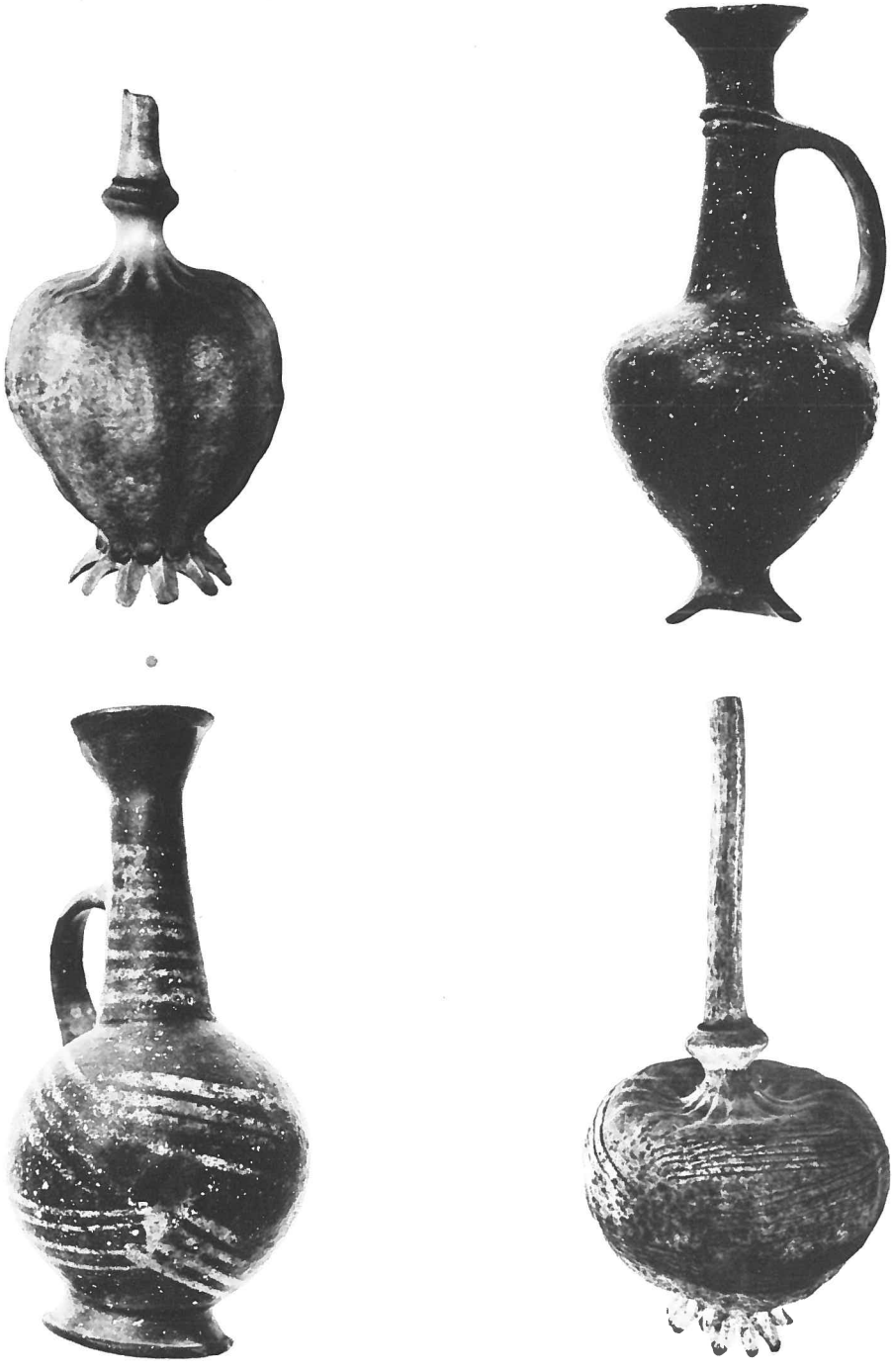
III) Thou shalt make for him poultices:
Red shepenn, garden tongue . . . sycamore leaves. Bind upon it.

Breasted commended the application of willow leaves because "they contain salicin."[143] They contain very little of it; and anyway the treatment would amount to putting traces of aspirin on wounds, which would not be particularly effective.[144]

As for dung, I would have thought that no amount of enthusiasm could lead to praise it as a drug; but I was wrong. Breasted exclaims in admiration that dung is "ammoniacal."[145] Perhaps this was the most benign adjective that Breasted's medical adviser could supply (what about "natural" or "biological"?), but it is meaningless in this context. The only benign comment I can make is that the Smith papyrus is very light on dung; other papyri are much more "ammoniacal"—they recommend excrements from man and eighteen other animals, including flyspecks scraped off the wall.[146]

The "red shepenn" had no acceptable translation in 1930; now it seems to mean poppy, either the common corn poppy or *Papaver somniferum*.[147] If it was corn poppy, its alkaloids have no morphine-like effect.[148] If it was the opium poppy, it is conceivable that an extract applied to a wound might be absorbed in large enough amounts to work as a shot of morphine. There is some evidence that opium did reach Egypt sometime during the Eighteenth Dynasty (c.1590–1340 B.C.),[149] that is, a century or two after our present edition of the Smith papyrus. Opium, incidentally, is the dried sap that oozes from slits in the poppy capsules (Fig. 3.20). During the Eighteenth Dynasty, Egypt began to import tiny jugs made by hand in Cyprus, so distinctive in size and shape as to suggest a trademark. Nowadays they would stand a good chance of being seized at customs by the narcotics squad, for they are just too similar to poppy capsules (Fig. 3.21). Even their finish often recalls the buff-brown color of the dried capsules; and what could the parallel lines be if

3.20 The basic technique for harvesting opium has not changed for millennia. The marks in this poppy capsule left by the three-pronged scraper (photographed in Laos in 1972), are very similar to those drawn on the "opium juglets" found in Egypt.



3.21 Two of many small juglets (top right, bottom left) that came to Egypt from Cyprus around 1600–1500 B.C., compared with poppy capsules (same scale). The similarity in size, shape, and surface pattern suggests that these juglets were full of opium. Insert at right shows scale.

not the slits from which the opium trickled? The crafty Cypriotes had probably devised these suggestive juglets to export a costly drug, opium dissolved in wine or water.[150]

At this very time, about 1550 B.C., the Ebers papyrus suggests a fail-safe drink to placate a crying baby: an infusion of shepenn, improved with flyspecks scraped from the wall.[151] Again about this time, upstream in Thebes, death befell an architect by the name of Cha. He was laid in his grave with an alabaster pot full of ointment. In 1927 an Italian pharmacologist analyzed what was left of it and found, mixed in with the fat, something that behaved chemically and physiologically like morphine.[152] What opium would be doing in an ointment, again I do not know; but it seems very likely that the opium producers of the Greek islands had found customers in Egypt sometime between the Smith and the Ebers papyrus (Fig. 3.3).

In the second phase of treatment for the badly infected chest wound, several drugs were prescribed to "dry up the sore." I read this to mean "stopping suppuration," which suggests that antiseptics might be hiding here. The "Northern salt" was chiefly sodium chloride.[153] It could well have some antiseptic effect, as it does in salted meat or fish, but concentrations sufficient to kill bacteria would also hurt the tissues. The "green pigment" deserves a special treatment.

The Logic of Eye Paint

"Powder of green pigment . . . Triturate; bind upon it"—so goes the prescription. Thanks to the chemists, we are rather well informed about Egyptian green pigments.[154] They were called by the general name of *wadj*, which means "to be green." Here is one way to spell it:

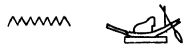
dj

wad

(det. "concept")

But in most cases wadj referred to one particular green stone, malachite (Plate 3.3). This is copper carbonate. It lay about in the eastern desert and on the Sinai peninsula and, though very beautiful, was actually a copper ore.[155] Another ore designated as wadj was chrysocolla, copper silicate, which is a lovely blue-green (Plate 3.4). A third way to obtain a green powder was to grind up an artificial frit, that is, a kind of glass obtained by melting together sand, natron, and copper minerals.[156]

The Ebers papyrus also mentions a fourth kind, wadj "of boat":



n

(= "of") "boat"

Being myself quite familiar with the blue-green patina that forms on the copper sheathing of old shipwrecks and on bronze fittings at sea, I found very attractive the interpretation of this "boat green"—published ten years ago—as "scrapings of marine hardware."[157] For safety, however, I wrote to the author—and almost wished I had not. Dr. Harris had since been seized by a reasonable doubt: what if the "boat green" were just some messy green stuff scraped off the bottom of a wooden boat? The original idea had been suggested in the nineteenth century, when copper-lined hulls were still within living memory; but the Egyptians did not build their boats that way.

Thus were shipwrecked the "scrapings of marine hardware." However, all is not lost. Somehow, *some* green pigment was being obtained from copper, because it appears to be implied in the expression *wadj ḥmty*, "coppery green" or "copper green," where  *ḥmtyy* is an adjective from *ḥmt*, "copper."[158] In summary, then, the Egyptians had at least four ways to obtain their wadj—green pigments from copper compounds.

Very often wadj also stands for green eye-paint;[159] and be prepared for surprises, for ladies' makeup, seen in the perspective of time, transcends cosmetics. Century after century Egyptian women kept painting their eyelids either black or green (Plate 3.5).[160] The black makeup was called:

ms s d m (det. "grain") t
plural strokes

pronounced something like *mesdemet*. So persistent were the ladies in using this makeup, over roughly five thousand years,[161] that its name passed into the Coptic ⲥⲧⲏⲙ *stim*, then into the Greek *stimmi*, and finally into the Latin *stibium*, "antimony." It was, in fact, antimony sulphide (stibnite). Its Mesopotamian equivalent had an equally brilliant philologic career. It was called *guhlu* and was either stibnite or "galena," lead sulphide. Guhlu lasted long enough for the Arabs to take it over as *kohl*. Being a powder ground to extreme fineness, the kohl—*al kohl*—came to mean something extremely subtle; hence, in the late Middle Ages Paracelsus applied it to the spirit of wine—yes, *alcohol!* Strangest of all is that the Arabs themselves now call alcohol by the Latin word, *sbirtu*.[162]

The little kits for grinding eye paint were an important item of Egyptian toilette. Their name happens to be written like the word for "to protect," possibly an allusion to averting the eye diseases that were then and still are a scourge all over the Near East. Eye paints were offered to the gods, the statues of the gods were painted with them, and they are often mentioned in connection with the eye of Horus.[163]

Green as a color was related to joy (think of the daily contrast between greenery and desert, almost synonymous with life and death).[164] In Ptolemaic times, another word for joy was *turquoise* (ideally turquoise is blue, but by

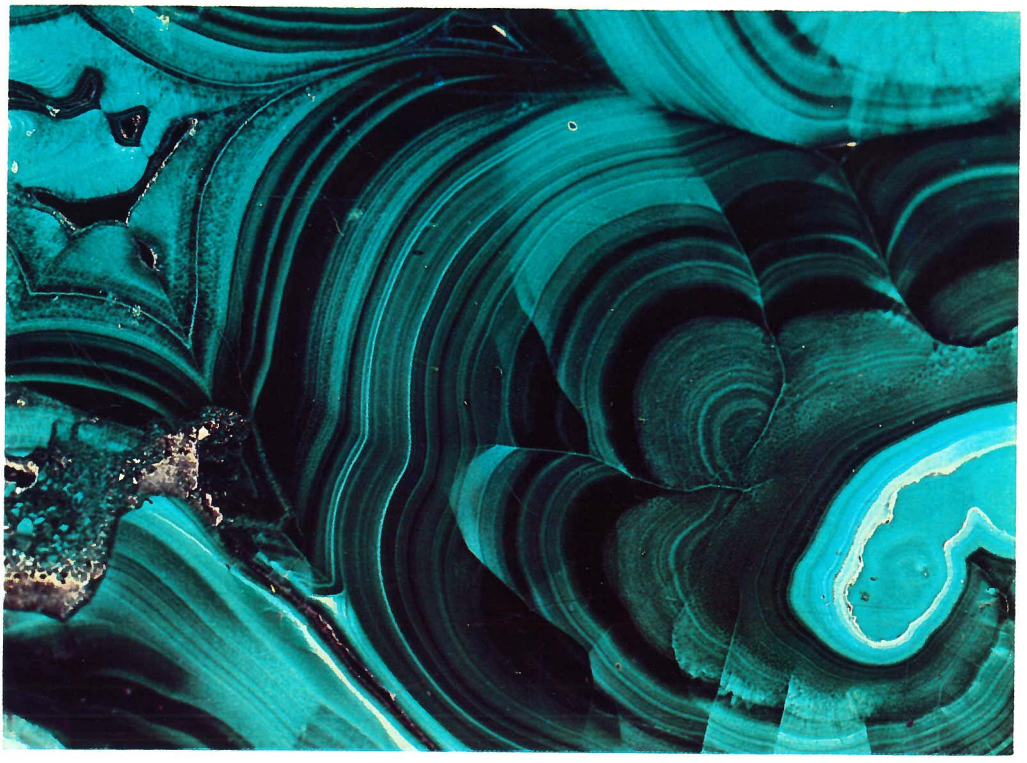


Plate 3.3 Malachite, the beautiful copper ore that was powdered to obtain green pigment for paint, eye shadow, and wound salves. Enlarged about 2x.

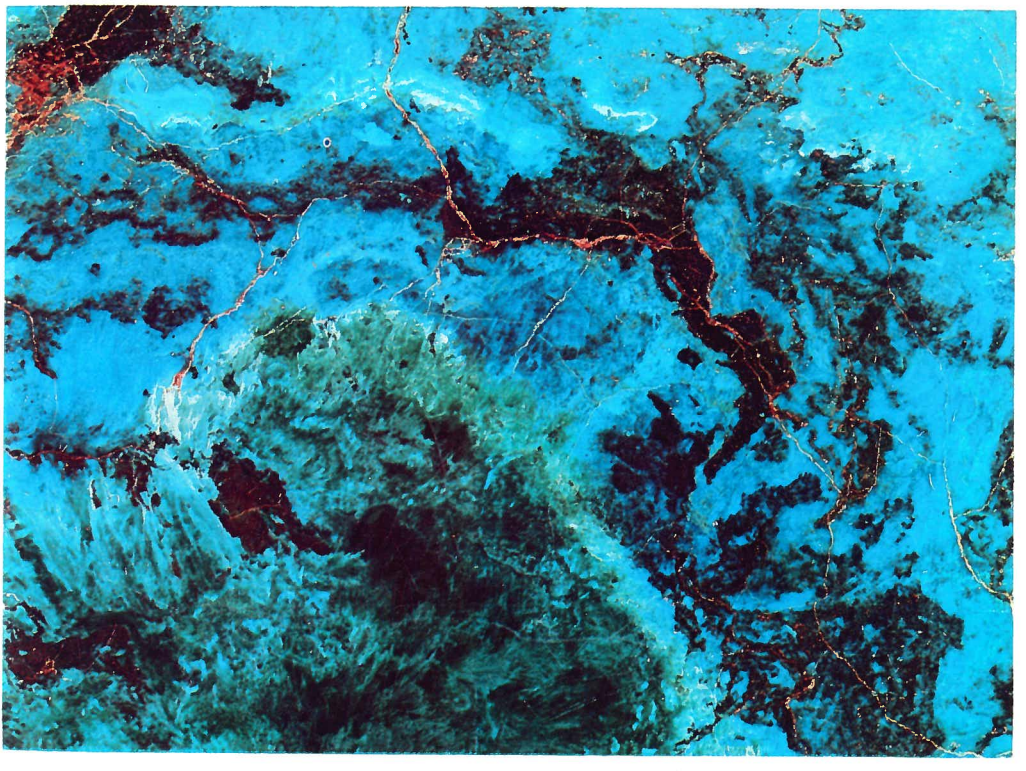


Plate 3.4 Chrysocolla, from a Greek word meaning "gold glue," is another lovely copper ore that was ground for pigment, used in paint, gold solder, and medicine. Enlarged about 2x.

Plate 3.5 Typical Egyptian eye makeup with blue-green copper pigment (in this instance the precise variety is not known). Head found in Tutankhamun's tomb, c.1350 B.C.

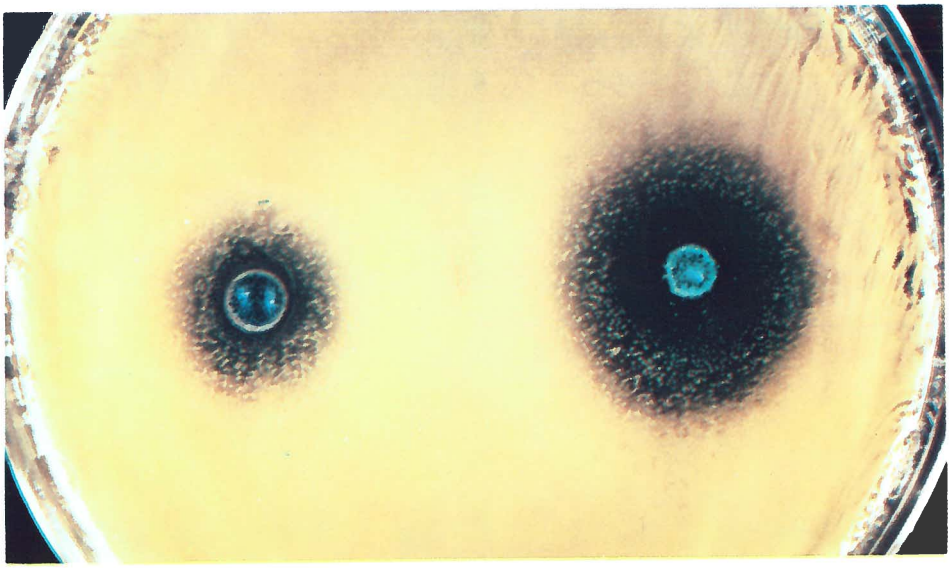


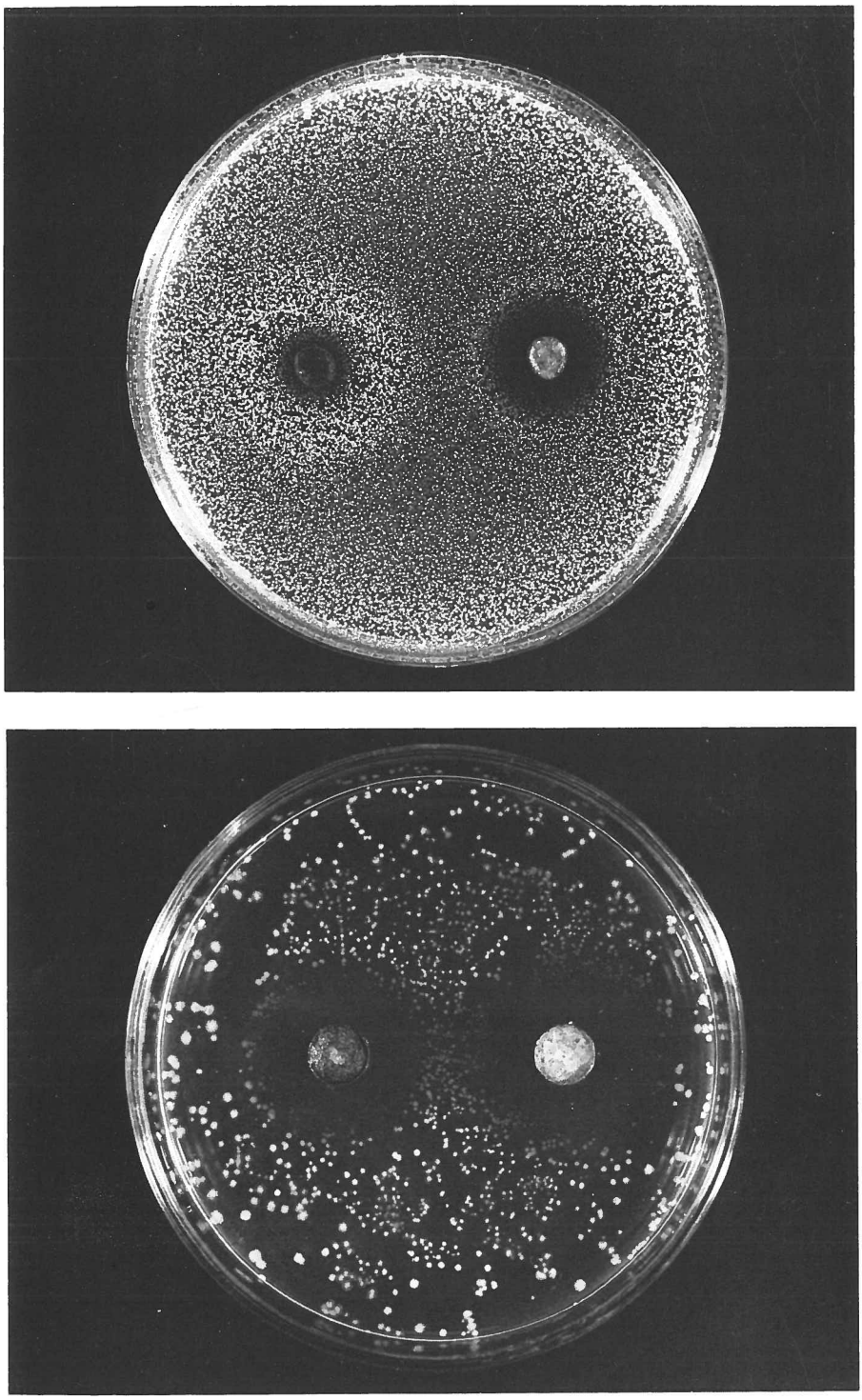
Plate 3.6 Effect of powdered malachite (right) and chrysocolla (left) on bacterial growth. Here the culture medium was sewn with harmless bacteria (*Sarcina lutea*); some powder was put into each of the two little wells and allowed to stand for eight hours at 4°C. Then the plate was incubated at 37°C. Bacterial growth (yellow background) failed to occur in a dark ring around each well; malachite was more effective.

the time it is found, it has often turned green from exposure to the light).[165]

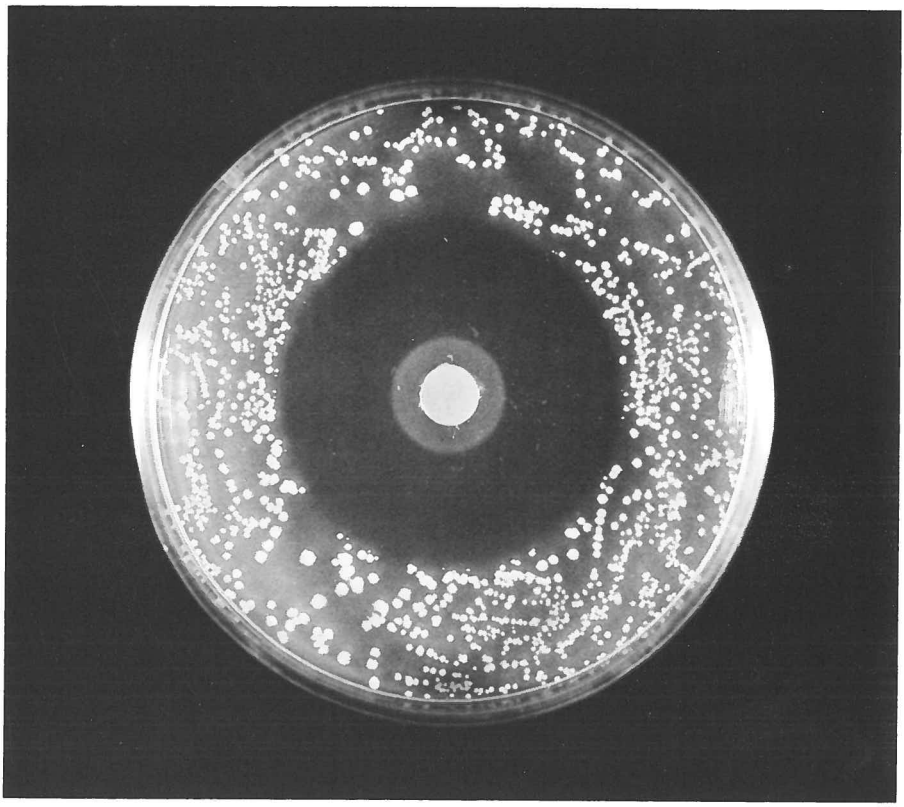
Taking all this into consideration, I would conclude that whoever first decided to put green pigment on an ugly, infected wound must have had in mind something more than just a kind of paint. But could it have done any good? The intriguing fact is that every one of the four green pigments happened to be a copper compound. Copper is fairly toxic,[166] and what kills people should kill bacteria. Suspecting that one or the other *wadj* may have worked as an antiseptic, I set about procuring samples of green powders that would qualify as wadj, to test their capacity to prevent bacterial growth in cultures.[167] The first two samples were easy to make. I sacrificed small pieces of malachite and chrysocolla and ground them to a fine powder in a porcelain pharmacy mortar. A third sample, according to my original sources, might have been the patina from the copper sheeting of an ancient New England wreck (a precious specimen in my possession); but this plan, of course, had to be scrapped. The problem was to prepare an acceptable wadj directly from copper. Eventually I adopted the oldest method available, as described by Dioscorides in the first century A.D. In his day the copper-green powder now called verdigris was known in Greek as *iós xystós*, literally "scraped [copper-] rust," and in Latin *Aerugo rasilis:* "But Aerugo rasilis is thus prepared. Pouring into an hogshead, or some such like vessel, ye sharpest vinegar, turn upon it a brazen vessel: it is good if ye hollow look downward, if not, let it be plane. But let it be made clean & having no breathing place. Then after 10 days take off ye cover & scrape off ye Aerugo that has come on it; or having made a plate of ye brass itself, hang it into the vessel, so as not to touch ye vinegar, and after ye like number of days scrape it off."[168] This last method works beautifully: we used strips of copper plate hung over vinegar in a tall, closed jar; overnight they became covered with a lovely blue-green wadj.

