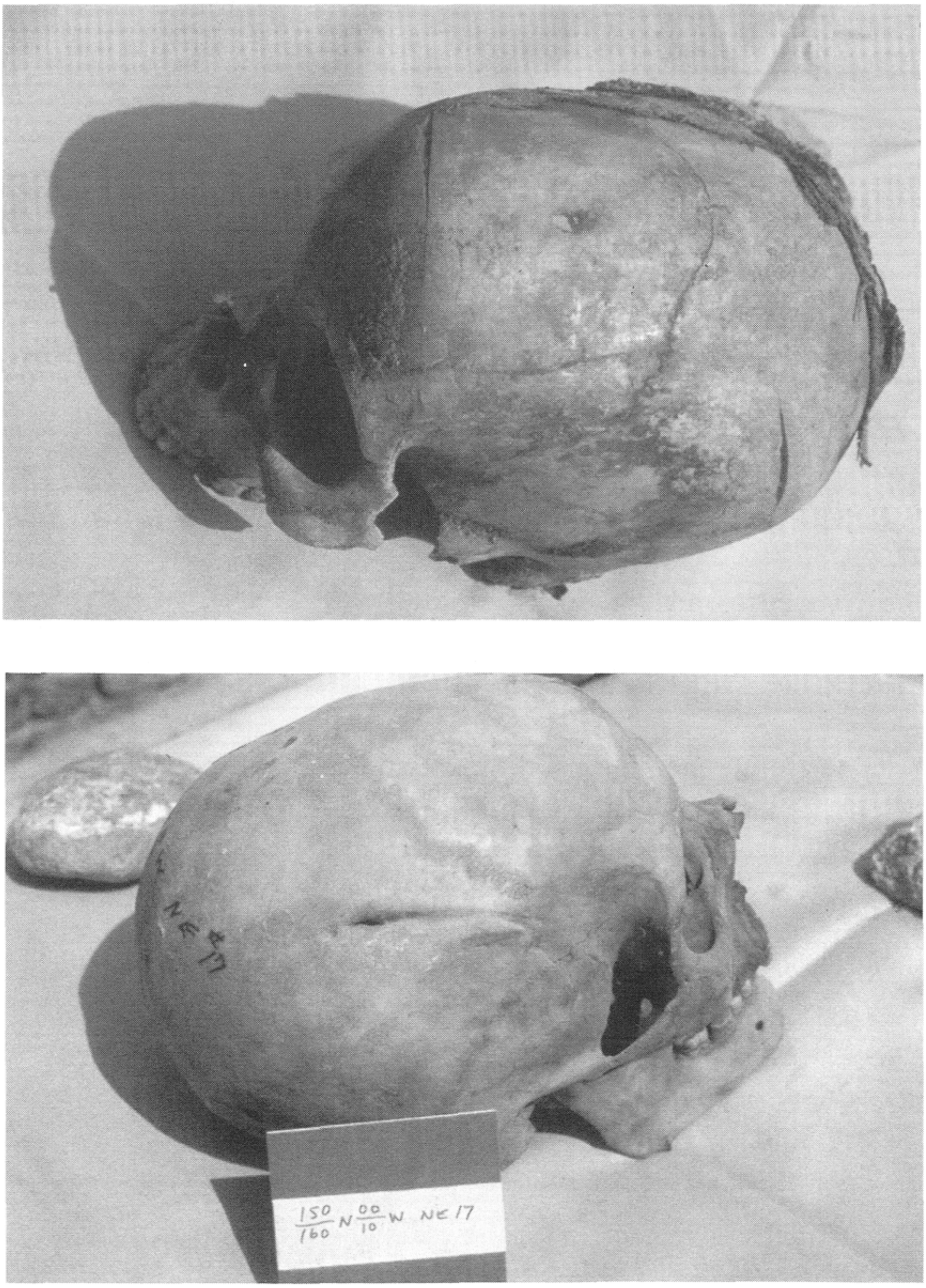
Neuropathology and the Scriptures

M. Gary Hadfield



Trephinated Skulls. Trephination usually resulted from either surgery or a blow to the head from a weapon such as a sword, knife, or axe. These two skulls are from an early Christian cemetery excavated by the BYU Egyptian Archaeology Team. *Top:* trephinated skull with cuts and a round hole. *Bottom:* trephinated skull with some healing of the wound. Courtesy of BYU Eg. Arch. Project.

Neuropathology and the Scriptures

A medical assessment of the slayings of Goliath and Shiz, Christ's sufferings and healings, and other biblical and Book of Mormon events helps to illuminate and confirm these accounts.