Using infected wounds as a source of pathogenic bacteria, the three powders were then submitted to a standard test. The results were fair for chrysocolla, good for malachite, and spectacular for verdigris; none of the bacteria resisted the onslaught of this last wadj (Plate 3.6, Figs. 3.22–3.23). Whatever the logic that prompted the use of wadj on wounds, I must conclude that the green wound-dressings—apart from their cheerful color—may well have beaten off some infections. Copper poisoning through a few local applications should not have been a major risk. If the test of time means anything, malachite and chrysocolla remained in use until the Greeks launched the variety that became most popular: verdigris (which is in fact corrupt Middle English for *vert-de-Grèce*). Dioscorides' concluding paragraph on chrysocolla rings distinctly true: "But Chrysocolla hath a faculty of wearing off scars, of repressing flesh-excrescencies, & of cleansing, & of binding & of warming & is gently corrosive with some little biting. And it is of ye number of those medicines that cause vomiting & are strong enough to kill."[169]

Skip another two thousand years: staphylococci are being fought with copper to this very day. There is a staphylococcal skin infection called impetigo. In France at least, a very popular—and, I am told, practically indis-



3.22 Two other experiments to test the bactericidal power of malachite and chrysocolla, this time against a pathogenic bacterium, *Staphylococcus aureus*. *Above:* The technique is the same as for Plate 3.6. This method gives the bacteria an unfair advantage, because the dry powder in the little wells has difficulty in diffusing out; hence, the inhibition of bacterial growth is not marked. *Below:* here the powder in the wells was moistened with water, which allowed more copper to diffuse out. Under these conditions, more comparable to those of a wound dressing, both minerals are very effective.



3.23 This time "green of copper" is in the center well: copper acetate scraped off copper plates exposed to vapors of vinegar. The bacterium is *E. coli*. "Green of copper" has a devastating effect on bacteria, as shown by the dark ring.

pensable—prescription against impetigo is the *Eau Dalibour*. It was devised around the year 1700 by Monsieur Jacques Dalibour, surgeon general to the army of Louis XIV. Its principal ingredients are copper and zinc, and it worked like a charm for "all Manners of Wounds, Cuts, Slashes by Sword or Sabre, and Injuries by all Cutting and Bruising Devices."[170]

Grease, Honey, and Lint

Mrht, byt, and *ftt*—this is the standard wound salve of the Smith papyrus:

mr		t			t		f	"sun" ***
	h		byt			*		**
r		*					t t	nh ("every")

* Det. "pot" + plural strokes, meaning "stuff in pot"

** Det. "backbone and ribs" (fibers seen as backbones of a plant)

*** "Sun" means "day." The vertical stroke means "the preceding sign ('sun,' hence 'day') stands for the object drawn."

The lint, ftt, was some sort of vegetable fiber,[171] possibly a fluffy pad as shown in Fig. 3.5; it was also used as a contraceptive.[172] To a bad wound in the throat that gives fever and drives the patient to his mooring stakes, ftt is applied alone and dry, without bandages, "perhaps to promote drainage" by capillary action.[173]

The grease, mrht, could be anything from vegetable oil to snake grease. The animal varieties come from at least twenty-two species.[174] Byt, or honey, was by far the most popular Egyptian drug, being mentioned some 500 times in 900 remedies. It came from wild bees, since the Egyptians did not practice apiculture.[175]

To visualize the salve, one should know the proportions of honey and grease. A single reference suggests $\frac{1}{3}$ to $\frac{2}{3}$.[176] Note here the improvement over Akkadian pharmacy: the Egyptians often specify the relative quantities of ingredients in their recipes, probably in volumes rather than weights.[177] They had several ways to indicate fractions. Here is one:

$\frac{1}{2}$ $\frac{1}{4}$ $\frac{1}{8}$ $\frac{1}{16}$ $\frac{1}{32}$ $\frac{1}{64}$

and if the reader will guess how this came about, he deserves an honorary Ph.D. in Egyptology (for the answer, see Fig. 3.24).[178]

Anyway, we prepared a mixture of $\frac{1}{3}$ honey to $\frac{2}{3}$ fat, using either beef fat or butter; and it turned out that $\frac{1}{3}$ honey is just right; more makes the paste too sticky. Despite the pleasant consistency, I thought at first that this would be dreadful stuff to put on an open wound. I visualized swarms of flies feeding on the honey, swarms of bacteria feeding on the sugar, and tissue reactions caused by the grease: when fatty substances are injected into the tissues, they produce a persistent lump called a fat granuloma. Today, looking back on this skepticism, I feel I should have paid more attention to one very unusual feature about this salve: the way it is recommended in the Smith papyrus. Egyptian remedies in general come with long lists of possible substitutes: "another . . . another . . . another . . ." often reinforced with comments like  "good, good," "really proven," "proven  (= a million) times"—as is common with drugs that do not work. But the combination of "lint, grease, and honey" is recommended for twenty-two of forty-eight cases[179] with the bluntness of "penicillin," as if the author really knew that it worked.

One day, as my wife was spreading vaseline over a minor burn, I began to wonder. We still apply ointments to small cuts. Are vaseline or lanolin so very different from ox grease, ibis grease, lion grease, or grease from a hippo's foot?[180]

I looked up some literature, beginning with the bees. Bees are clean little beasts. If they are killed and dipped in a culture medium, bacteria rarely grow

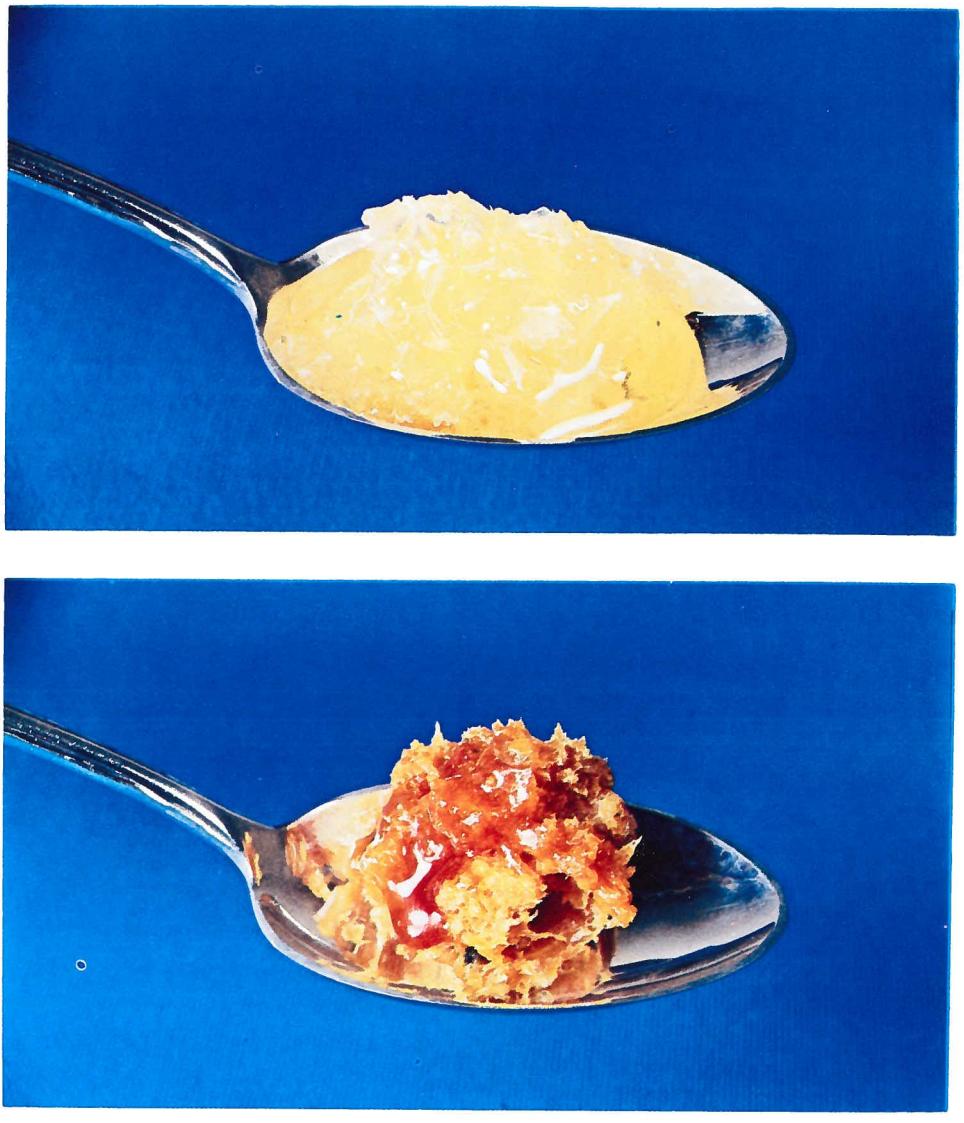


Plate 3.7 *Above:* A spoonful of honey in the comb. *Below:* Ancient honey, which lay underground in Paestum for about 2500 years. The color, consistency, and stickiness of the ancient honey were close to normal (the taste has yet to be tried).

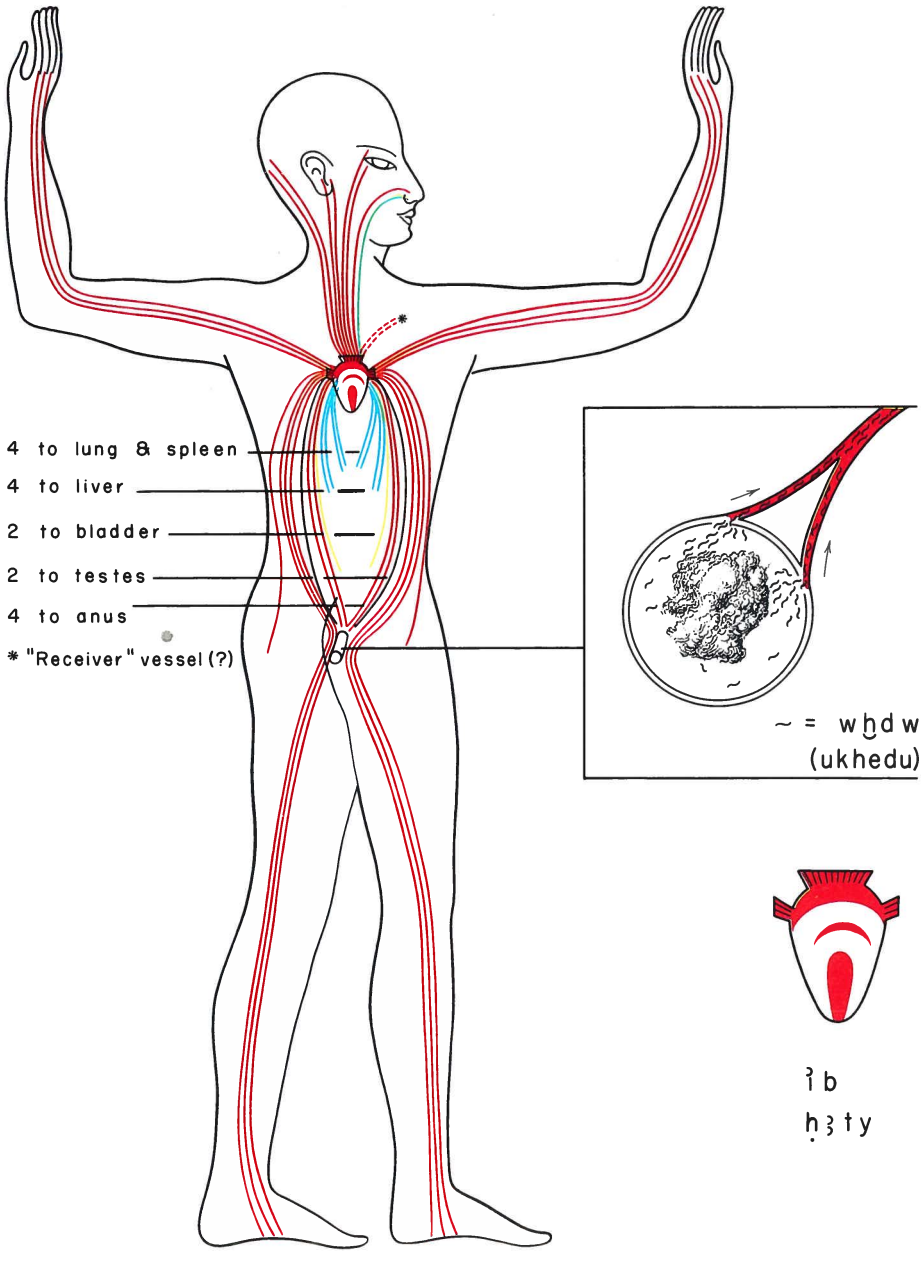


Plate 3.8 An informed guess about the vascular system as the Egyptians saw it. All vessels came from the heart, but they had a second assembly center around the anus. Some vessels carried blood (red), others mucus (green), urine (yellow), semen (black), water, and air (blue). Air entered the nose, passed through the heart, and went to the anus. *Upper insert:* A cross section through the anus, showing that the vessels opening to it could become flooded with excrement and carry elsewhere the dangerous *ukhedu*. Hence the central role of the anus in Egyptian medicine. *Lower insert:* The heart, which could speak through the vessels (a reference to the pulse?). Mysteriously, it had two names, *ib* and *ḥaty;* both could be abbreviated to 𓄡 .

out.[181] Some years past a scientist worriedly noticed that honeybees were crawling "over the human excrement of the family privy" in Tennessee.[182] He tested the maximum survival time of bacteria in honey, using bacteria of the typhoid-colon group, and found much to his relief that all were killed within hours or days, as follows:

B. dysenteriae	10 hours
B. paratyphosus A	10 hours
B. paratyphosus B	10 hours–1 day
B. typhosus	10 hours–2 days
B. proteus vulgaris	3–4 days
B. coli communis	4–5 days

The honey was heat-sterilized, inoculated with the bacteria, then kept at room temperature (under these conditions the bactericidal activity is due mainly to the osmotic effect). The addition of 10 percent physiological saline to the honey often increased its effect; saline up to 50 percent did not decrease it appreciably.[183]

Thus honey does not support bacterial growth: if this were not so, the bees would have a hard time, and many housewives too. Honey is antibacterial for several reasons. The most obvious is a simple concentration effect: being extremely hypertonic,[184] it draws water from the bacterial cells, causing them to shrivel and die. This mechanism works so well that an offering of honey, piously buried in Paestum in a sacred chamber 2500 years ago,[185] never decayed and is recognizable to this day (Plate 3.7).

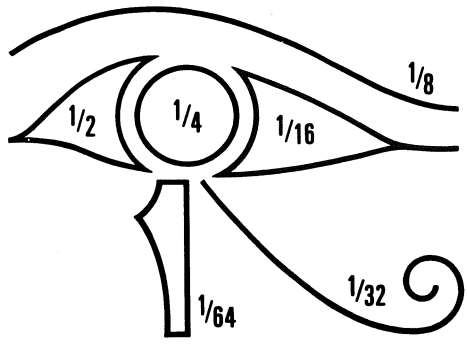
But honey can also prevent the growth of bacteria by an antibiotic mechanism discovered several years before the advent of penicillin, and active even in dilutions as low as 13 percent.[186] One of the active principles, inhibine, turned out to be an enzyme secreted by the pharyngeal glands of the bee: glucose oxidase.[187] The reaction is as follows:

$$\text{glucose} + O_2 \xrightarrow{\textit{glucose oxidase}} \text{gluconolactone} + H_2O_2$$

where H_2O_2 is hydrogen peroxyde, the common household disinfectant, and gluconolactone equilibrates with gluconic acid, a mild antibiotic.[188] A convenient system indeed.

Inhibine is destroyed by light or heat. But a group of French workers discovered in honey yet another type of bacteriostatic activity that is resistant to both light and heat.[189]

The bee's antibacterial arsenal is not exhausted with honey. Cracks in the hive are patched with a sticky material called propolis, gathered from buds, and this too is antibiotic.[190] It even inhibits plant growth: if potato germs are introduced into the beehive, the bees quickly clean them up and cover them with a thin layer of propolis. Result: no growth.[191] Its main active principle is galangine, a flavonol, which now holds U.S. patent 2,550,269 as a food preservative.[192] During the Boer War, propolis was used successfully, it was said, for the treatment of wounds.[193]



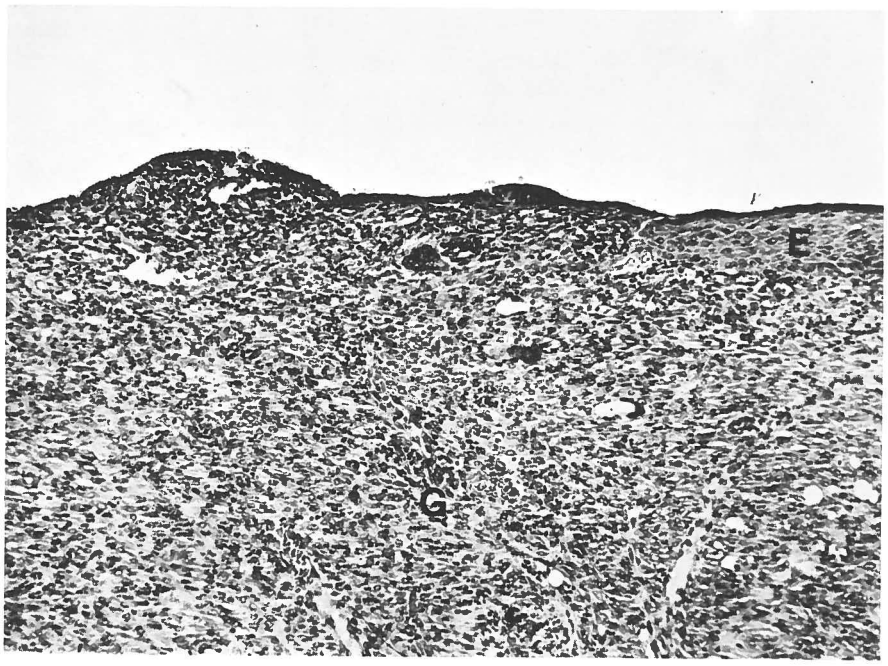
3.24 The eye of Horus, the falcon-god, was used as a device to express fractions. The whole story is very unmathematical. Horus and Seth became involved in a fight over the succession to their father. The eyes of Horus were pulled out and torn to pieces, and the physician-god Thoth put them together again. But the fractions for each part of the eye add up to only 63/64; presumably the last bit was supplied by Thoth.

Honey as a wound dressing never quite faded out. In Shanghai during World War II, hardship brought back the use of honey and lard for ulcers and small wounds. The results may not have been as "extraordinarily good" as claimed,[194] but like many other recent attempts they prove that honey is well tolerated and basically harmless, though it may sting for a while and cause some delay in healing.[195] The main advantage seems to be mechanical. Despite its own stickiness it prevents the dressing from sticking to the wound, because it draws out a large amount of fluid,[196] and this is said to have a cleansing effect, especially useful on dirty or infected wounds.[197]

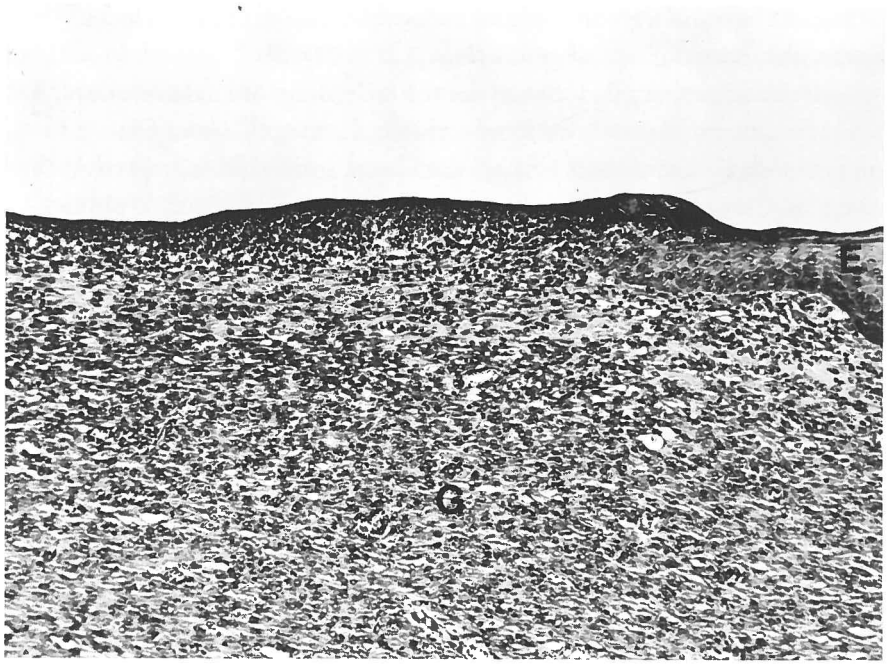
In summary, *the swnw happened to choose an ingredient that was practically harmless to the tissues, aseptic, antiseptic, and antibiotic.* I should say *the* ingredient: nothing else, in ancient Egypt, could have begun to match these properties of honey. The nearest competitors would have been the resins, which were in fact used, but they were scarce and too sticky, or too dry, to use pure.

Now for the case of grease. On this score scientific literature was of little help. It was well known that fats and oils injected into the tissues produce untoward reactions, but it was not clear what would happen if fat were applied to the surface of a wound, which is reacting anyway. I suspected that the tissue reaction would be exaggerated, perhaps to the point of mushrooming into those exuberant growths once called by the Calvinistic name of "proud flesh." Several millennia of medical practice are worth the sacrifice of a few guinea pigs: we put Egyptian pharmacy to the test of science and compared wounds that had been treated with either beef fat or vaseline (the latter is said to be practically indifferent to wound healing). After eight days, both kinds of wounds had closed to a comparable degree, with no trace of "proud flesh" (Figs. 3.25–3.26).

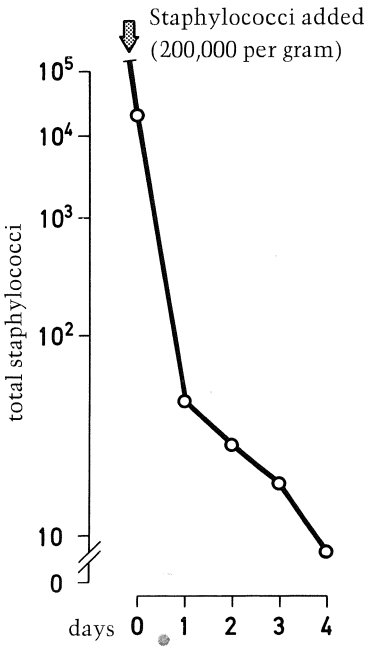
A pessimist might still object that the grease-and-honey mixture could spoil. But actually it kills bacteria. To give the mixture the roughest possible test, we made it up with butter (apparently not known to the ancient Egyptians), which contains many bacteria of its own, including a group of coliform bacteria. Result: the bacteria initially present tended to disappear, and if



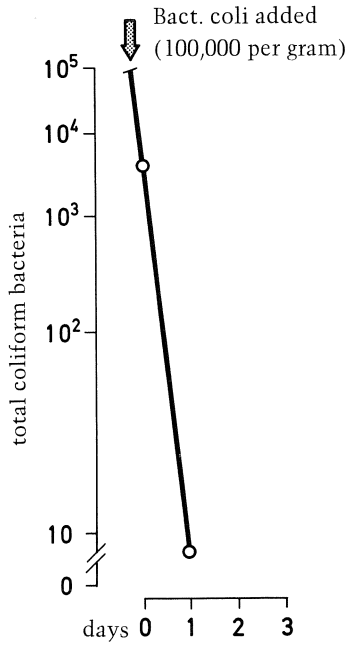
3.25 Microscopic section of the surface of an open wound in guinea-pig skin, left untreated for seven days except for a vaseline dressing. It was filled with granulation tissue (G), and the epidermis (E) is growing back over it. This is the normal course of events without any treatment.



3.26 Microscopic section of a similar wound of the same age, which has been kept under a dressing of *byt* and *mrht*, "honey" and "grease." Compare with the preceding figure: no harm has been done.



3.27 The self-sterilizing, antiseptic effect of the ancient Egyptian wound salve, ⅓ honey and ⅔ grease (here butter). The added staphylococci are rapidly killed.



3.28 The same experiment with another pathogenic bacterium, *E. coli.*

pathogenic bacteria were added, like *Escherichia coli* or *Staphylococcus aureus,* they were killed just as fast (Figs. 3.27–3.28).[198]

All this goes to say that, in view of the technology of Pharaonic days, it would be difficult to produce a more sensible ointment. One wonders how the ingredients were chosen. Perhaps there were some cultural reasons that escape us. Consider this hint from a charm: "I prepared for him . . . honey, which is sweet to men, but bitter to the dead."[199] But the truth is probably simpler. Both grease and honey would prevent the bandage from sticking; both have a soothing consistency; grease spoils little, oil and honey not at all. To a decay-conscious mind like that of the Egyptian, this last must have been an important consideration.

After this tribute to Egyptian acumen, it is only fair to remember that the bees, as embalmers, were actually ahead of the Pharaohs. When the hive is invaded and the intruder gets killed but is too large to be thrown out, the bees simply cover its corpse with propolis. After a while, all that is left is a harmless mummy (Fig. 3.29).[200]

It must have taken a long time to work out this method; but insects had time. We had perhaps four million years. They had at least 400 million.[201]

The Drug That Came from Pwnt

It happened one day around 1370 B.C., when Egypt was running a huge empire, reaching all the way through Syria to the Euphrates and beyond.

3.29 Mummy of a mouse found in a hive. The bees had covered it with antiseptic bee-glue (propolis), and it had dried out without obnoxious decay. The mummification is mainly due to drying, but the propolis surely helps.

Amenophis IV received a letter from Palestine. It came from Milkili, one of his lieutenants.[202]

Political affairs were a nuisance to Amenophis. He was a peculiar character, all wound up in a religious world of his own—the world of Aton, the Disc of the Sun. So great was his passion that, braving an irate clergy, he had the name of the ancient god Amun hammered off all the monuments he could reach. Eventually, to make the break more definitive, he stormed out with Nefertiti and all his court and founded a new capital of his own, Akhetaton (Fig. 3.30).

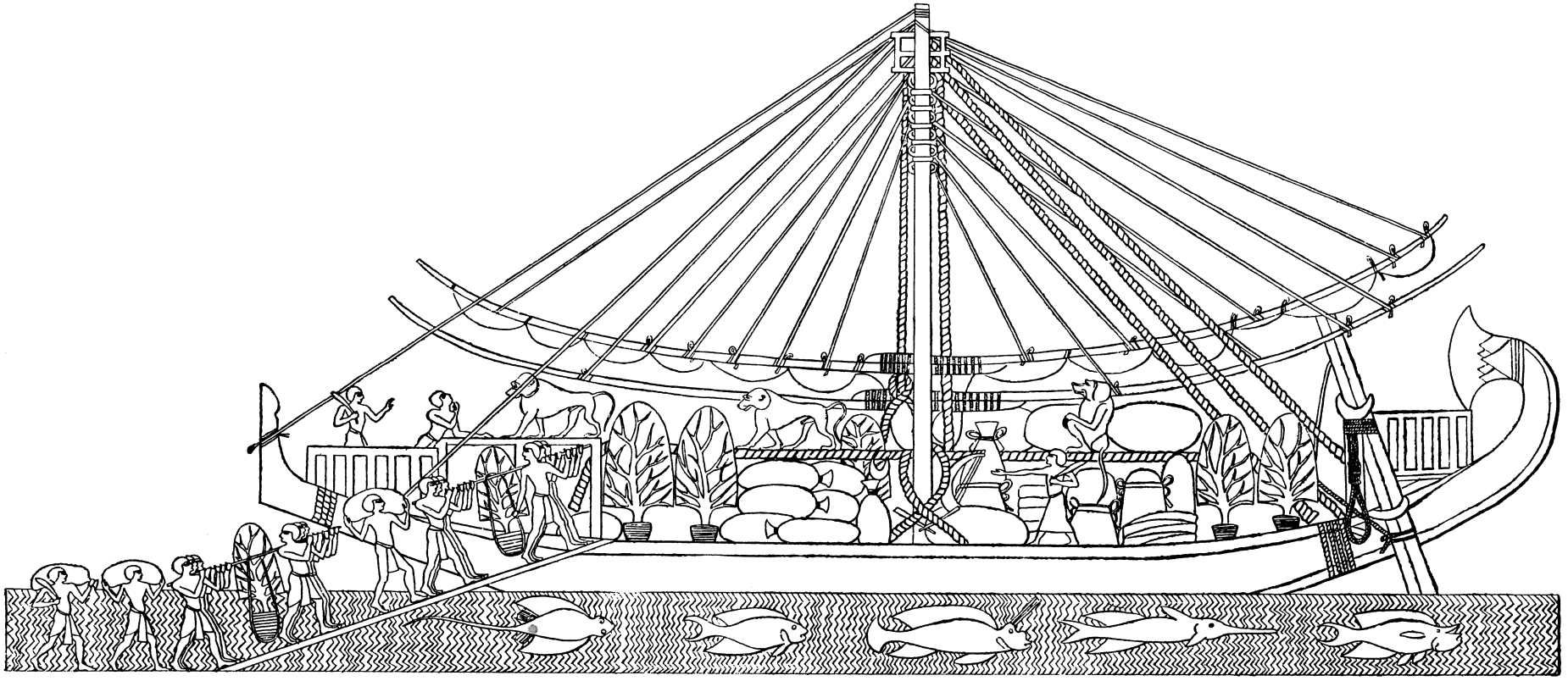
So Milkili's letter did not go to Thebes, but to the plateau that is now El Amarna. It was written in cuneiform characters on a clay tablet; deciphered by the palace cuneiformist, it must have read then as we can now read it among the "El Amarna Letters":[203]

> To the King, my Lord,
> my Gods [*sic*], my Sun,
> thus saith Milkili, thy servant,
> the dust of thy feet.
> At the feet of my King, my Lord
> my Gods, my Sun
> 7 times and 7 I fall.
> I have heard what the King, my Lord,
> has written to me.
> And let the King, my Lord,
> send troops
> to his servants, and
> let the King, my Lord,
> send myrrh
> for medicine.

3.30 Akhenaton (Amenophis IV) and his wife Nefertiti, c.1370 B.C. Perhaps, when they posed for this portrait, they were perfumed with the oil of myrrh they had received as a wedding gift.

Milkili was no little lamb. In the past, the Pharaoh had received serious complaints about him; but since then they had made peace.[204] Now Milkili was sending three terse messages: "I have taken notice of your orders. Please send soldiers. Please send myrrh."

Asking for myrrh as a personal gift was not exactly modest. Myrrh, like frankincense and all the aromatic resins, was not a product of Egypt.[205] The Pharaoh himself had to buy his supplies from southern Arabia, from Abyssinia, and from what he called the land of Pwnt, probably the Somali coast. Perhaps Amenophis IV remembered the two stone boxes of myrrh that he himself had received as a gift from Tushratta, king of Mitanni, at the time of his wedding with Nefertiti: one had contained myrrh, the other oil of myrrh.[206] Perhaps another memory flashed through his mind: the old myrrh trees back in Thebes. Some one hundred years earlier one of his royal ancestors, the energetic Queen Hatshepswt, tired of depending on imported myrrh, had sent an expedition of five ships to the Land of Pwnt. They had returned triumphant, loaded with myrrh, dogs, baboons, and thirty-one myrrh trees (Fig. 3.31). The trees had been planted at Thebes and were supposed to have flourished thereafter. But even if they still existed, Amenophis would have had nothing to do with Thebes, let alone with trees that had been planted in the very garden of Amun,[207] so his only choice, to satisfy Milkili's request, would have been to draw on the palace supplies, being sure to leave enough reserves to embalm—Aton forbid—a royal mummy.



3.31 One of several Egyptian attempts to import myrrh trees: the expedition of Queen Hatshepswt to the Land of Pwnt. From a bas-relief, c.1500 B.C.

But what did Milkili have in mind? What ill did he plan to heal with "myrrh as medicine"—maybe some intestinal trouble? We will have to look at the sources. Myrrh appears in dozens of Egyptian prescriptions. It is unusually well identified, as Egyptian drugs go, under the name of *antyw*:[208]

a (det. "pot")
tyw*
n plural strokes

*Note that this is  for *tyw*, not  for *a*. The scribes must have had some training as birdwatchers, for there were at least fifty-four bird hieroglyphs.

The other major resin, used mostly as incense, was called *sntr*, perhaps the resin of the turpentine tree.[209]

Now through the entire lot of the medical papyri, myrrh is applied externally in 63 of the 66 cases where it is used; incense resin is used in the same general way. Obviously Milkili was not asking for an internal remedy. Since he was a soldier, what we need to know next is whether there were wound salves based on resins. There are none in the great Smith papyrus, which must have been written by a honey-lover; but there are many plasters with myrrh in the Ebers papyrus, which was about 150 years old in the days of Amenophis (recent literature, on the Egyptian time scale). Here is one myrrh salve:[210]

> What is done for a wound in the neck:
> Myrrh, one part. Flour of the *djbt*-plant [*no amount given*].
> Work into a mass, bind on.

I would actually prefer this other salve for burns, also prepared with a resin:[211]

> *Snṯr*-resin, one part.
> Honey, one part.
> Anoint with it.

Well, we know from Milkili himself that he did not need myrrh for offerings—or because he liked the smell of it. He wanted soldiers, and myrrh for medicine. I submit that everybody knew, at the time, that myrrh was good for wounds. So, going back to his letter, I read between the lines: "Amenophis—whatever people have been telling you about me, remember I am here to be skewered for your pleasure."

Magic As an Antibiotic

Magic, like penicillin, is directed against the cause of disease. The choice between drugs and magic depends on the current set of causes. In ancient Egypt, where evil forces caused a lot of trouble, magic was a perfectly logical therapy; an accepted science, with Isis as patroness. There was no clearcut distinction between so-called rational medicine and magic: drugs and incantations were administered in all possible combinations,[212] and by the same or by different practitioners.[213] Magic was especially indicated against the so-called "hidden diseases," or internal ones, as we now say; but oddly enough, it was used also for wounds.

What is a wound, anyway? To our way of thinking it is something out in the open, which should require nothing but ordinary, down-to-earth consideration. But read this extraordinary passage of the Smith papyrus, probably the world's oldest discussion of causes.[214] The text describes "a man having a smash of his skull, under the skin of his head . . . while his eye is askew because of it, on the side of him having that injury . . . Thou shouldst account him one whom something entering from outside has smitten . . . An ailment not to be treated." The Commentator explains: "As for: 'Something entering from outside,' it means the breath of an outside god or death; not the intrusion of something which his flesh engenders." He is obviously distinguishing between internal and external causes.

If even a wound implies "the breath of an outside god," treatment by magic is clearly indicated. It was used, for instance, in spells to accompany the acts of bandaging and of removing a dressing. Of the following examples,[215] the first occurs at the opening of the Ebers papyrus. As to the second, to be recited upon the removal of a bandage—think of the anxiety that this operation always induces; the soothing litany has real clinical merit. For burn wounds there is an oft-quoted, rather picturesque charm that has come down in several variants. It is a dialog between a messenger and the goddess Isis.[216]

To understand these incantations, it helps to know that Isis, the magician-goddess, had a good brother, Osiris, and a bad one, Seth. Seth killed Osiris and ripped him apart. Isis patiently reassembled him, lay over his body, and succeeded in conceiving Horus. Then she resuscitated her brother-husband. Every Egyptian hoped that after death he too might be as lucky as Osiris: extending this idea, every sick person was also Osiris and could be cured by Isis.[217] Then Seth, in another fit of dismembering rage, tore out the eyes of Horus and ripped them apart. It was Thoth, the ibis-god, who put them together again.

Incantations prevailed when the clinical situation was somber. For snake and scorpion bites, for instance, there were magic formulas but essentially nothing in the way of local treatment.[218]

BEGINNING OF THE RECITAL
FOR APPLYING A REMEDY
ON ANY PART OF THE BODY
OF A MAN

I have come from Iwnw [*Heliopolis*]
with the Great Ones of the Great House
the Lords of Protection
the Rulers of Eternity

And yet I have come from Sais
with the Mother of the Gods
—I am in their safekeeping—

I know charms that the Almighty wrought
to chase away the spell of a God,
of a Goddess,
of a dead man,
of a dead woman . . . (continue at will)
that are in this mine head
in this mine nape
in these mine shoulders
in this mine flesh
in these mine limbs
to punish the Accuser, the Master of Those
who allow decay to seep
into this mine flesh
numbness
into these mine limbs
as Something entering
into this mine flesh
into this mine head
into these mine shoulders
into this mine body
into these mine limbs

I belong to Ra. Thus spoketh he:
"It is I who shall guard the sick man from his enemies.
"His guide shall be Thoth [*main patron of the physicians*]
who lets writing speak
who creates the Books
who passes on useful knowledge
to Those who Know, the Physicians
his followers,
"that they may deliver from disease
the sick man of whom a God wishes
that the physician may keep him alive"

I am one of those of whom a God wishes
that he may keep me alive

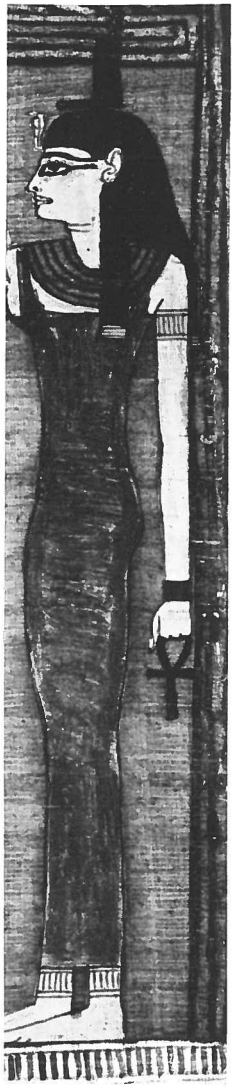
Spoken While Applying Remedies
to Any Sick Part
of the Body of a Man

REALLY OUTSTANDING,
MILLIONS OF TIMES

Loosened is he
who is loosened by Isis
Loosened was Horus by Isis
of the evil he felt
when his brother Seth
killed his father Osiris
O Isis, great in sorcery,
mayest thou loosen me
mayest thou deliver me
from everything evil
and vicious
and **red** [*perhaps the swnw, while unwinding the bandage, hoped the skin beneath would not turn out bloody and inflamed*]
from the spell of a God
from the spell of a Goddess
of a dead man
of a dead woman
of a fiendish man
of a fiendish woman
who will be fiendish within me
the like of thine loosening
the like of thine delivering
thine son Horus
for I stepped into fire
I stepped out of water
I shall not be caught
in this day's trap

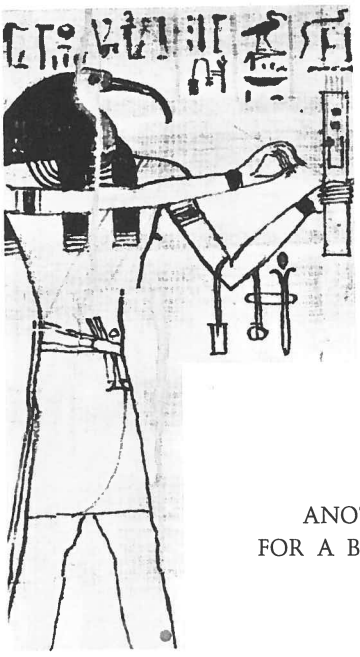
I spoke as if I were yet a child still small

Speak, Ra, of your belly
Mourn, Osiris, over that which seeped out of your body
[*possibly the decaying corpse of Osiris*[219]]
Behold thou hast saved me
from all things evil
and vicious
and **red**
from the spell of a God,
from the spell of a Goddess,
of a dead man,
of a dead woman . . . (continue at will)



Isis

REALLY OUTSTANDING,
MILLIONS OF TIMES



Thoth

Horus

ANOTHER INCANTATION
FOR A BURN ON THE FIRST DAY

"Your son Horus has burned himself in the desert"
"Is water here?"
"There is no water here"
"Water is in my mouth, a Nile is between my thighs,
I have come to put out the fire.
Flow out, burn!"

Recite [*this charm*]
over the Milk of a Woman
who Gave Birth
to a Male Child

Gum; hair of a ram; place onto the burn.

And here is a spell "against blood" (bleeding? redness?), with a perfectly Egyptian ending:[220]

A CHARM TO DISPEL BLOOD

Retreat, creature of Horus!
Retreat, creature of Seth!
Dispelled be the blood that cometh by Wnw [*a city*]
Dispelled by the red blood that cometh by *wnw* [= *"by the hour"*]
You know not the dam; retreat before Thoth!

This Charm will be Recited over a Red Pearl of Cornelian
Placed in the Anus of the Man or Woman.

THIS IS TO DISPEL THE BLOOD.

Psychotherapy should help, no matter at which end it is applied.

Ukhedu—Not So Wrong

I have yet to see a psychiatric study about the Egyptian concern with the anus. One of the seven medical papyri, and 81 of the 900 prescriptions, refer only to the anus.[221] The Egyptians soothed it, refreshed it, smoked it,[222] and somehow even kept it from twisting and slipping.[223] Medically speaking, all this attention is difficult to justify; but philosophically the Egyptians had a point, because they apparently took the anus as the center and stronghold of decay.

Worry about decay must have slowly grown to a national concern. It governed daily life even in the time of Herodotos: "For three consecutive days in every month they purge themselves, pursuing after health by means of emetics and drenches; for they think it is from the food they eat that all sicknesses come to men."[224]

An explicit statement of the basic theory does not exist; but evidence from many sources, pieced together, suggests this reasoning: *decay is typical of death, disease, and wounds; decay also occurs inside the intestine; so this internal decay must be a source of disease.*

To live by this theory must have been uncomfortable indeed. Condemned to walk around all day with an internal load of deadly material, the Egyptians took whatever measures they could; and in so doing, they became all-time experts on enemas. Their enormous pharmacopoeia (close to 700 items) may have been almost worthless by modern standards, but if there was one effect it could definitely induce, that was probably diarrhea.[225]

The most frightening aspect of the feces was that they contained a very pernicious thing called *ukhedu.* Ukhedu lay there dormant, but might arise and settle anywhere else in the body.[226] The word *ukhedu* (actually *whdw*) cannot be translated, but it looks like this:

kh

w w (det.)

d

Sometimes it is shortened to the "rot" determinative only  as the rotten stuff par excellence.[227] The ukhedu was either male or female, caused disease and pain, and could be killed. It could work its way into the vessels and travel around, setting up disease (Plate 3.8). In essence, what bacteria can do, it could do.