M. Gary Hadfield

The scriptures, read as an account of a wide range of human experiences, reflect things of the spirit, body, heart, and mind. As a neuropathologist, I have tried to bring medical insights to bear on passages of scripture that appear to involve disorders or diseases of the brain or of the nervous system. This article explores some of those cases, particularly from a clinical and historical point of view.

People with diseases or injuries of the nervous system have dramatically affected sacred history. Their circumstances provide some of the more important moral teachings and object lessons in the standard works. Some were afflicted with strokes, palsies, dumbness, or blindness, while others suffered from head and neck injuries, epilepsy, or nervous system infections, possibly including leprosy (Hansen's disease). The scriptures also contain interesting descriptions of mental illness, but they will not be treated here.[1]

Neuropathology is the medical discipline concerned with diseases of the nervous system. Classically, it deals with organic illnesses and injuries of the brain, spinal cord, peripheral nerves, and skeletal muscle, as observed with the naked eye and the microscope. The scope of neuropathology is currently expanding to include examination of these excitable tissues with sophisticated molecular techniques.[2]

Accounts of neurological afflictions in the scriptures increase our awareness of age-old, as well as current nervous system disorders, while scientific progress in neuropathology sheds light on certain scriptural passages. Even so, much about the nervous system remains unsolved, and it is sometimes difficult to discern whether

the ancient and modern diseases are one and the same, and whether both the descriptions and the translations from the Greek and Hebrew texts of the Bible accurately describe the clinical conditions of each case. Further, depictions of nervous system diseases in the scriptures are fragmentary, and the manner in which their causes and significance were understood in biblical times surely differs from our present understanding.[3] Nevertheless, several interesting instances of nervous system diseases in the scriptures can be considered from the vantage point of neuropathology.

The Brain

Many ancient peoples, including biblical writers, seem unclear about the functions of the brain as the seat of higher intellectual, emotional, sensory, and motor activity. While some experimentation advanced their understanding of the functions of the brain,[4] it was sometimes thought that the heart performed these roles. This erroneous conclusion probably derived from the effects of nerves which innervate the heart. In response to intense emotions and feelings, the autonomic nervous system can cause strong internal sensations in the left breast and make the heart speed up or slow down. Scriptural passages associate the heart with the intellect and also with the emotions. For example, one reads, "For as he thinketh in his heart, so is he" (Prov. 23:7), and "Thou shalt love the Lord thy God with all thy heart" (Luke 10:27).

About the time of the Italian Renaissance, investigators began to understand the role of the brain in terms of modern physiologic concepts. Michelangelo, for one, seems to have been well aware of the brain's relationship to the intellect. It has recently come to light that one of his masterpieces, the famous fresco on the ceiling of the Sistine Chapel which shows God touching the finger of Adam, depicts a shape like the human brain. Dr. Frank L. Meshberger has discovered that the extremities of the figures of Elohim, Eve, and the attending angels are arranged in such a way as to reconstruct perfectly the brain's major features, as seen from its medial aspect[5] (see figure 1). This neuroanatomical *tour de force* must have stemmed from Michelangelo's careful dissection of cadavers. Meshberger concludes that God, in this scene, is not granting Adam life, because