And of course, ukhedu could turn up in a wound: "Another remedy to heal a wound in which the ukhedu have arisen. . ."[228]

The Egyptians' fear of ukhedu was justified in view of their amazing concept of the vascular system. Although the vessels were known to have their main center in the heart, they were thought to have a second rallying point around the anus.[229] Hence, my scheme of the Egyptian vascular system had to be drawn, uniquely, as viewed from the rear (Plate 3.8).

The vessels, incidentally, were called *mt*, plural *mtw* (*metw*):

mt

(det. "flesh")

t w

The word is very ancient and indefinite. Sometimes it stands for hollow vessels; sometimes for tendons or "cords," and should perhaps be rendered as "sinews." Perhaps the spelling by means of the penis (also *mt*) helped to convey the multiple notion of a hollow tube as well as a cord;[230] but the Coptic *mut* preserved only the connotation of "solid strand, muscle." The metw contained blood, air, urine, tears, feces, depending on where they went. They seemed to have "mouths," so that they could take up drugs and disgorge disease under a magic spell. The heart spoke through them, and they could become dumb and die. They were subject to a goodly number of diseases[231] not well translatable: they could move, jump, tremble, become stiff or stretched; with given remedies they could be strengthened, soothed, cooled, or softened.[232]

"There are 12 metw," writes the scribe of the Ebers papyrus, then promptly gives a list of 22, just after having given another list of 50. Four or more led directly to the anus, into which they probably opened with little mouths,[233] but the six vessels going to the lower limbs passed so dangerously near the anus that they were exposed to becoming "flooded with excrements," which could rise even to the heart.

This was lowering the blood vessels to the status of sewers. The two lists of blood vessels that have come down to us are presented from exactly this angle. Instead of promising a beautiful vascular tree, the introductory sentence of each list suggests the map of a sewer system full of ukhedu:

> [*Ebers papyrus*] Beginning of the book of the wandering of the ukhedu in every part of the man's body, as found in writings under the feet of Anubis . . .[234]

> [*Berlin papyrus*] Beginning of the collected writings about the wandering of the ukhedu, found in old writings in a case with books under the feet of Anubis . . .[235]

Physicians reading these lines will have noticed that they are still fighting ukhedu, under different names: *Escherichia coli*, endotoxin, endogenous septicemia . . .

Embalmers Against Bacteria

When medicine could no longer help and the patient died, he had to face decay all over again, this time with the even greater danger of getting out of shape for the afterlife. Surely the Egyptians had noticed that if the body was buried in sand, decay was held down to a minimum. By this simple method people could be preserved (jackals and hyenas permitting) almost as

well as papyri, simply by being dried up very fast. But that was not enough; religious pressure created a new art, embalming. This I will discuss in some detail, for I see it as a glorified struggle against bacteria; and in this sense, its technical aspects are of concern also to the living.[236]

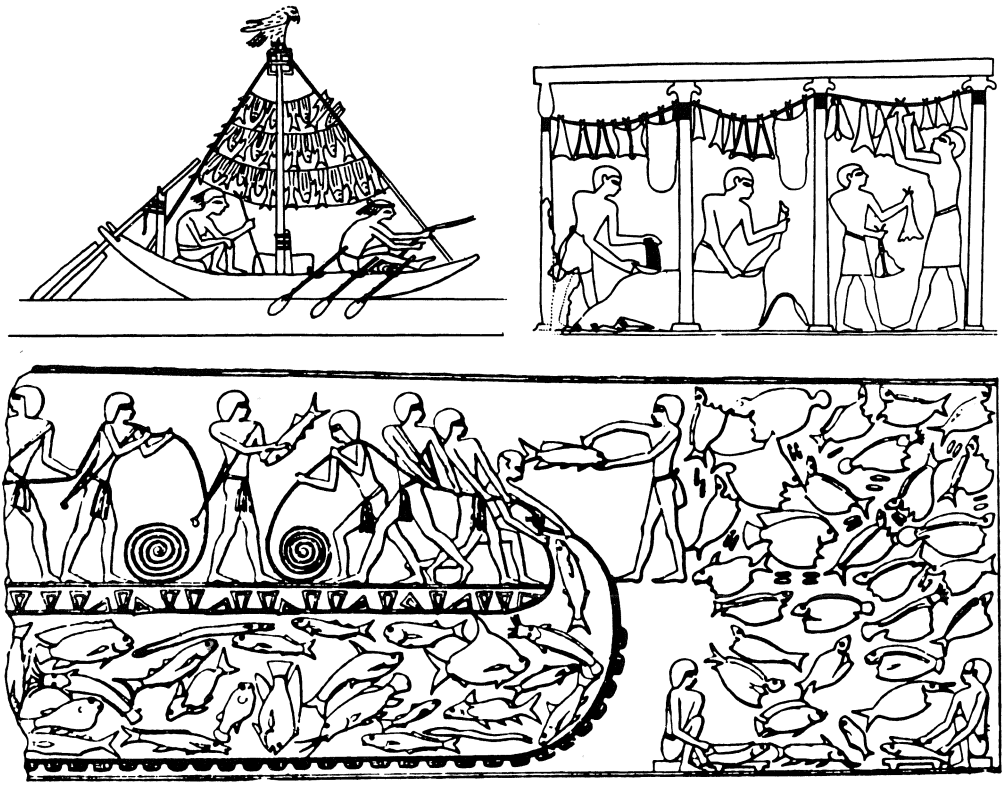
Embalmers have two main enemies: the digestive power of bacteria (putrefaction) and to a lesser extent the digestive power of the tissues themselves (autolysis). Aside from freezing, both processes can be stopped either by removing the water, essential to the digestive action, or by stopping the action itself. The latter aim can be achieved rather brutally by soaking the tissues in a solution known as a fixative, which destroys all life, including bacteria, and leaves the tissues as a cemetery of wrecked molecules. This is the technique of modern undertakers. It turns the body into a firm lump that will discourage bacteria and molds for weeks and months; sealed aseptically in an airtight box, it might well defy centuries.

What fixatives were available to the Egyptian embalmers? Our modern list, with names such as potassium bichromate, formalin, picric acid, and mercuric chloride, sounds wholly irrelevant. One chemical available in large quantities was alum.[237] With one dubious exception, it seems that it was never used.[238] However, thinking of its virtues in tanning leather, I tried to use a saturated solution as a fixative. The result was disastrous: the tissues simply fell apart. Alcohol should work, but its concentration in wine, let alone beer, is too low. The only chemical possibility I see is vinegar. Owing to its 4–5 percent content of acetic acid, it is a good fixative and food preservative; and as such, it was certainly known to the Chinese as well as to the Romans.[239] But vinegar was never mentioned in the context of embalming. Moreover, the technique of fixing the body like a cabbage preserve would have been psychologically hard for the embalmer to recommend (I am now thinking of the embalmer's public relations) if the purpose was to keep the body fit for another life.

This is not loose talk: the embalmers also rejected two other techniques and far more obvious ones, drying and salting. Fish curing certainly antedates mummification (Fig. 3.32).[240] Yet here, too, I can see that nobody would like to step into a new life pickled like a sardine, any more than tanned like a shoe. I take it for granted that the embalmers ruled out salting without a second thought, as an insult to the deceased (and maybe also hard to sell among the living). This was perhaps in the mind of that Mesopotamian king who, after his archenemy had been slain, ordered that his body be brought to him "in salt."[241]

So, whatever else the embalmers did, they certainly used no salt solution and probably no fixing bath at all. Not much is left. The next best way to reach deeply into the tissues and stop decay would have been drying, either in the sun (not too practical), with fire (very expensive in Egypt), or just in sand, as in the ancient "natural" process. There is not the slightest evidence for any of these methods.[242] What the embalmers actually did was a bizarre compromise between drying and chemical fixing: they probably buried the body under lumps of their beloved, all-purpose natural soda: *natron*.

Although natron occurs in other parts of the world, Egypt gave it fame. It



3.32 Man's first organized, successful fight against bacteria: the preservation of food by drying and salting. Both techniques are older than embalming. *Top left:* gutted fish hung to dry from a mast (c.1900 B.C.). *Top right:* meat hung up to dry (Thebes, c.1900 B.C.). *Bottom:* netting and cleaning sea-fish, whose flattened-out carcasses suggest drying (Saqqara, c.2500 B.C.).

is another gift of the Nile. River water seeps into the ground, especially during the floods, and works its way to distant flats, where it emerges to form shallow lakes, often below sea level. As the lakes evaporate, a yellowish or reddish crust forms on the shore and on the bottom: this is natron, long recognized as a national treasure, to the point that it eventually became a government monopoly. It is now found in Egypt in three places, including Wadi Natrun.

Its name, *ntry*, could be written with the simple ideogram  which combines

the symbol of divinity  (a cloth wound around a pole) with  "a bag of linen." It had lofty associations:

ntr (det. "god")

ideogram:

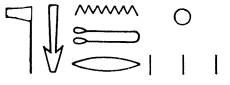
ntr + t (det. "theoretical concept") + r + y

god *natron* *divine*

Chemically, natron is a mixture of sodium carbonate and bicarbonate—its main components—with sodium sulphate and common salt as impurities, the latter in proportions varying from 0.5 to 50 percent.[243] One obvious difference with salt is that natron acts as a mild detergent, because when mixed with fats, it forms sodium soaps:[244]

Animal fat (triglyceride)		Natron (carbonate)		Water		
$\begin{matrix}CH_2OOC(CH_2)_nCH_3\\ \vert\\ 2\,CHOOC(CH_2)_nCH_3\\ \vert\\ CH_2OOC(CH_2)_nCH_3\end{matrix}$	+	$3\,Na_2CO_3$	+	$3\,H_2O$	$\longrightarrow$	
$6\,NaOOC(CH_2)_nCH_3$	+	$3\,CO_2$	+	$2\,\begin{matrix}CH_2OH\\ \vert\\ CHOH\\ \vert\\ CH_2OH\end{matrix}$		
Soap		Carbon Dioxide		Glycerol		

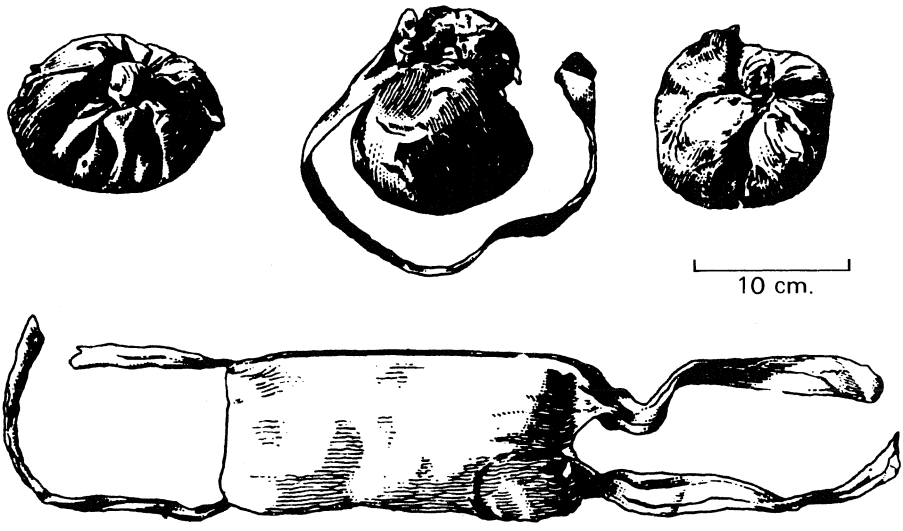
Natron had a great many uses: prominently as a "soul detergent" for purifying the mouth before worship and for making incense, which was called *s-ntr:*



	n	(det. "grain")
ntr sn	t	
	r	plural strokes

It was also used for making glass and glaze, for cooking, for compounding medicines, and for bleaching linen.[245]

Because of a mistaken translation from the Greek of Herodotos, it was once thought that the embalmers plunged the body in a solution of natron, like a fish in brine. This would have required large tanks or pots, and none of the kind were found.[246] The Greek verb was actually ταριχεύειν, "pickling," which does not imply the use of a solution.[247] It is now almost certain, thanks to chemical studies and actual trials, that the Egyptians used natron in bulk, which is a much easier process, not so messy—and far less effective. If this is true, it is possible to visualize what was going on in the "beautiful house"[248] (the pious name for the morticians' workshop) at the height of the embalming art: the embalmers removed most viscera, replaced them with



3.33 Small bags of solid natron from the mummy of Tutankhamun: the ancestors of mothballs.

lumps of natron either loose or in little packages, then covered the whole body for forty days with more natron (Fig. 3.33). In a well-aerated place, and perhaps in the sun, this combined—rather inefficiently—drying with chemical fixing. The natron surely made life unbearable to the bacteria and stopped decay at the very surface of the body, then diffused inward (together with its salt content, which could be high) to the depth of a few millimeters. But this diffusing process was very slow, and in the meantime, bacteria and insects could find safe corners to go on with their job. The evidence is still there to behold—beetles and maggots tucked away beneath yards and yards of wrappings.[249]

In essence, this was a mothballing technique with very weak mothballs. The reasons that made the embalmers prefer natron over salt were probably cultural, but to some extent chemistry too was on their side. Mothballing in natron was better than nothing. Dr. Lucas, the late Honorary Consultant Chemist to the Department of Antiquities, Egypt, gave it a try using pigeons—plucked, eviscerated, and then buried under lumps of dry salt or natron. After forty days he retrieved them hard and dry, "much emaciated," but essentially mummified. They were also in the company of many little insects, especially after being buried in natron; but both sets of pigeons were "practically free from disagreeable smell, of which there had been very little during the forty days of burial."[250] And both sets of animals were chemically salted, for the natron had been giving up its sodium chloride: so that the Egyptians were salting their mummies anyway.[251]

Dr. Lucas also tried a 3 percent natron bath, because in one case at least the embalmers had used it to preserve the organs of Queen Hetepheres.[252] After forty days the pigeon was bleached white, but "plump and in good condition, with the skin intact." It was laid out to dry and gave off a slight smell of putrefaction for some weeks. But another pigeon left in a 3 percent salt solution "was no longer recognizable as such." Thus, salt may be cheaper, but natron works in weaker concentrations.

To sum it all up, the embalmers used in the solid state a substance that would work fairly well if dissolved. The overall result needed a lot of retouching.

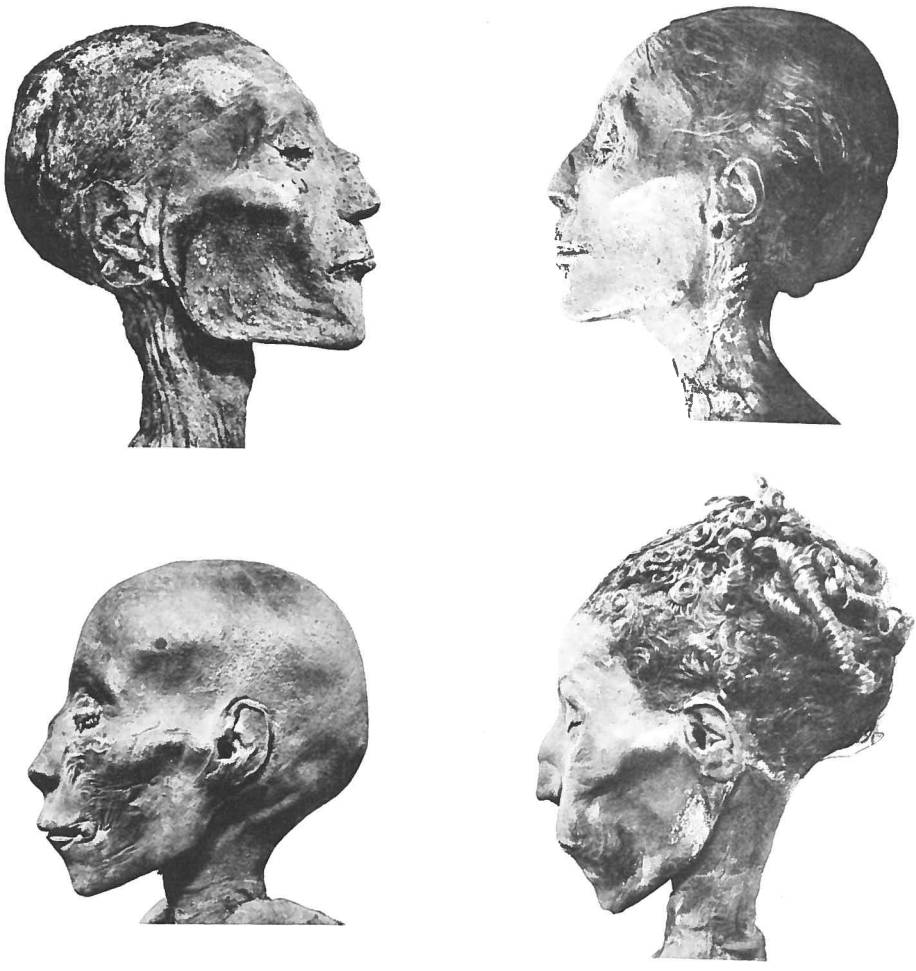
After the natron, there was another month of work: now was the time for treating with resins and gum resins, especially frankincense and myrrh, pure or mixed with fats and oils. Resin and pitch were sometimes melted over fire and poured on very hot, over the body, over the finished mummy, or even over the coffin itself. All this was very expensive, because none of these products was native to Egypt, not even the common juniper berries or the very important "cedar oil" of Herodotos, which is probably juniper oil;[253] both of these came from western Asia. In fact, you will recognize here Mesopotamia's favorite drug, burashu (juniper). And if it is true that cassia and cinnamon were also used on mummies,[254] the embalmers were importing their commodities from as far as China.[255]

A cheaper scent was onion. Onions were used freely—inside the body, between bandages, even over the eyes and in the ears.[256] Perhaps it was their name that counted, for the word *hedjw*, "onion,"[257] punned with *hedjet*, "damage [to the evil forces]."[258] Whatever the reason, their use must have had something to do with their smell. Now there is something about onion smell that needs a closer look. It has been claimed that onion paste emits vapors that are injurious to protozoa and to bacteria as well, and that it prevents the infection of wounds.[259] Antibacterial activity has been found in onion extracts.[260] A relative of the onion (*Allium cepa*), garlic (*Allium sativum*), has done even better: it has yielded an antibacterial substance that has about 1 percent of the activity of penicillin, but is also effective against Gram-negative bacteria, which are practically unaffected by penicillin.[261] In 1971, in the search for new pesticides as substitutes for DDT, garlic extracts were tested; they proved to be effective against mosquito larvae in concentrations as low as five parts per million.[262]

Two onions in the pelvis could at best discourage only a few bugs for a few hours. However, this episode anticipates a theme that will recur again and again: in his primordial struggle against bacteria, man had a trusty ally in his sniff.

Back to the embalmer. In the great days of the art, the finishing touches included packing handfuls of sand, mud, or linen pads under the skin to fill it out,[263] adding artificial eyes and nails, as well as other aesthetic improvements. The whole procedure was a major financial investment. There were in fact, noted Herodotos, three types of service at increasing cost: the lowest-priced operation was rinsing out the intestines by way of the anus (the embalmers knew where the ukhedu was); next came the treatment of the body with natron; and last, the full treatment just described.

The achievements of the embalmers have been either extolled to legendary heights or debunked as poor craftsmanship. There is truth in both extremes, for the embalmer's method was a compromise, and its result was precarious. Some of the mummies, when exposed, gave off such a horrendous stench that they had to be destroyed without further ado.[264] A few others, face eternal sleep with a certain degree of humanity (Fig. 3.34). The head of



3.34 Four of the best royal profiles: Ramses V (top left), Thutmosis IV (top right), Thutmosis I (lower left), and an unknown lady. They were embalmed between 1550 and 1100 B.C.

Seti I is by far the masterpiece (Fig. 3.35). There is no reason to believe—Anubis forgive me—that the Egyptian embalmers had any particular secret. However, in view of the fact that they were trying to achieve "fixation" without any fixatives, they did very well. Placed in their position, a modern undertaker would consider the job impossible.

Psychologically, the embalmers proved to be extremely subtle in devising a preservation technique that was entirely their own, with no possible overtones of pickling. Technically, I believe that their major asset was the generous use of resins. Even if not fixed, a particle of tissue embedded in resin should be preserved forever, like the prehistoric insects embedded in amber. Add to this that resins, at the time, had a long tradition as agents of purification and as a link with the heavens. Lumps of resin were found buried in predynastic tombs, long before the practice of mummification, perhaps for use as incense; and even later, when 50 kg of resin were poured over a sarcophagus,[265] the purpose was not to preserve the marble. In any event, whether it was a matter of religion, magic, cosmetics, odor, or all these combined, resins

3.35 Seti I—perhaps the summit of the embalmer's art, c.1300 B.C. The body, much damaged by tomb robbers, is covered with resin-impregnated linen, now of stony hardness.

were a perfect choice as embalming material, and possibly the only one under the circumstances. They are wonderfully fitted to defy millennia. In his description of the "Royal Mummies," one of which I quoted above for its dreadful smell, G. E. Smith mentioned twice a "strongly aromatic odor" from powdered wood.[266] One such odor dated from the Seventeenth Dynasty, about 3500 years ago. And the body of Meneptah, son of Ramses II (Nineteenth Dynasty), was covered with very fine linen impregnated with a bright yellow, resinlike material, which when dissolved in alcohol, developed a pleasant odor "like Friar's balsam."[267] This odor came from the time of the Exodus, about 1230 B.C.[268]

But even resins could not operate miracles. Under the resin not much of the mummy is left, especially of the limbs, since the embalmers concentrated their efforts on the face. Consider the legs of Ramses II. They were encrusted with a resinous mass 6 mm thick; beneath it, the limbs "seemed to consist merely of a layer of skin closely clinging to the bone."[269] And the thigh muscles of Tutankhamun, for all of the flamboyant looks of the mummy as seen from outside, were a couple of millimeters thick.[270] In this respect, it is ironic that all the labor of embalming—seventy days of it—led to no consistent improvement over the work of nature, for some of the best preserved bodies are from predynastic times and had been simply buried in dry soil.[271] So effective was this natural process that in one child, who died around 3500–4000 B.C., the intestine preserved the remains of the last

3.36 Nature alone accomplished this feat of embalming: a miserable Dane was strangled to death and thrown into a peat bog about two thousand years ago, where the tannic acid turned his skin into leather—perhaps the same method that he had used to make his leather cap.

medicine: a skinned mouse, young, well chewed, and mixed with vegetables.[272] It seems that mice were admired for their prodigious vitality: the swarms that appeared after each flood were thought to form spontaneously out of the mud, so that swallowing a mouse was something like taking a pill of life.[273]

Nature alone has produced mummies even more spectacular than these dried-up bodies. In the turf bogs of northwestern Europe it is not rare to discover bodies of human beings who fell in, or were thrown in, 500 to 3000 years ago.[274] Some are so well preserved that fingerprinting is possible (Fig. 3.36). In this case nature's secret is a chemical: the flesh is literally tanned, that is, toughened, by the same principle that turns fresh hides and skins into leather. Many substances can accomplish this, but the best natural agent is tannic acid, obtained since time immemorial from oak galls, oak bark, and other plant products.[275] It is odd that the tanning principle, so ancient and so well-known, was never put to use for the preservation of bodies. Perhaps, once again, the obstacle was psychological: shoe technology and religion do not mix.

Too much has been said about lessons that medicine may have learned through embalming.[276] The points of contact are more theoretical than real. It has been noticed, for example, that in the *Book of the Dead* "treating" and "embalming" are sometimes expressed with the same word, *srwkh*:[277]

r

s kh (commonest determinatives)

w

This calls for two comments. First, four thousand years from now, someone may notice that in the backward 1900s people spoke about curing patients as well as sausages. Second, Egyptians actually had two different words: *srwkh*, "to treat," and *sdwkh*, "to embalm." However, the  *r* and the *d*, in their cursive, hieratic form, are very similar; and the scribes who copied and recopied the *Book of the Dead*—which was to be buried with the corpse—did not pay much attention to such details.[278]

Certainly the bandages that were prepared for embalmers could be used on live people, and sometimes they were.[279] The major antidecay drugs, especially natron and the resins, were the same, but there was one major exception. Honey, the standard antiseptic of the Smith papyrus, was not currently used in Egyptian embalming.[280] If it is true that the body of Alexander the Great was carried to Egypt in honey, this embalming was done in Babylon.

Another instance of embalming in honey occurred in the Near East when Hasmonean, ruler of Judea, was poisoned, and "his dead body also lay, for a good while, embalmed in honey, till Antony afterwards sent it to Judea, and caused him to be buried in royal sepulchre."[281] To test the feasibility of embalming in honey, we ran a few experiments using rat and mouse tissues. It seems that very small pieces might be preserved almost indefinitely. But with larger pieces, deep down where the honey cannot reach, putrefaction is rampant, gas develops, and the result is a terrible waste of work, especially for the bees. They must have buried Hasmonean in a hurry.

I see no evidence that the embalmer's crude handling of organs advanced the knowledge of anatomy any more than did the butcher's. In the long range, however, his approach probably helped medicine indirectly. It may have accustomed the Greeks to the notion that the body can be manipulated after death, and thus helped to establish the practice of human dissection in Greco-Egyptian Alexandria.

After the Swnw

Twice as long as Christianity, almost: this is how long the swnw's civilization lasted. Its ways and its medicine had time to soak into Western life to an extent difficult to fathom; but here again words help. *Na*, our symbol for sodium, is a living fossil of *natron*, the maker of mummies; just as Nefertiti's eye shadow, *msdmt*, slid over into our *Sb* for antimony; and *gum* is straight from *ḳmyt* through the Greek *kómmi*. Tradition derives *ammonia* from the stench of camel urine around the temple of Amun.[282] One of the many theories on the origin of the word *chemistry* holds that it comes from *Kmt*, the original name of Egypt (in Coptic *Chemi*):[283]

t

km m

(det. "village")

And the pharaoh is embedded for good in our *paper.* The word for pharaoh (which came down through the Hebrew) was *pr-aa*  literally "the Great House"; and *pa-pr-aa* meant "that of the pharaoh": papyrus was indeed a royal monopoly.[284]

Those "beaten" sheets of papyrus probably influenced the history of medicine more than any ancient drug. The genius required to create them is beyond belief. It is a sobering exercise to take a stem of papyrus (not from Egypt, however, where it is extinct except in the far south) and try to make a sheet from it following Pliny's instructions. It does not even look as if it should work. Yet the sheets represented only one use of the plant. I like to think what a native Egyptian might have been able to accomplish if abandoned on an island overgrown with papyrus. He could have used some parts of the plant for food, while using others to equip himself with clothes and sandals. He could have built a whole ship, with sails and ropes, and even caulked it. He could have loaded it with food and fuel in baskets, plus articles for sale—mats, wicks, sieves—and he could have sailed away while making paper to write up his story.[285]

As regards the treatment of wounds, besides a vast number of uninterpretable or unwholesome plasters, the swnw dreamed up two great salves, possibly the best of antiquity and certainly the ones that I would choose: honey with grease, and honey with aromatic resins. He produced some excellent anatomoclinical correlations; probably the first tapes and sutures; the beginnings of hemostasis by the cautery; the beginnings of antisepsis with copper salts, in the form of green eye shadow (what was there about Egyptian eyes that made them so influential?  ?);[286] and a theory about infection and contaminated blood that was bound to change form but never died. The concept of bad blood (and getting rid of it) later became the main excuse for venesection, and contributed to wasting more innocent blood than many wars have spilled.

If fame is a measure of success, we can only congratulate the swnw. In the Mediterranean world his art was unsurpassed, until it was absorbed and replaced by Greek medicine. We shall bid him farewell in his own words—as live Egyptians hailed the dead:[287]

May his *metw* flourish . . .
May his *metw* be sound . . .
May his *metw* be excellent . . .
May his *metw* be comfortable . . .

4 The Iatrós

Athens, 400 B.C. Two physicians are discussing their patients, in a language now listed as dead. Here are some of their professional terms: "arthritis . . . epiphysis . . . rheuma . . . crisis . . . asthma . . . tetanos . . . anthrax . . . opisthotonos . . . mesocolon . . . epiploon . . . dysenteria . . . sepsis . . . ataxia . . . stranguria . . . pleuritis . . . hypochondria . . ."[1]

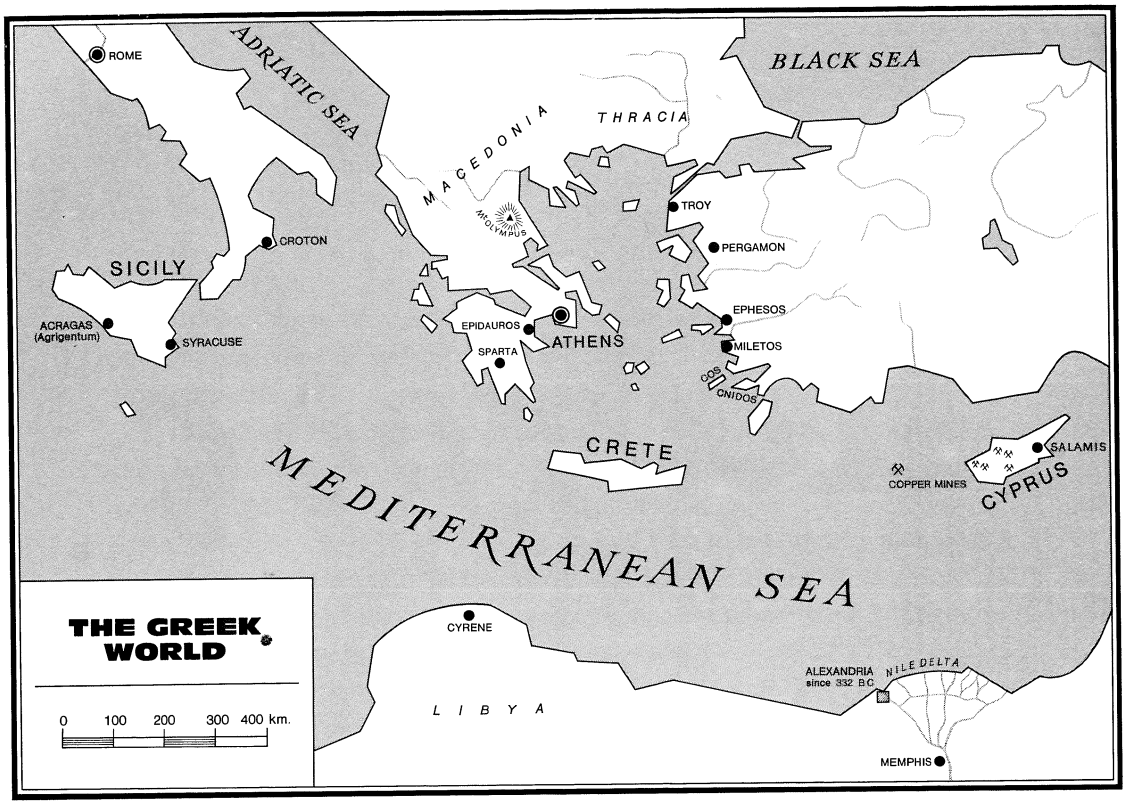
Every one of these words is essential in today's medical jargon. Suddenly, we feel among modern men.

Greek Medicine: The Sources

There is a good reason for lifting the curtain so abruptly on Athens of the golden age: the beginnings of Greek medicine, which should fill a library, are mostly blank pages. Surely the medical terms used in 400 B.C., the time of Hippocrates (460–380 B.C.), were not an instant product. Famous physicians had already come and gone,[2] and if Xenophon was accurate in reporting the words of his master, Socrates, medical treatises made "a large collection."[3] But alas, not one of these ancient books has survived; and after the Hippocratic works there is another blank of four centuries.[4] What is left of the beginnings adds up to fragments, quotations, pots and shards, and a few stones.

Ἰατρός

And poetry, from about the ninth century B.C.: the oldest witness of Greek medicine is Homer.



4.1 The Greek world: from Asia Minor to Sicily.

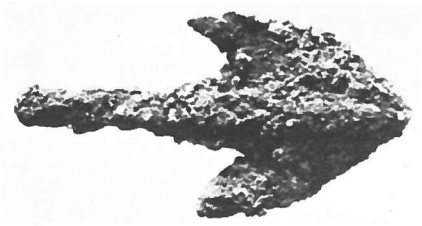
Wounds in Verse

There are 147 wounds in the *Iliad*—31 to the head, all lethal. The overall mortality rate was 77.6 percent.[5] The single nicety about this bloodshed, besides the poetry, is that for the first time in history one hears of the wounded being carried off the battlefield and tended in barracks, *klisíai*, or in the nearby ships.[6]

Wound care itself was just above rock bottom. Once, a iatrós was wounded: he was Machaon, the very son of Asklepios. The first attentions that he received in the *klisía* were a seat, lots of storytelling, and a cup of Pramnian wine sprinkled with grated goat cheese and barley meal, served by a beautiful woman.[7] Plato finds that even this treatment was too much—not the woman, but the cheese and the barley, which, he says, are surely inflammatory.[8] Later, Machaon's wound was washed with warm water by the same woman;[9] others, less fortunate, had this service performed by fellow warriors.[10] Nothing was done to stop the bleeding, which may account for the high mortality. In fact, bleeding must have been considered hopeless, for the one and only type of hemostasis mentioned in Homer is an *epaoidé*, which means that somebody sang a song or recited a charm over the wound.[11] Whether it worked or not, the poet does not say:

Ἰατρός

> Then . . . the wound of noble, god-like Odysseus
> They bound up skillfully, and checked the black blood
> With a charm.



4.2 Bronze arrowhead with two barbs from Homeric Troy. It was lying in the rubble, in the middle of a street. Slightly enlarged.

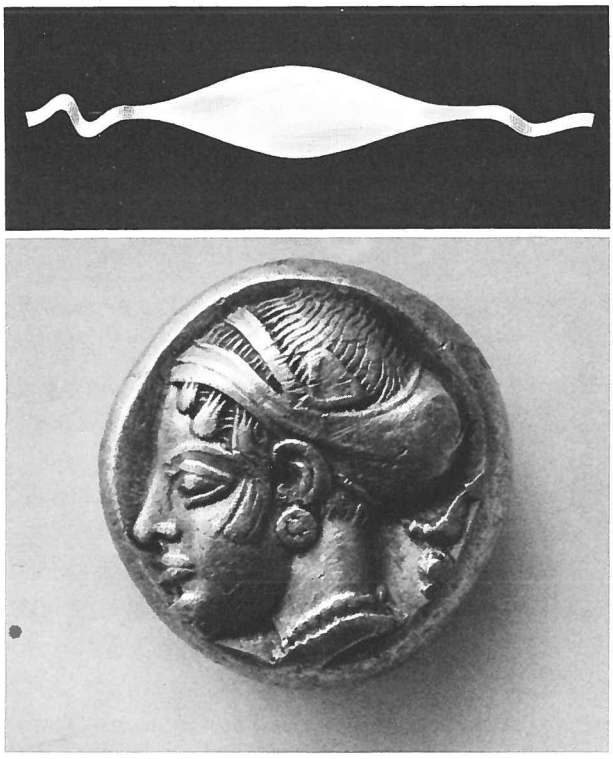
Arrowheads were made of iron[12] or bronze. Some were *tricuspids,* "with three barbs";[13] but most had two, thin enough to break off if pulled back through a leather belt.[14] One of these, just one, was actually found in the ruins of Troy VII-a, the Homeric level (Fig. 4.2). Arrowhead barbs have always been a curse of battlefield surgery. For the wounded at Troy there was no way around the problem except by enlarging the wound with a knife[15] or possibly by pushing the arrowhead through.[16] In later Greece, around 400 B.C., Diokles of Carystos invented a gadget that eased out the arrowheads very neatly (Figs. 9.14–9.15).

Drugs were also applied to the wound. They came only from plants, apparently raw, the more complex Egyptian and Akkadian poultices being either ignored or forgotten. The only detail available is that the wound of Eurypylos was sprinkled with "bitter root," possibly onion.[17] Its purpose was to cool and dry the wound.[18] Both of these concepts reappear in the Hippocratic books, where it is explained that wounds should be kept warm, unless inflamed, and dry, because the dry state is the natural one.[19] Perhaps there is another message, now lost, in the bitterness, for Galen notes that the bitter taste is typical of counterpoisons.[20] Even in a medical classic of ancient India it is said that "The Bitter taste is so disagreeable as to produce disgust for itself, but . . . it destroys the action of poisons."[21] I take this to be a variation on the universal theme that a good medicine must be unpleasant.

Binding is mentioned only twice in Homer, so it is possible that some of the braves walked or lay about with their sores exposed rather than dressed. When an item that seems obvious today is omitted in an ancient text, the historian's attitude is necessarily skeptical: the omission could mean "item unknown" just as well as "item obvious."[22] However, some four hundred years after Homer, Hippocrates actually states that not all wounds should be dressed or bandaged: which is not as bad as it may sound, because the dry scab that forms over a noninfected wound is now recognized as a natural dressing.[23]

Ἰατρός

One of the two bandages mentioned was needed for Agenor, whose hand had been pierced by a spear. He bound it with a sling, *sphendóne,* of wool, which his squire held ready,[24] presumably something like an eye patch. Hippocrates, too, mentions a sphendóne.[25] It must have looked like the woman's hairband of the same name (Fig. 4.3) and was undoubtedly the most economical form of bandage.[26]

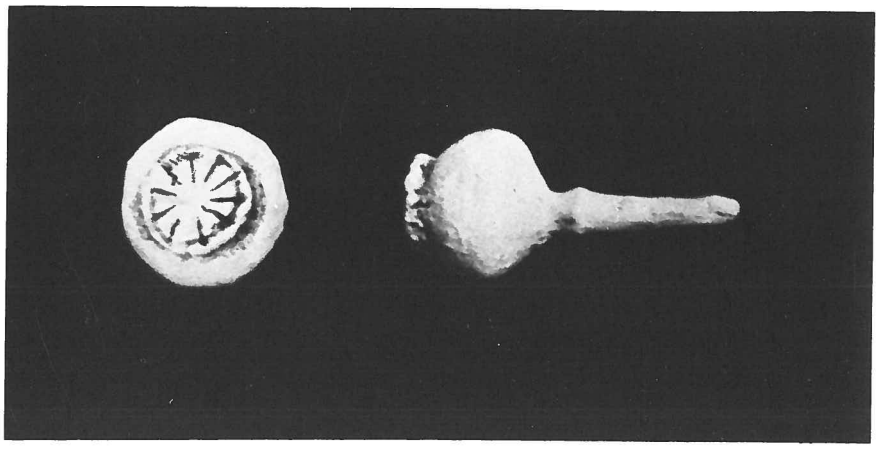


4.3 The Homeric bandage (above)—called *sphendóne,* "sling"—was probably shaped like the hairband of the same name (below), worn by a young woman of Phókaia around 500 B.C.

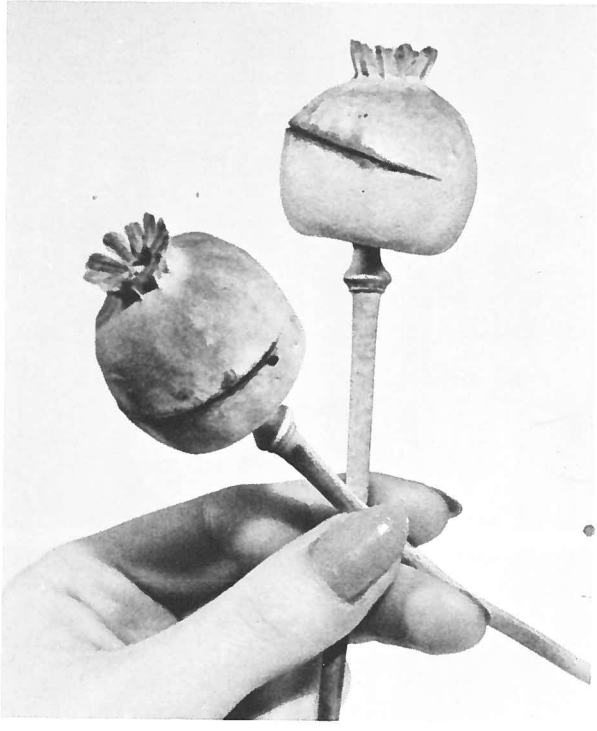
The pain of a wound was supposed to be soothed by drugs put on it[27] and maybe also by a drink of wine.[28] A sip of opium, though never mentioned, should have been within easy reach: with the Egyptians importing Greek opium before the war of Troy, surely some of that opium stayed home. The evidence is compelling. A woman's pendants in the shape of poppy capsules were found in Sparta.[29] This precise shape recurs in objects found all over Greece: pottery, jewels, even clay models that may have been offerings to the gods (Fig. 4.4).[30] Often the capsules are represented with several slits. These are the knife marks: they shed the tears of sap that dry into crude opium (Fig. 4.5).[31] Finally, in 1937, Greek archeologists exploring Crete dug their way down into a secret room, doorless and windowless, where they were greeted by the raised arms of an ancient Minoan goddess. She had strange eyes, perhaps closed. Before her were the remains of a heap of coals and some pottery; and she wore three hairpins shaped as beautiful, well-slit poppy capsules (Fig. 4.6).

Ἰατρός

The goddess of the poppy dates from 1300–1250 B.C., precisely the time of the war of Troy. This coincidence supports the tradition whereby opium was the active principle of Helen's famous Egyptian potion, *nepenthes,* which relieved the deepest sorrows.[32] It may seem bizarre that a Greek lady would need an Egyptian recipe to use Greek opium, but one has to remember that when Homer wrote his lines, the best trademark for a drug was "Made in Egypt" and had probably been so for one thousand years.

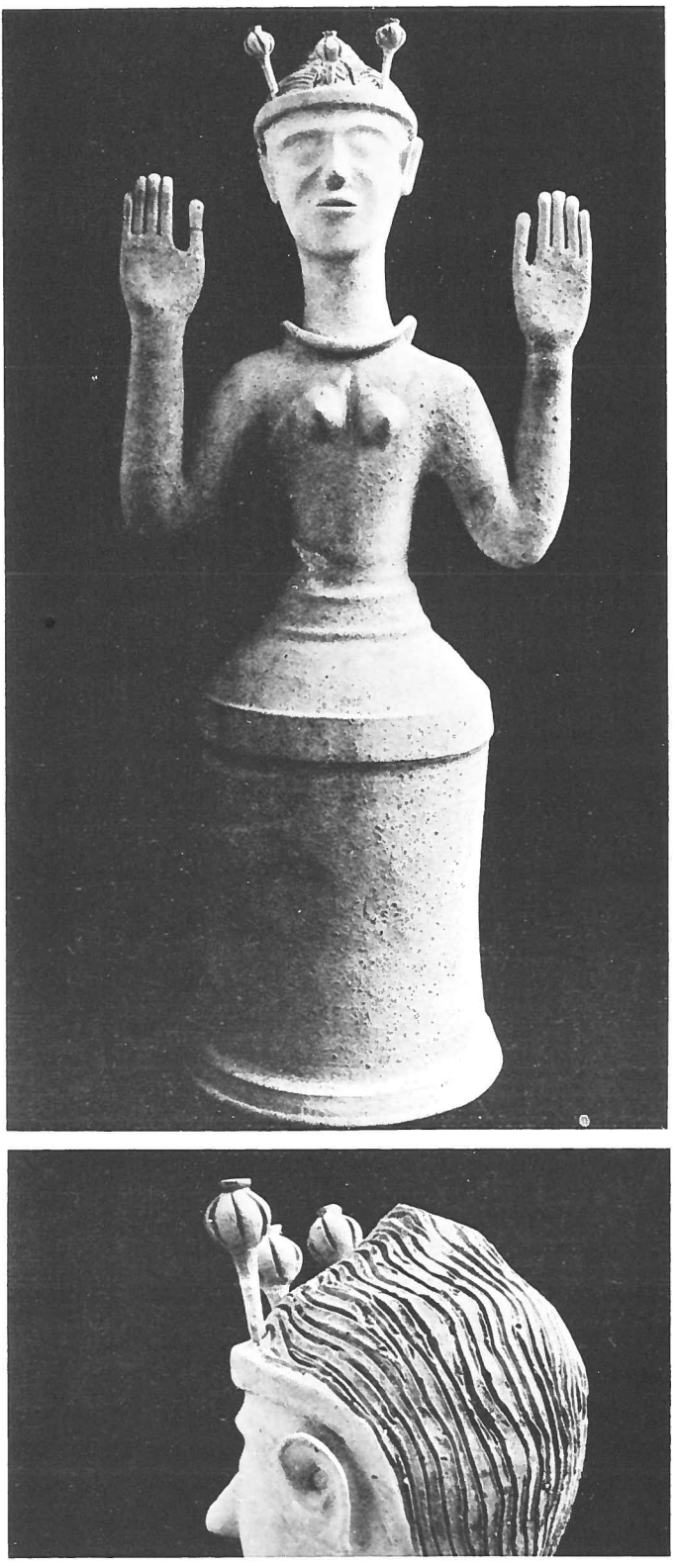


4.4 Clay model of a poppy capsule found in a sanctuary. It was probably a votive offering to Hera, eighth–fifth century B.C. The "asterisk of Dioscorides" on the top of the capsule and the "knee" in the stalk just below leave no doubt as to the identification. Slightly reduced.