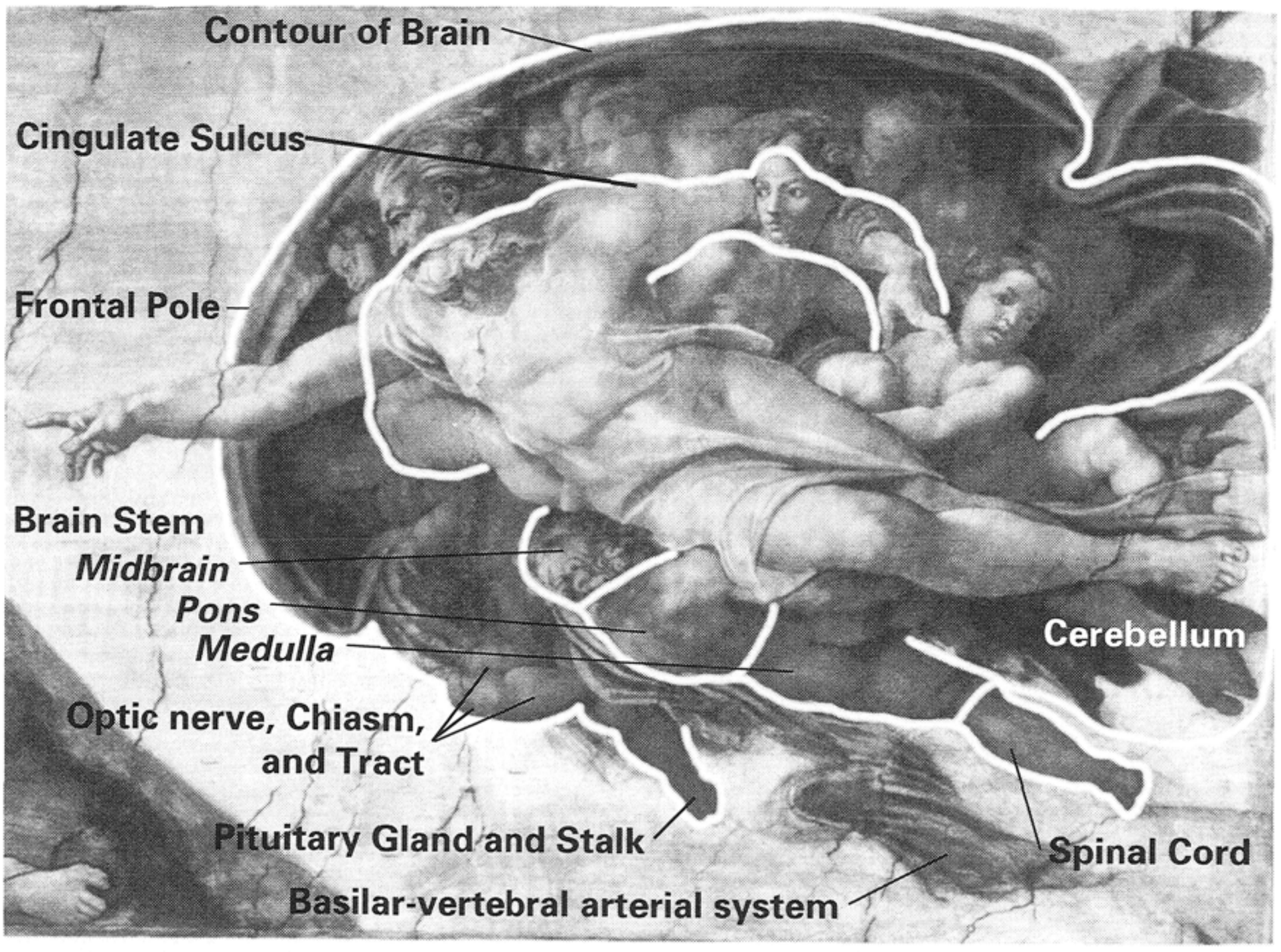


Figure 1. Detail from The Creation of Adam (1508–12) by Michelangelo. Dr. F. L. Meshberger has discovered that this painting is a neuroanatomic reproduction of the human brain as one would see it when the two hemispheres are separated (midline sagittal section, medial view). The perimeter of the scene is that of the brain itself.

Deep within the brain, a major landmark, the cingulate sulcus, curves around God's shoulders and left arm, the angel under his right arm, and Eve's forehead. The structures on the right side, in the vicinity of God's feet, represent the cerebellum. The shape of the angel lying just beneath God (at the base of the brain) is that of the brain stem and spinal cord. The angel's head is the midbrain, the shoulders and back are the pons, the buttocks and thighs are the medulla, and the leg represents the cervical spinal cord.

The drapery at the bottom right is the vertebral artery as it courses through the cervical vertebrae, twists upon itself, and joins the basilar artery which courses along the brainstem. The leg of the adjacent angel, which extends below the robe, is the pituitary stock or hypophysis, and the foot is the pitutitary gland itself. Unlike God's feet, which have five toes, the angel's foot is bifid, accounting for the anterior and posterior halves of the pituitary gland. The opposite inferior extremity of this angel is flexed. The thigh, the knee, and the leg represent the optic nerve, chiasm, and tract, respectively. (Frank Lynn Meshberger, "An Interpretation of Michelangelo's *Creation of Adam* Based on Neuroanatomy," *Journal of the American Medical Association* 264 [October 10, 1990]: 1837–41.)

Adam is awake and reaching out to God. Rather, it depicts God's endowing Adam with intelligence.

Latter-day scripture reveals that intelligence, or the core of the individual human being, is coeternal with God and was not created by him (D&C 93:29). But God has designed, constructed, and given a spirit and physical body within and by which this intelligence could develop further. While it is impossible to draw firm conclusions about the material details of our most remote origins, the nature of our primordial intelligence allowed birth as spiritual sons and daughters of God. With the aid of the physical body, including the brain and the five senses, our intelligence can escape prior limitations to increase in knowledge and to control its environment. These bodies give us the potential, with God's help, to become like him in every meaningful way.[6] To this end, God created the human body to embody the spirits of his children.