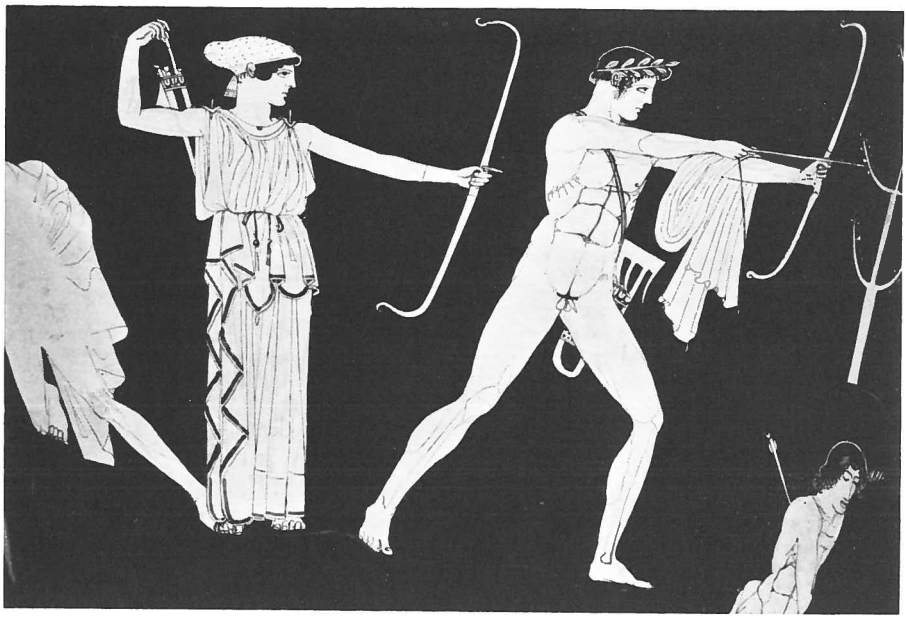


4.5 Real poppy heads or capsules, artificially slit. Juice oozes out of the slits and dries, forming opium. Its morphine content is on the order of 5–10 percent.

Of one casualty Homer says that the wound was "sucked out."[33] Experts have haggled over this word, some trying to interpret it as "pressed out."[34] Yet it is clear that something had to be taken out of the wound: perhaps just dirt, but more likely an abstract "bad influence," a concept typical of primitive medicine.[35] It might also have been arrow poison. Although this kind of treachery never occurs in the tales about Troy, the *Odyssey* mentions a voyage of Ulysses all the way to Epiros to get some arrow poison.[36] It would be



4.6 A Minoan goddess wearing poppy capsules as hairpins; the vertical slits in the capsules are stained brown like opium. This little statue (78 cm) was found in a secluded setting highly suggestive of opium smoking (c. 1300–1250 B.C.).



4.7 The Greek bow, *tóxon*, gave the word *toxic*. Here Apollo and Artemis are killing the sons and daughters of Niobe.

interesting to know what poison this might have been. If it came from a plant, Greece had perhaps two dozen candidates, the likeliest being *Helleborus orientalis Lam.*,[37] black hellebore—the very same root that was to become the pet prescription of the Hippocratics!

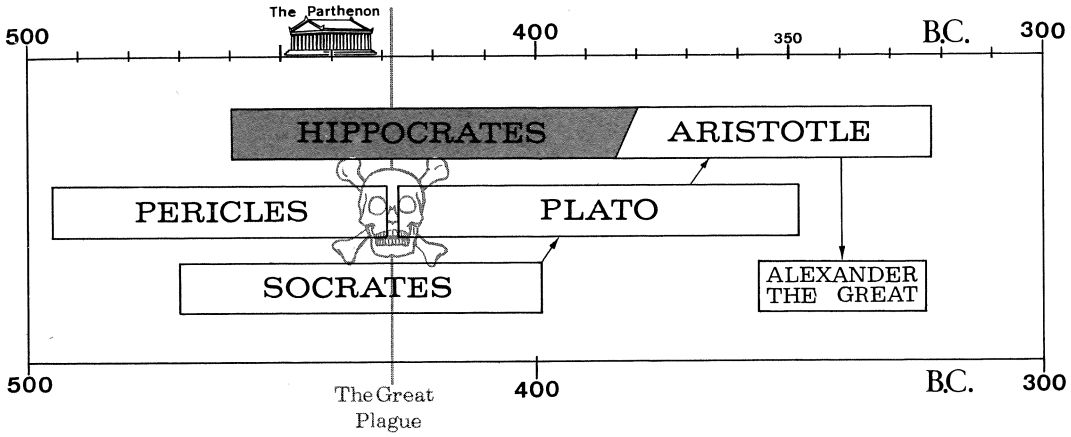
The drug sought by Ulysses in Epiros was called a *toxic*. However, *toxic* then did not mean poisonous at all; it meant "for-the-bow-and-arrow," from *tóxon*, "bow" (Fig. 4.7). Think how many poisoned arrows must have flown to change the meaning of toxic.

Arrow poison, wrote a Greek physician of the first century A.D., was used by the *bárbaroi*.[38] That word, too, has changed. It meant strangers. The author must have forgotten about Ulysses.

Surgery Without Surgeons

To return to the year 400 B.C., at that time Hippocrates should have been in his sixties and perhaps practicing in his home island of Cos. He had lived through the age of Pericles, the building of the Parthenon, the Great Plague of Athens, the fall of Athens to the Spartans, many a première of Sophocles, Euripides, and Aristophanes, and the last years of Socrates (Fig. 4.8). In Plato's dialogs Socrates speaks of him with utmost respect, and so does Aristotle:[39] at least we can be sure that he really existed. But we do not know for sure anything that he really said, let alone discovered. The Hippocratic Collection represents not his collected works but rather the remains of a library, possibly that of his medical school at Cos.[40] It is a potpourri of about seventy anonymous essays and fragments varying in length from one to a few pages, and very uneven in value. A few contain passages worthy of the master; others are poor, incomplete, or even contradictory.[41] The voice of Hippo-

Ἰατρός



4.8 The life span of Hippocrates, in the context of two centuries. Arrows run from master to pupil.

crates, that voice which guided men for 2200 years, comes through as blurred as if it arose from the bottom of a well. But let there be no misunderstanding: if medicine was not born here, it was certainly reborn here.

The Hippocratic Collection is at its best in matters surgical, and has a lot to say about wounds. It also gives a picture of the iatrós that is a far cry from the homely asu. In those days, Greek physicians spent much of their time traveling[42]—or to use their term, doing *epidemics:* the word has radically changed its meaning, for it meant "visits to places" (several Hippocratic books are titled *Epidemics*). However, the iatrós also had a permanent working place in town, called the *iatréion.* This was a truly professional establishment, roomy, with "two kinds of light, the ordinary and the artificial . . . either direct or oblique,"[43] and equipped with surgical instruments, drugs, apparatus, and perhaps scrolls of medical literature. The physician himself, though not aseptic, was spotless, neat, and reassuring—even perfumed[44] (one book discourages the use of "elaborate" perfumes[45]). By today's standards he probably had rather long nails, since they had to be "neither longer, nor shorter than the fingers"[46]: perhaps he could not have trimmed them any better using shears instead of scissors, but Galen comments that this nail length was just right.[47] His skill in bandaging had been acquired in formal exercises, using one end of the bandage, or both ends, and "with both hands or either separately"[48] (Fig. 4.9). Even his posture in operating had to be elegant: "If he stands, he should make the examination with both feet fairly level, but operate with the weight on one foot (not that on the side of the hand in use) . . . When seated, his feet should be in a vertical line straight up as regards the knees, and be brought together with a slight interval. Knees a little higher than the groins and the interval between them such as may support and leave room for the elbows. Dress well drawn together, without creases, even and corresponding on elbows and shoulders."[49]

Ἰατρός

Since the daily practice in the iatréion was mostly surgical, the word itself has been translated with the old English expression "the Surgery."[50] This is misleading: to the mind of the Greeks the medical art was one,

4.9 Achilles trying to employ a favorite style of Greek bandage: a left-handed and right-handed spiral, intertwined. It should be easy to finish off the bandage with a knot—but here Achilles has a problem, because he has turned both spirals the same way. From a vase of about 490 B.C. (just before Hippocrates).

without distinction between medicine and surgery.[51] It is significant that the Greek language of the time ignored the word *cheirurgós,* "surgeon," but used the name *cheirurgía,* "hand-work," and the verb *cheirurgéin,* "to work with the hand";[52] surgery was one of the physician's techniques, not a separate way of life.

Outpatient Care, Hippocratic Style

Now we shall try to step into the iatréion and see what happened there in real life. Detailed descriptions of clinical cases, complete with treatment, do not exist in the Hippocratic books. However, there are many bits of cases, sometimes even with the name of the patient: Thrinon, Billos, Dislytas. Those bits that are alike can be fitted together, and Hippocratic theory can be used to bind them. So, as an archeologist might rebuild ten acceptable amphorae out of a seabottom covered with shards, I rebuilt ten patients—and we may assume that they stand for men, women, and children who really sought help at the iatréion. In the case studies that follow, every medical fact and most words of the physician are lifted from the original text.[53]

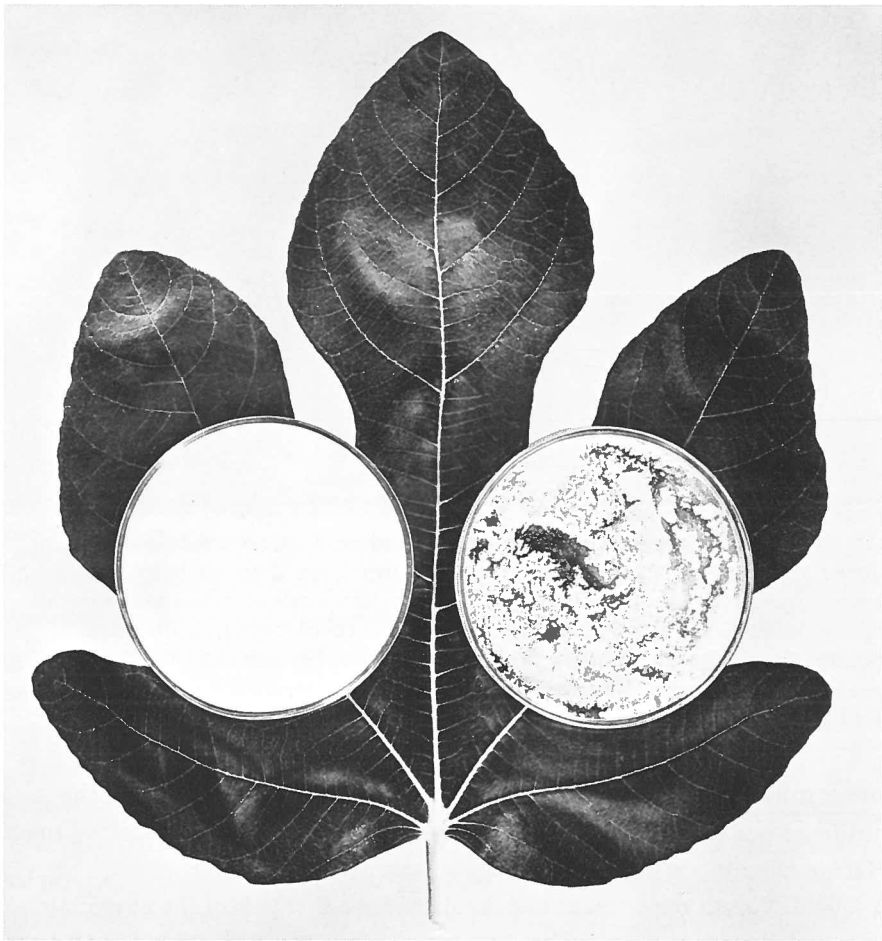
The mood in the iatréion is set by a special hospital smell: smoke from the brazier where the cauteries are kept red-hot, fumes of boiling drugs, the aroma of herbs, resins and spices on the shelves, and a soupçon of roasted human flesh. In a corner, it looks as if a man were being pulled apart in a horrendous machine: actually he is being "treated" in the Hippocratic bench for a supposed dislocation of the hip. The iatrós and two male apprentices are working around him.

Patient No. 1: Severe Hemorrhage

Two men run in carrying a carpenter: his axe had slipped and cut his foot deeply. He is very pale and bleeds a lot. While the men lay him on a couch, the physician sees to it that the wounded leg is raised.[54] Then he dips a towel in cold water and wraps it loosely around the ankle. This will help to check the hemorrhage, because "cold water is to be applied not *to* the spot, but *around* the spot whence blood flows"[55]—a Hippocratic aphorism that stood the test of experiment in 1970.[56] Another towel is dipped in warm water and wrapped around the patient's head:[57] the idea is evidently to draw blood up there and away from the injured foot. In the meantime, an assistant has stepped outside and gone to a fig tree, where he is breaking off leaves and gathering the drops of white sap on a plug of wool.[58] The plug goes onto the wound.[59] Then—surprise—a beautiful white bandage, rolled from both ends, is soaked in red wine and applied dripping, with an adroit play of both hands.[60]

Ἰατρός

As for the juice of the fig tree: to the mind of the iatrós, it was a very good means to stop bleeding.[61] The reason was obvious to every Greek. Hear this passage from the *Iliad.*[62] The brazen Ares has been speared and immortal blood flows from his wound. Paieon spreads simples thereon, and "even as the

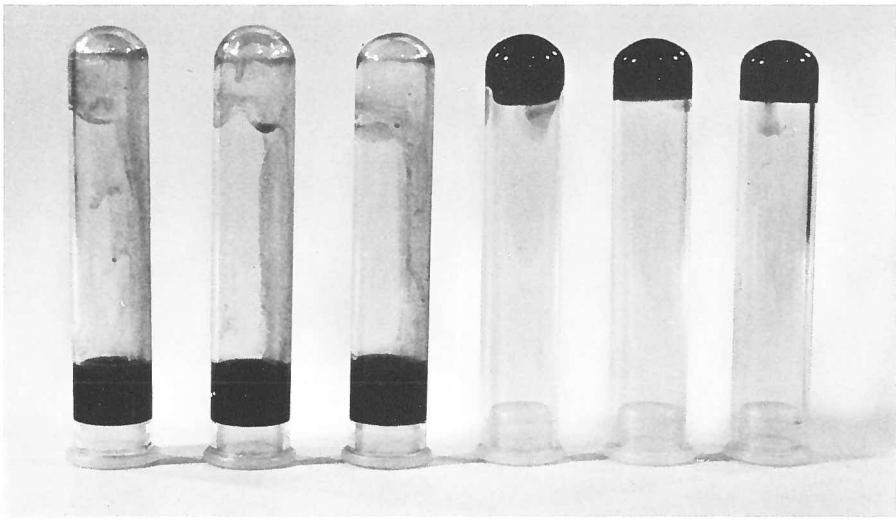


4.10 Confirming Homeric chemistry. The bottom of each of two glass dishes was covered with milk; three drops of latex from a fig tree were dropped into the dish at right; and the photograph was taken within a couple of minutes. Curdling is already obvious.

juice of the fig speedily maketh to grow thick the white milk that is liquid, but is quickly curdled as a man stirreth it, even so swiftly healed the furious Ares." Evidently Homer knew, or thought, that the sap of the fig tree caused milk to clot. From this, in Hippocratic logic, it was only a short step to conclude that what clots milk should also clot blood.

Therapy has changed so much since the *Iliad* that I found myself unable to assess either of these biological statements. So, with the help of two assistants, I scoured the Genevan countryside for a suitable fig tree and eventually procured a syringeful of latex. A drop of the latex mixed in a small dish of fresh milk made it curdle unbelievably fast (Fig. 4.10), just as Homer said. Our surprise was great. Then we went back to the literature (more of a task than doing the experiment) and found that this effect of fig-tree juice was current knowledge throughout antiquity. It is also mentioned casually in a Hippocratic treatise, which takes for granted that the reader is so familiar with the phenomenon that he can use it by analogy (as in the *Iliad*) to understand a medical theory: disease causes bodily humors to clot, just as rennet

Ἰατρός



4.11 Disproving a Hippocratic treatment for bleeding. First, six test-tubes were aligned, right side up; the three at left received two drops of fig-tree latex; and one ml of blood was added to each of the six tubes. Then three minutes later they were all turned upside down, as shown. In the "blood-only" tubes (right), clotting had occurred normally; in the others, the blood ran down, because the latex, far from speeding up the clotting, had prevented it altogether. (Until the sap is tried on a bleeding wound, however, Hippocrates still has a chance to be correct).

causes milk to curdle.[63] The word for rennet is *opós,* "the juice," and the curdling juice par excellence was that of the fig tree.[64] We had stumbled upon a fact of elementary dairy technology at least as old as Homer.

Thus far our experiment had confirmed the first part of the physician's reasoning: "Opós will clot milk; therefore, opós will clot blood." Opós did clot milk. But the second and critical step of the reasoning proved a total failure: when we added the fig-tree juice to blood, clotting was prevented altogether (Fig. 4.11). Chances are that fig-tree latex as a styptic should be written off to psychotherapy.

Back to the iatréion. The physician is planning what to do next, in case the hemorrhage should continue; and he might explain it to the carpenter in these terms: "If the milk of the fig tree will not stop the bleeding, I can apply a ligature around your leg. If you have ever been bled from the arm, you will know that a gentle tie will increase the flow of blood; and that a stronger one will stop it.[65] But I will not leave the ligature on too long, because the part of the leg below it might become gangrenous."[66] In the meantime, more cold water is poured over the ankle.

Ἰατρός

The bleeding stops; but beware. Shortly the iatrós reaches for a sharp blade, ties a band above the carpenter's knee, slits a vein in his ankle, and makes him bleed again! Quite a letdown after the brilliant beginning. This is the product of too much theory and too little anatomy. Muddled by notions that he takes for facts, the Greek practitioner has to live and work by this dilemma:

Hemorrhage kills, but bleeding helps.

So he compromises by stopping the hemorrhage and causing more bleeding. A dangerous game, especially in the hands of one who does not yet know how to tie off a spouting vessel.

Still, the iatrós had already worked out the main principle of the tourniquet, and even its built-in danger, gangrene: toward saving lives, this was a major step. Or rather, it should have been so: because this basic principle of first aid, the tourniquet, somehow failed to gain general acceptance. In the Hippocratic Collection it was clearly mentioned only once; it reappeared incidentally in the first century A.D. by the pen of a second-rate Roman writer, who ridiculed it.[67] And then it was lost. To this day, the credit for discovering the principle of the tourniquet is assigned to Ambroise Paré, who staunched bleeding in the mid-1500s "with a strong and broad fillet, like that which women usually bind up their hair withall."[68]

It is difficult to understand how a statement of this importance in the Hippocratic Collection could have been so consistently overlooked, even by modern commentators.[69] One reason may be that the tourniquet is mentioned in the context of a theoretical principle, in relation to surgical bleeding (venesection), not as a practical technique useful in first aid. Also, it appears in a book that rates fairly low in the traditional scale of excellence: category 5 in Littré's 11-point classification, under the heading "a mere collection of notes and extracts."[70] In fact, this book was never translated into English. Here is the passage, which comes after a short note on a woman suffering from quartan fever: "In case of profuse bleeding, one must find the appropriate position; in general, if [*the part*] is low, it should be brought high. In venesection, ligatures increase the flow of blood; if strong, they stop it."[71] The danger of gangrene by ligature is stated twice, but even more laconically; the clearest of the two passages reads: "Causes of gangrene of the tissues are: constriction in wounds with hemorrhage, compression in fractures of bones, and mortification from bandages."[72]

But whatever the reasons that drowned out the message in modern times, in the days of Hippocrates the tourniquet was bound to fail: the ligature of bleeding vessels was not yet known. After three or four hours, anyone who had applied a ligature faced a desperate choice: either leave it on, and cause gangrene; or remove it, and run the risk of more bleeding. The discovery had come too early.

Patient No. 2: A Round Ulcer

Ἰατρός

Next comes a plump woman, with bad varicose veins and a typical complication thereof: a stubborn ulcer on the ankle, which is bandaged. The iatrós begins by taking a pot from the burner and pouring some water, first over his own hand to check the temperature,[73] then over the woman's hand, because it is the patient who must decide whether it is comfortable.[74]

The bandages are removed while the ankle is showered with the warm water.[75] This is primarily a wash, but in the intention of the iatrós the warmth itself is essential, for two reasons. First, he believes that it will keep

the sore "relaxed," thereby preventing "spasms" (anything from chills to tetanus, as we shall see). Second, he has been taught that heat favors bleeding[76] (which is true), and he believes that this will be good for the ulcer.

As for the woman's bulging varicose veins, they will remain untouched. The books recommend puncturing them once in a while, "as circumstances may indicate," but also warn that large sores may follow:[77] perhaps a more scientific way to restate, 1200 years later, the warning of the Ebers papyrus that it is wrong to cut into "snakelike swellings."

Now the ankle is sponged with hot vinegar,[78] very carefully, because the smell of vinegar was supposed to be "harmful, especially for women"[79] (this I cannot explain). The ulcer turns out to be almost perfectly round and hollow—one of many possible shapes (a detail of no relevance today).

"For an obstinate ulcer, sweet wine and a lot of patience should be enough,"[80] says the iatrós; "but this one is round, and it will not heal unless I change its shape into a long one. I could burn it out with a caustic,[81] but it will be faster to use a knife." So this is the treatment: carving the circle into an oval. The pain is made more bearable by allowing the patient to rest after each cut.[82]

After this astonishing procedure comes the dressing: a pad of wool dipped in an *énaimon*, a "drug for fresh wounds" (usually anglicized as *enheme*):[83]

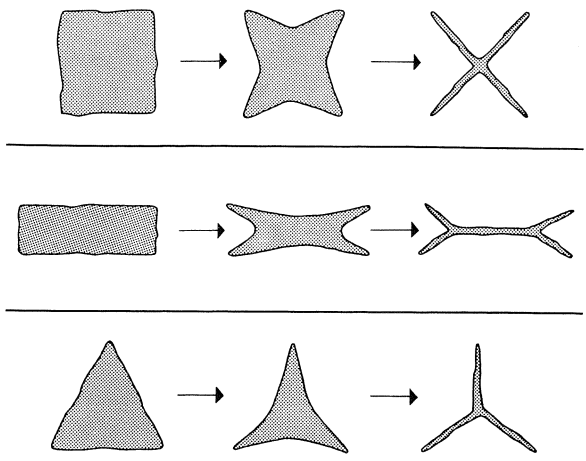
Copper acetate (*verdigris*)[84]	equal parts, dilute in wine
Copper oxide, red (*flower of copper*)[85]	
Lead oxide (*molýbdaina*)[86]	
Alum, Egyptian, roasted	
Myrrh	
Frankincense	
Gall nuts	
Vine flowers	
Grease of wool[87]	

As a wound drug, this medicated wine might be better than nothing. The four inorganic salts would probably sting but would also kill any bacteria within reach. Myrrh and frankincense would add a touch of perfume to the proceedings and join the fight against bacteria. No harm is likely to come of the gall nuts and vine flowers. The only dubious ingredient is the grease of wool, essentially a crude form of lanolin smelling strongly of sheep and probably not too clean. The Greeks loved it. Its texture, smell, and taste seem almost real in the lines of Dioscorides.[87]

The bandage over the ankle is drawn tight, probably too tight for modern standards. The purpose is to apply pressure over the swelling, so as to squeeze out dangerous blood and humors.[88]

Finally, the woman is sent home with the inevitable purge and the very appropriate warning that standing, walking,[89] or even sitting will cause her sore to heal more slowly.[90]

There is one especially bizarre procedure in this case, namely, changing



4.12 Gaping wounds heal by the inward movement of their margins, called wound contraction; hence the branching shapes of the scars.

the shape of a round ulcer. It is mentioned only once in the Collection, but thereafter the bad reputation of round ulcers grew into a surgical axiom. Ambroise Paré took it for granted,[91] and Francis Adams, the learned surgeon and commentator on Hippocrates, agreed in 1849 that "circular sores are particularly difficult to heal. Every experienced surgeon must be aware of the fact, however it may be accounted for."[92] If Adams says so, we have to think twice before brushing it off.

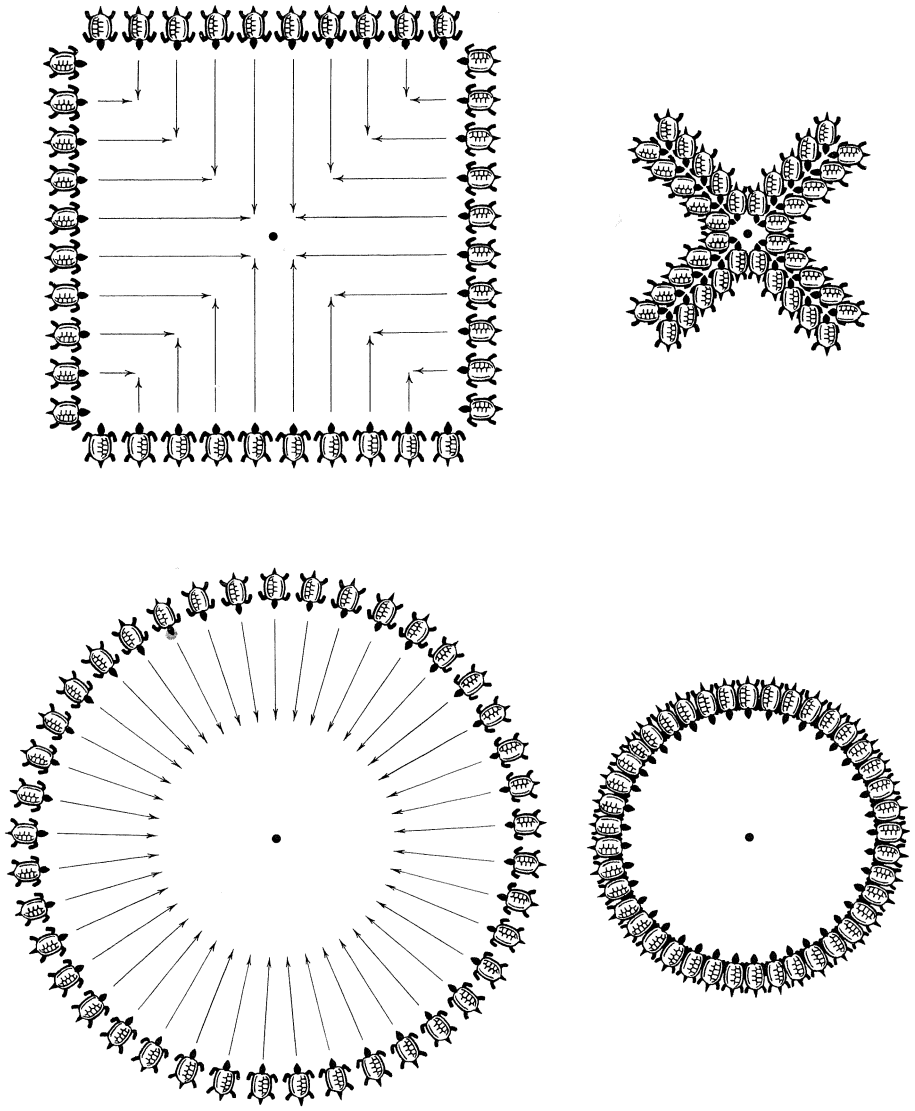
There is indeed a fair amount of truth in the lore of the round ulcers. All gaping wounds close, to a large extent, by contraction: the raw surface becomes lined with a contractile tissue that draws the opposite margins together. Hence, square or triangular wounds heal with star-shaped scars (Fig. 4.12). As for a round wound, in theory, if it were to remain round and heal by pure contraction, it would have to reduce itself to a point: ultimately its margins would have to pile up into a vanishing space, which is not conceivable. The phenomenon is more intuitively obvious than scientifically understood; but the final result is well illustrated by the analogy with two sets of imaginary turtles. One set is laid out in a square, the other in a circle. Instruct the turtles to crawl toward the center, and see what happens (Fig. 4.13).[93]

In practice, a round wound does not heal as well as an irregularly shaped wound, unless some force is present that draws it into an oval.[94] Wounds with a surface of 30 square centimeters, produced experimentally in rabbits, took on the average 18.82 days to heal if they were triangular, 25.46 days if they were circular.[95]

Ἰατρός

The ulcers that develop in legs with varicose veins are difficult to heal (round or not), because their blood supply is bad. Long-standing ulcers also develop thick, firm, fibrous edges that resist the centripetal pull. Hence, the ancient practice of carving them out was dangerous—indeed heroic—but not entirely irrational.

If patient no. 2 heeded the advice not to walk after the surgery (she probably had little choice) this alone should have helped her ulcer. Her dressing was antiseptic. Perhaps she gained something at the iatréion.



4.13 Using turtles to understand the rules of wound contraction. A formation of crawling turtles laid out in a square (above) shows how the inward motion of the margins leads to an *X*. A circular formation of turtles (below) can never close: this resembles the behavior of round wounds, which cannot heal except by changing shape.

Patient No. 3: Pus in the Chest

Ἰατρός

This feverish young man is directed to sit on a stool, facing away from the light.[96] On the back of his chest, rather low, there appears a broad, soft lump. To the iatrós the correct diagnosis is obvious: there is so much pus in the pleural cavity (empyema) that it is ready to come out through the skin. Empyema so far advanced as to bulge under the skin is rare nowadays, but it was common in antiquity. Celsus recorded that "it is common for fistulae to have their exit between ribs."[97]

To confirm his diagnosis, the iatrós seizes the patient by the shoulders, shakes him, and listens closely,[98] expecting to hear "a wave and a noise . . .

like [*shaking*] a skinsack."[99] But this time there is no noise at all. This he takes to be a bad sign.[100] Pus is definitely there, since it is ready to come through the skin, so it must be "too thick, or too abundant," to splash around in the pleura.[101]

In any event, the correct conclusion is that pus must be removed from the chest, and this calls for surgery. Although the painful spot indicates where to incise, the iatrós prefers to double-check. He and his aide dip their hands into a jar full of wet potter's clay and quickly smear it all over the back of the patient. Then they watch attentively. The first patch to dry up will indicate the hottest point of the skin and therefore the best place for cutting.[102] The back of the patient is now washed with a lot of hot water, and the operation is performed. The style of the text suggests that this was routine surgery:[103]

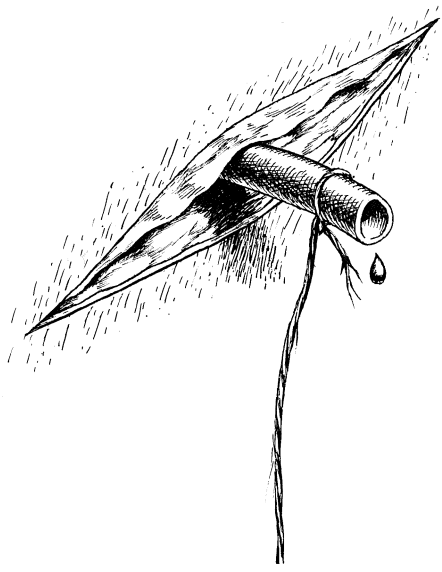
> Cut as low as possible so that the pus may flow out more easily. Cut between the ribs, the skin first, using a knife with a rounded blade. Then take a pointed knife, wrap its blade in a cloth so that only the point will protrude as much as the length of a thumb's nail, and cut through [*to the pleural cavity*]. Let out as much pus as you think best, then put in a tent[104] of raw linen attached to a thread [*presumably to retrieve the strip of linen, should it slip beyond reach*]. Let out the pus once a day. On the tenth day, having removed all the pus, put in a tent of fine linen; then inject warm wine and oil through a small tube, so that the lung, accustomed to be moistened by the pus, may not remain suddenly dry. Remove in the evening the oil and wine injected in the morning; that injected in the evening, remove it on the following morning. When the pus becomes as thin as water, slippery to the finger, and scanty, put into the wound a hollow tin drain. When the pleural cavity becomes dry [*i.e. ceases to produce fluid*] cut the drain shorter little by little, and allow the incision to heal as you retrieve the drain.[104] Signs that the patient will escape death: if the pus is white and pure and contains streaks of blood, there are good chances of healing. But if pus . . . on the next day flows thick, greenish and fetid the patients die after the pus has run out.

Oil was still being injected into the pleural cavity some years ago in the treatment of lung tuberculosis;[105] drainage with a rigid tube is an important world première (Fig. 4.14). The overall procedure is quite advanced. But once again, postoperative treatment is just about disastrous. To stop the formation of pus the patient is bled from the arm, purged, and given a starvation diet: thin barley gruel and dilute *oxymel*, a mixture of water with a little honey and vinegar.[106]

Ἰατρός

Obviously, some of these patients came out alive. Daring as the operation may seem, it was probably suggested by the natural course of events (that is, the spontaneous exit of the pus) and by familiarity with holes in the chest due to stabbing with "spears, daggers and arrows."[107] Survival from such wounds was not unusual.

The patients were operated while sitting "on a firm stool"[108] (the firmness of the patient being taken for granted). Afterwards, they probably went home. It has often been claimed that the iatréion had facilities for inpatients. I checked the evidence and found it to be unbearably thin: one court



4.14 Surgical drainage of pus with a piece of tin pipe—another Greek practice that sank into oblivion.

case in which the defendant, a citizen of peculiar habits, was accused of sleeping at the iatréion *with the physician!*[109]

Not enough to make a ward.

Patient No. 4: A Fallen Lung

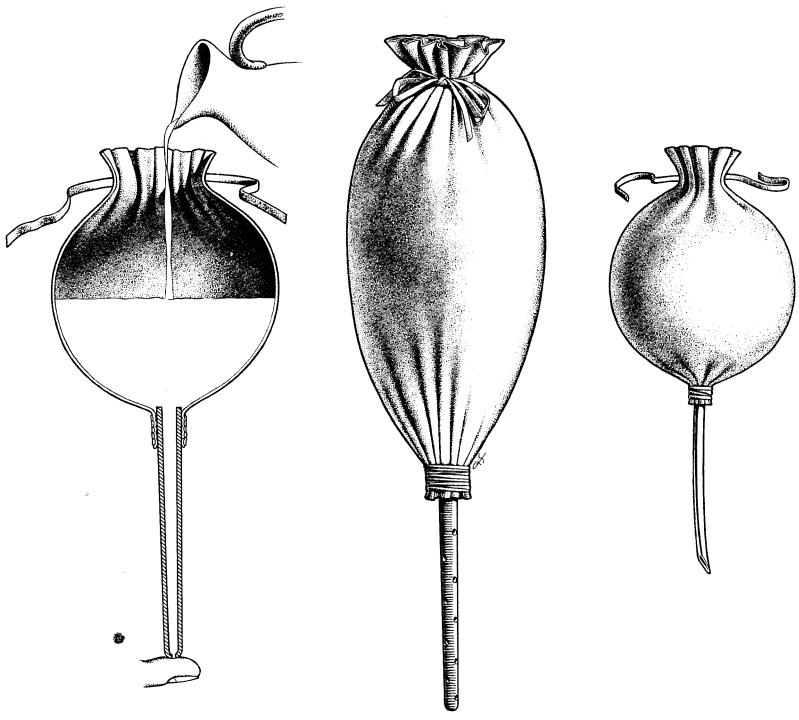
This young woman has been operated on for empyema several weeks before. The wound has begun to close, but now she complains of what she calls pleuritis. Doctors tend to be irritated by patients who offer their own diagnoses, but the young woman is not doing that. *Pleurón* meant "side," and *pleuritis* was vaguely "the thing of the side."[110] The ending *-itis* was still far from taking the turn it took with appendicitis, where it now means "inflamed." Athena Ophthalmitis had no red eyes; she was just the goddess "with the [big] eyes." Hepatitis was not a disease, but a vein connected with the liver, and steatitis was "the thing like fat," a stone.[111]

So the iatrós directs the young woman to sit on a stool, kneels behind her, lifts her chitón, and applies an ear to her back. Yes, auscultation! His gesture was just like ours (Fig. 4.15).

Ἰατρός

He hears an abnormal sound, "a creaking sound like leather."[112] Today we know what this means: the surface of the lung, roughened by infection and inflammation, is rubbing against the rib cage. As the iatrós sees it, the lung "has fallen against the side,"[113] and he has an answer to the problem. On a shelf are stored several pieces of tubes and dried animal bladders of various sizes, his disassembled syringes (Fig. 4.16). He attaches a bladder to a small tube and inflates it.[114] Then he slips the free end of the tube into the wound, pushes it into the pleural cavity, and blows in the air. Finally he withdraws the tube and plugs the passage with a solid rod of tin. He thus obtains an ar-

4.15 A iatrós listening for lung noises, of which he understood at least two.



4.16 Greek syringes: an animal bladder tied to a pipe was filled with fluid or air. The largest pipe (left) was for enemas; the finest, a feather shaft (right), was for the urinary ways. The middle one, made of silver, was for gynecological use. About one-third actual size.

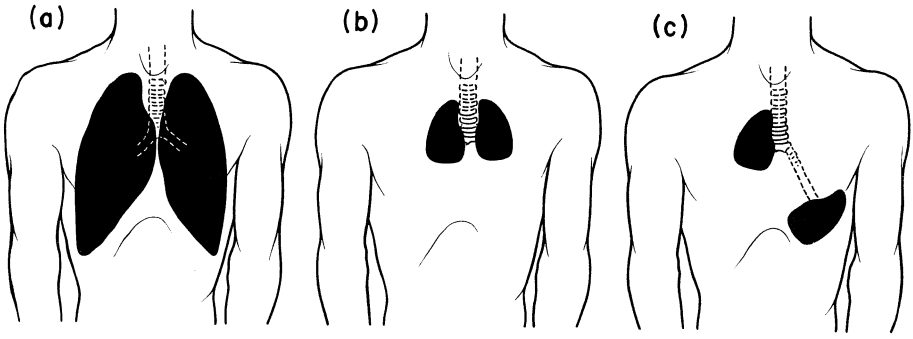
tificial pneumothorax—a nineteenth century invention! But why did *he* do it?

To solve the mystery we will have to analyze that phrase "fallen lung," which seems to make no sense at all. Commentators have either ignored it or found it bizarre.[115] Having first repressed all modern knowledge of anatomy, we will step into the sandals of a iatrós who is trying to learn something about the lung, perhaps by standing next to a butcher as he opens the chest of a slaughtered animal.[116] As the knife plunges into the rib cage, there is a faint wheeze: normally, the lungs are in contact with the inner surface of the chest, being held there by the negative pressure in the pleural cavity (Fig. 4.17a). The instant that a blade reaches the pleura, air is sucked in, and the lungs—while they are still out of sight—recoil inward and upward to their point of attachment (Fig. 4.17b). This is the position in which the Hippocratic physician finally sees them, and he necessarily takes it to be normal. If the normal lungs are perched high up in the chest, in order to come and rub against the lower rib, they obviously have to fall (Fig. 4.17c).

Ἰατρός

Now the purpose of the operation becomes clear: it was a matter of blowing back into place a lung that had fallen down, just like air blown into the vagina was used to straighten out a "displaced uterus,"[117] or the wind of the blacksmith's bellows to pop an intestinal obstruction.[118]

As a result of the operation, the creaking noise has disappeared. For the pain in the side, a beef bladder or skin bag full of hot water will help. But the young woman is no better off. The pain in the side is still there, because the iatrós has given her an acute pneumothorax (air in the chest)—luckily not



4.17 The Greek misconception of a "fallen lung": when a physician heard the lung rubbing against the chest wall, he thought it had dropped against it.

severe, but enough to cause discomfort, to speed up the heart rate, and to make breathing difficult. And her pleural infection has been increased. She would have been well advised, I fear, not to seek help.

Patient No. 5: A Cut in the Face

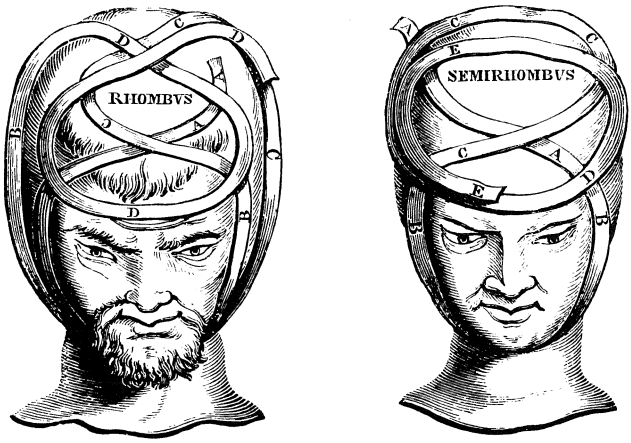
A youngster comes in accompanied by a slave. He has a clean slash on the nose, where a playmate hit him with an *óstrakon*, a piece of broken pot.[119] The wound is washed with a generous shower of white wine,[120] then patted with a sponge and pieces of clean, dry linen.[121]

"This is a sharp cut," says the iatrós. "Had there been any bruised flesh, I would have helped the wound to produce pus, for pus makes the bruised flesh melt away.[122] Since there is no bruise, I can make the wound close fast, without the formation of pus." He takes a bronze needle, threads it, stitches the flesh, and covers the suture with a mixture of copper oxide and honey.[123] The dressing is a double pad of cloth soaked in wine, then a slice of clean sponge, rather dry, and a handful of leaves.[124] The sponge under the bandage is to apply pressure. The leaves have not been understood,[125] but I assume they served the purpose of today's gutta-percha or plastic sheet, namely, to prevent rapid evaporation from the dressing. The bandage is an artful *semi-rhómbos* (Fig. 4.18),[126] its end being sewn in place with thread and needle.[127]

Greek physicians took great pride in sending away their patients with tricky and aesthetic bandages. The Hippocratic Collection has much to say on the art of bandaging, but also warns that some turn it into "a foolish parade of manual skill,"[128] and that a stupendous bandage is not equivalent to excellent medicine.[129] "Leave aside theatrical bandages that serve no purpose; this is miserable and fit for charlatans, and often hurts the patient. Indeed the patient is seeking not ornaments, but help."[130]

Ἰατρός

To a modern patient, the end of the bandage ritual brings a sigh of relief. But a Greek patient still had lots of trouble ahead. The physician might caution the child: "Now that your wound is sutured, we must prevent it from throwing pus, or it will open again. We will have to purify the body from below (*hypocatharsis*).[131] So drink this potion." The scrolls at the iatréion list over sixty drugs claimed to be cathartics (*catharsis* meant "puri-



4.18 Rhómbos and semirhómbos bandages. Bandaging the head was an art; Galen's book *On Bandages,* based on Hippocrates, has at least seventy varieties. To apply these bandages, follow the letters.

fication"), and some are indeed very powerful.[132] Then, turning to the slave, the iatrós says, "See to it that he drinks hydromel, seven parts water to one part honey,[133] but allow very little food and absolutely no cheese until I tell you." The Greeks made a great fuss about the dangers of cheese. They were probably alarmed by the resemblance between cheese, mainly coagulated protein, and the whitish fibrin that coagulates in sores—which they called *phlegm:* "cheese is phlegmatic."[134] Finally, the patient is instructed to come back "the day after tomorrow," for it was standard practice to change the dressings every other day.[135]

These sutures, with their Indian counterparts, are the first definite examples after the Egyptian *ydr.* In view of the tendency of nonaseptic sutures to become infected and drop off, it is not surprising to find that stitches in the flesh are mentioned only three times in the Collection,[136] and then only in relation to the nose and the eyelids. Modern surgeons are well aware that wounds about the face heal "more kindly," with less risk of infection.[137] Perhaps the iatrói, too, had discovered that wounds in the face stood a better chance of tolerating sutures.

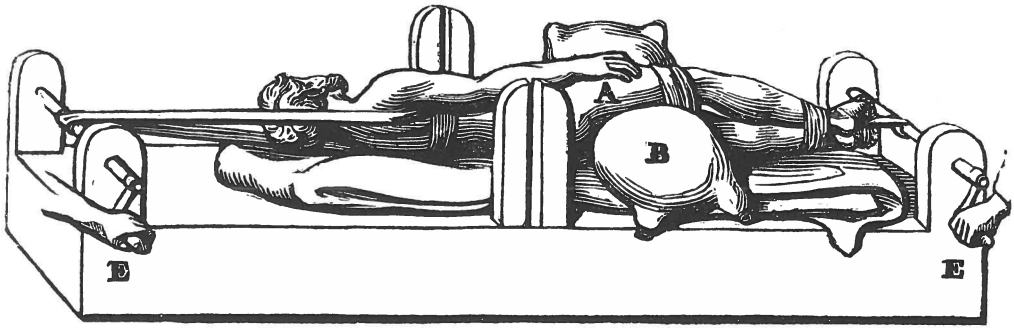
So far so good—except for the purge and the diet. If infection does not cause the suture to break down (young people are good patients in this respect), the iatrós will have performed a useful function.

Ἰατρός

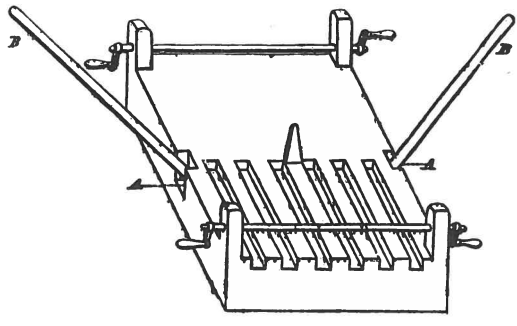
Patient No. 6: Recurrent Dislocation of the Shoulder

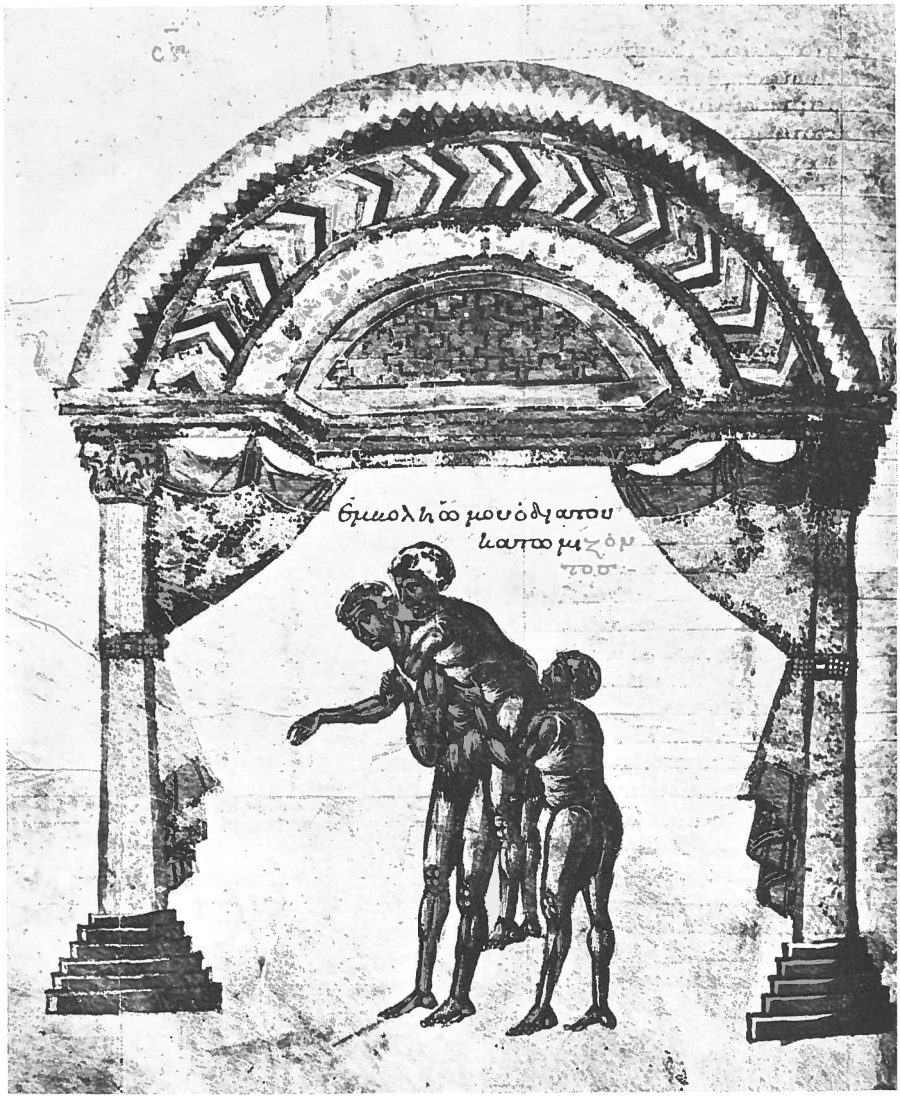
The next patient is a sleek *éphebos* still oily from his last wrestling match in the gymnasium (Fig. 4.19). He is clutching his left arm, obviously dislocated at the shoulder; the pain is not great, and it is the fourth time it has happened anyway. The treatment is routine to him. In principle, all dislocations were supposed to be treated on the contraption that is now called the Hippocratic bench or *scamnum,* basically a device for stretching the patient with winches (Fig. 4.20).[138] But a humerus that kept slipping out of its sockets

4.19 A Greek throw, the *se-oi-nage* of modern Judo, which will cause a heavy fall. The emphasis on dislocation of the shoulder in the Hippocratic books was certainly related to the popularity of wrestling.



4.20 The Hippocratic bench at work (above). Here the upper end of the femur (A) is supposed to have been luxated inward, so the inflated skin bag (B) eases it outward, while the limb is submitted to traction and counter-traction. Note the crankshafts (E); the screw had not yet been invented. This is a very dangerous machine, which could have helped only rarely, if ever. In a later interpretation of the bench (right), with two lateral levers (AB), the patient lay astride the central pin (*priapískos*).





4.21 One of nine ways to reset a dislocated humerus. The physician, if tall enough, pulls the patient's arm over his shoulder. This method was "very convenient at the wrestling school." From a Byzantine manuscript of the Hippocratic book *On Joints*, c.950 A.D.

could be reset by simpler means. Thus, the éphebos lies down on the bare floor; the physician sits down beside him, puts a little ball of sewn leather in the patient's armpit, and tugs at the arm while pushing the ball with his heel—a technique still recommended.[139]

Ἰατρός

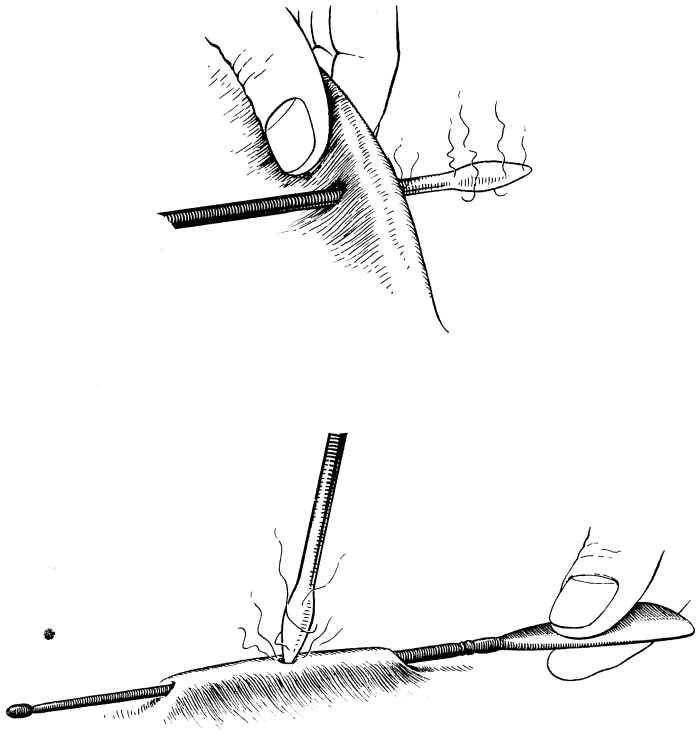
The main problem is solved once again; and if the maneuver had failed, the iatrós had eight other ways to go about it, like pulling the patient's arm over a door or over a chair (Figs. 4.21–4.22). This time, however, the young man is served a sermon. His humerus has been slipping out too often. What if someday it slips out during a real battle? It has happened to others, and that was their last time.[140] Since the joint is too loose, the remedy will be to poke a cautery through the skin of the armpit (Fig. 4.23). This will cause the tissues to retract and keep the bone in its place.[141] Gritting his teeth, the éphebos accepts the new challenge.

4.22 Another method to reset a dislocated humerus—over a door. From the same manuscript.

Before decrying the iatrós for suggesting this dreadful procedure, consider his grasp of matters surgical. He knows, in fact he applies the phenomenon of wound contraction, which is so powerful in burn wounds ("in this way the cavity, into which the humerus is mostly displaced, is best scarred over and cut off"). He also knows the basic surgical anatomy of the axilla and devises the operation accordingly, for the text mentions the "glands that everyone has in the armpit" and even the neurovascular bundle. Here is the physician's warning to the patient, transcribed almost literally: "I will heat the cautery until it glows white: that way it will be faster in going through the fold of skin; but be sure not to move, for deep down there are some nerves and a large vein, and at all cost they must not be touched."

Ἰατρός

The operation, extremely painful, leaves three black sores. Each one is covered with a lump of greasy wool. The iatrós is again worried that they



4.23 Triple cauterization of the armpit in cases of recurring luxation of the shoulder. The contracted scar left by the burns was supposed to hold the bone in place.

might catch cold, especially since they are burn wounds.[142] This obsession with cold may be connected with the specific choice of unwashed wool for the wounds. A seventeenth century Italian commentator refused to believe that the Divine Master himself could have recommended such filth,[143] but after all, if warmth is the purpose, greasy wool is warmer.

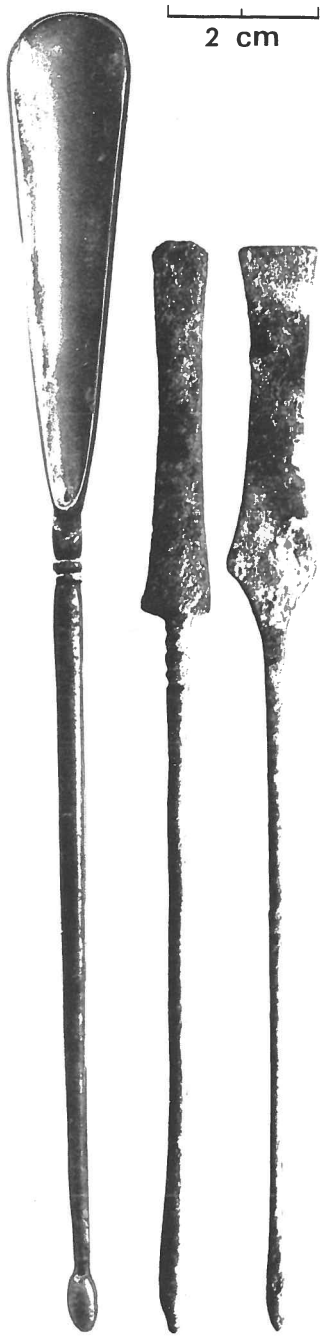
My guess is that in the long run the operation worked—by keeping the patient away from the palaestra, and maybe from the battlefield as well.

Patient No. 7: Carpentry on the Skull

This boy aged eleven is mentioned in the fifth book of the *Epidemics*. While grooming a horse, he received a kick in the forehead.[144] The iatrós explores the wound with a probe (Fig. 4.24)[145]—no fingers—trying to determine whether there is a fracture or maybe only a shallow dent left by the horse's hoof (Fig. 4.25). He calls such a dent by the name of *hedra*, literally "chair" or "seat." The Greeks were so concerned with the fate of bruised bone that they developed this special name for dents in the skull unaccompanied by fracture. It is one of the few Greek medical terms that died out, because the underlying concern has also disappeared: bruised bones heal perfectly well if left untouched and sterile (hedrae still happen, but they are absorbed into the general notion of contusion).

Ἰατρός

To the iatrós, this preliminary probing is essential. If there *is* a fracture, he will *not* operate further; if there is no fracture, he will drill a hole in the



4.24 Multipurpose probes, with which Greek physicians touched and treated wounds, rather than using their fingers, as had their Egyptian predecessors. Whether probes were better or worse than fingers depends on how clean they were kept.

4.25 Dents or notches in the skull, without fracture, caused by blows. The Greeks called them *hédrae*, and worried physicians scraped them away. How wrong they were is shown by the skull of this miserable prehistoric Peruvian, who had about seventeen hedrae (from sling-stones?), all presumably unscraped, and all healed.

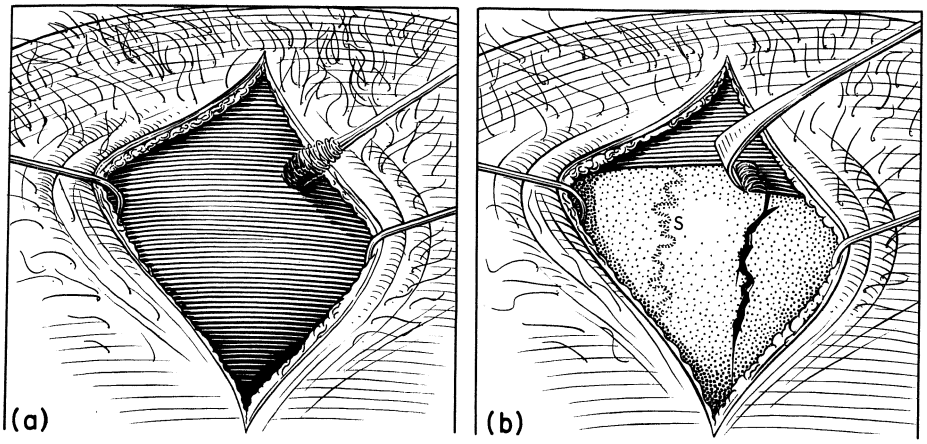
skull; and if there is just a hedra, he will scrape it away. Here he runs into a diagnostic problem: how is he going to distinguish a thin crack from a normal joint between two bones?

The answer is a hair-raising bit of carpentry *in vivo*.[146] First he shaves the head.[147] Then he enlarges the wound, lifts the scalp all around it, and packs the space with lint. Then he plugs the wound itself with a plaster made by boiling vinegar and barley flour, and covers the whole with a bandage. That is all for the day. The next day he removes everything, smears the skull with something that looks like black shoe polish;[148] and covers it again with oil, linen, and more barley plaster. The third day he scrapes the blackened skull with a sharp knife: experience has shown him that the black will come off everywhere except from cracks and dents (Fig. 4.26). He goes on scraping until all the black is gone. To the Hippocratics this horrible procedure was very important. Perhaps they thought that bruised bone would decay and slough off, as soft tissues do, and therefore preferred to scrape it out from the start.

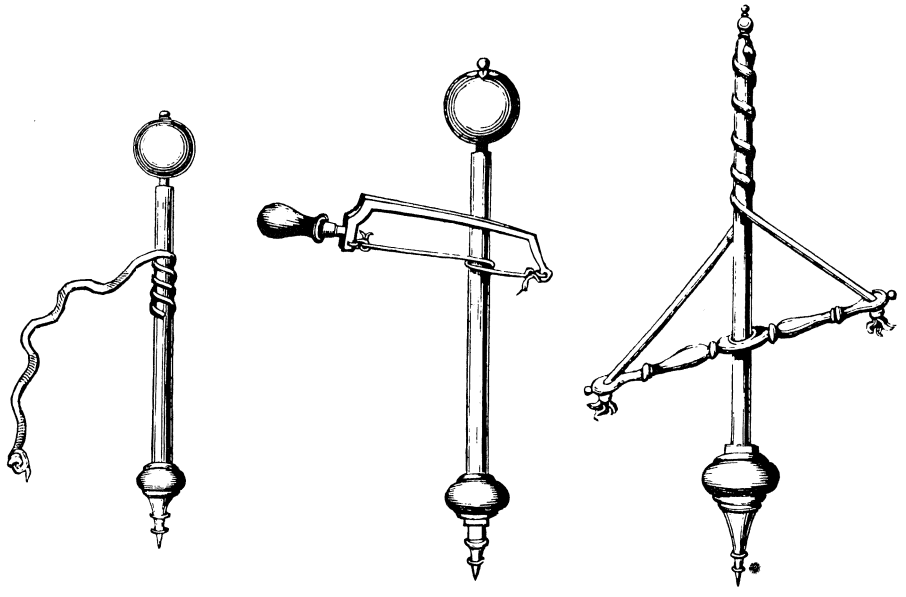
The most perplexing part of the story is that if the iatrós had found no fracture or hedra at all, he would have felt compelled to drill a hole with one of the several gadgets at his disposal (Fig. 4.27). In essence, *if you find no hole, make one.* Rivers of ink have flowed over this riddle. But again, it made good sense in the context. To the mind of the Greek physician, a blow must cause blood to spill beneath the skull or humors to accumulate there; all this material has to be given a way out before it turns into pus. If there is a way out already, such as a fracture, fine; but if not, it will be necessary, as Francis Adams put it, to "slacken the tightness of the skull."[149]

Ἰατρός

Drill slowly, recommends the text, because the bone may heat up and burn.[150] The unknown writer was well acquainted with this problem, because similar hand-drills were used to start fires,[151] much as in ancient Egypt.



4.26 Greek method for distinguishing a crack in the skull from a normal suture (s): just smear a black paste on the bared skull (a) and scrape (b). Only cracks will show up.



4.27 Three types of Greek bone-drill (*trýpanon*). Drills like these were also used on wood for starting fires, as in Egypt.

Twenty days after the operation the little groom is shaking with fever, his face red and swollen beyond recognition.[152] The bacteria have taken over. His trouble is diagnosed as erysipelas and is treated with a cathartic,[153] besides plasters on the face and a burn with the cautery. He will survive; but it is somewhat startling to read that "his wound had nothing to do with these accidents."[154]

Ἰατρός

Patient No. 8: A Chest Like Boiling Vinegar

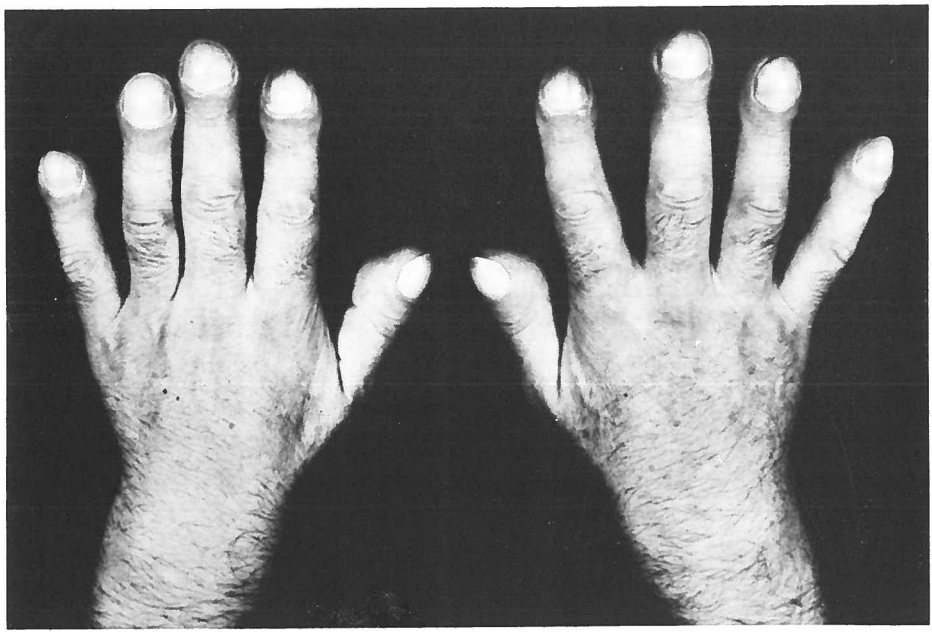
Fighting a fit of cough—a long, rumbling cough—a withered old woman staggers in and takes a seat. She is out of breath and obviously feverish. When

she has quieted down a bit, the iatrós kneels down behind her, puts an ear to her back, and listens for a long while. If it was a surprise to see him practice auscultation, there is no word for what will happen now. This ancient Greek is about to draw conclusions worthy of a modern treatise of pathophysiology—except, alas, for the therapy.

To him, it sounds "as if it were boiling inside like vinegar."[155] He takes this to mean, quite correctly, that there is fluid inside the lung.[156] Then, unlike many of today's physicians, who leave their patients in the dark, he tells the old woman the complete story as he sees it. This is actually a calculated display of insight, on the principle that it impresses a patient to be told his own symptoms before he has a chance to describe them himself.[157] His speech might run: "You must have been coughing like this for a long while. I can tell from your fingernails. Remember how they used to be curved only sideways, like mine; now see how they are curved also the other way (Fig. 4.28). Your toenails must look the same. This means that your lungs are sick. You will probably have more fits of coughing and fever like this one, and the tips of your fingers might even become swollen. Then perhaps the water in your lungs will seep out and pour into the space all around. Should this happen, I will be able to help you by drilling a little hole in a rib and tapping that water, a little at a time.[158] In the meanwhile, I will keep studying your urine, which tells me how your disease progresses.[159] I shall give you some fumigations, and a diet that will dry up your body."

Note how this talk has improved the situation. The patient is greatly relieved to know that she is in the hands of a doctor of obvious competence, who knows the present as well as the past and the future; he even guessed about the fingernails. She has also escaped the knife. If she gets worse, she can

Ἰατρός



4.28 "Hippocratic fingers." This strange effect of chronic lung disease is not yet well understood.

hope for a treatment; and in the meantime her medicine is not too unpleasant. It was worthwhile going to the iatréion.

The physician, too, is gratified. He may not have spelled out the diagnosis in modern terms (chronic bronchitis on bronchiectasis with recurrent bronchopneumonia), but this is not at all his concern, for almost anybody can tell what is going on right now. What counts most is to be able to anticipate what is going to happen—*prognosis* rather than diagnosis. In his eyes, he should be congratulated for making what he calls a good prognosis; good, that is, primarily for his ego. Today's physicians behave somewhat alike when they speak of a good diagnosis after having discovered a hidden cancer.

To understand the peculiar lack of interest in diagnosis in ancient Greece, remember also that disease, in general, was always viewed as the same: an imbalance. The author of *On Breaths* goes so far as to say, "Of all diseases the fashion is the same, only the seat varies."[160] The satisfaction of a beautiful diagnosis was therefore minimized, and the iatrós replaced it with a "beautiful prognosis." Here is a rather shocking example: "If convulsions do appear, death is likely, and there is a chance for a beautiful prognosis."[161]

As to the curving nails and swelling fingertips, they belong to the category of strange but true: they are common effects of chronic lung disease. Although theories abound,[162] on the whole the phenomenon is not understood much better today than in the days of the iatréion. French clinicians still record it as *hippocratisme digital.*

Note also that the iatrós has been able to recognize the presence of fluid bubbling in the bronchi by placing his ear on the chest. But what can he be hearing that is *boiling like vinegar?* Other readings have been proposed for this passage, such as "smelling like vinegar"[163] or "seething like sour wine,"[164] which is chemically impossible; none improves the meaning. The answer is probably the simplest. It occurred to me one day that it might help to pour some vinegar into a pan and heat it. As it started to boil, it produced a very special rushing, crackling noise, quite unlike that of boiling water, and comparing very well with the sound heard over a lung when fluid obstructs the finest bronchi, a sound called "fine moist râles" in modern terminology. The iatrós was familiar with the procedure of boiling vinegar, a common step in preparing drugs and plasters.[165]

Patient No. 9: Punches in the Head

Ἰατρός

The next patient looks like a nightmare: a giant, with scarcely any face, just a bloody mess of black eyes, swollen ears, and a broken nose. This is the new breed of professional boxer.[166]

Boxing had degenerated by 400 B.C. In the old days it had been a game like all others, practiced by gallant young amateurs whose fists were protected by soft leather thongs (Fig. 4.29). Then over-competition bred professionalism, which spoiled the game.[167] Boxing was taken over by huge brutes, "pothunters," who wandered from city to city in search of a bloody fight to the finish (Fig. 4.29). They wore a new kind of sharp, cutting gloves called *sphái-*