The human brain in that body is one of the most powerful organs; it differs from that of lower forms of life in having a very large frontal lobe capable of higher mental functions. Once the "forgetfulness" and "one-track mindedness" of mortality are laid aside, it seems safe to conclude that the brain will evidently become an even more powerful instrument in the resurrected body. "The glory of God is intelligence," says a revelation (D&C 93:36). In this light, our eternal intelligence may be more pervasive than its elemental relationship to the brain, be it spiritual or physical, although this observation must remain tentative.

Mental Agony of Jesus in Gethsemane

The most graphic and most important neuropathological scene portrayed in the scriptures is the one about which we know the least. It concerns the greatest intelligence of all, that of Jesus, whose mental anguish and suffering in the garden of Gethsemane and on the cross is beyond full human comprehension (D&C 19:15–18). The physical or chemical alterations that occur in the brain during such an ordeal remain unknown. However, complex metabolic and neurotransmitter alterations that occur during severe emotional states, including depression, stress, and psychotic episodes, can be depicted by modern imaging techniques and brain scans with radioactive tracers.[7]

In the case of Jesus, his suffering was so intense that, according to Luke 22:44, he bled from every pore.[8] Medically, this condition is called hematidrosis:

> It consists of an intense vasodilatation of the subcutaneous capillaries. They become extremely distended, and burst when they come into contact with the millions of sweat glands which are distributed over the whole skin. The blood mingles with the sweat, and it is this mixture which pearls over the whole surface of the body.[9]

Though bloody sweat is a very rare phenomenon, it may occur in highly emotional states or in persons with bleeding disorders.[10] Hematidrosis would indicate that Jesus' blood pressure was greatly elevated and that his sweat glands were intensely overactive, as dictated by an autonomic nervous system that was responding maximally to his tortured mental condition and emotional agony in Gethsemane.

Nothing in human experience matches the degree of mental agony suffered by Jesus, yet human psychological suffering may become inordinate. It is well known that extremely depressed patients often undergo such intense mental distress that they even seek self-destruction for relief. Acute situational reactions in response to overwhelming danger may also produce intense fear leading to total disability or causing one to literally "drop dead in his tracks," particularly if there is an underlying heart condition.[11]

In a related vein, some in this life are permitted a brief taste of Christ's agony as a warning of future suffering if they do not repent (D&C 19:15, 20), or, in the case of the sons of perdition (D&C 76:31–38), of the fate awaiting them. But this fleeting experience is soon withdrawn. It is sobering to contemplate Christ's warning to the unrepentant, who "must suffer even as I" (D&C 19:17). By taking upon himself all the suffering for the collective transgressions and pains of the world, Jesus was able to redeem us from the Fall and from our sins, on condition of repentance. This experience permitted him to understand and know our weaknesses perfectly, so that he could succor us (Alma 7:12). His "grace is sufficient for all" (Ether 12:27).[12]

Jesus' Physical Suffering on the Way to the Cross and during Crucifixion[13]

As a result of bleeding from his pores, Jesus' skin would have been fragile and tender. The sensitization of nerve endings would

have enhanced the pain both of the blows received at the hands of the Sanhedrin during Jesus' nighttime trial and of the flagellation and crown of thorns that he received on the following morning from Caesar's soldiers.[14]

The flagellation that Jesus suffered would have laid open his back muscles, mutilated sensitive nerves, and produced hemorrhaging and shock. The pain would have been aggravated as the cross piece, which he bore partway to Golgotha, wore into his lacerated back. The extreme discomfort of his nerve endings would have been abruptly renewed when he was stripped of his clothing and nailed to the cross. His raw back would have continued to rub against this rough shaft for three hours.

Even this pain may have been somewhat overshadowed by that produced by the nails. The large median nerve, which supplies the hand, runs between the major bones of the forearm and was probably crushed or severed during the nailing of the spike through the wrist. Excruciating bolts of pain would travel up the arms, while the hands would experience cramps. If Jesus' feet were nailed one foot on top of the other, through the metatarsal region, the deep peroneal nerve and branches of the medial and lateral plantar nerves would be similarly injured. Every breath, indeed each movement on the nails, would cause new flashes of pain.

Mercifully, this suffering ended when he finally uttered, "It is finished" (John 19:30). Jesus had drunk to its dregs the bitterest of cups that a deified mortal could consume. Yet, the physical suffering of crucifixion, contrived to produce the most excruciating and lingering pain, seems to have been less than the agony that Jesus endured in Gethsemane when he took our sins upon him.[15]

Jesus' Miraculous Healing of Nervous System Diseases

The mortal or physical body, including the nervous system, is vulnerable to many diseases and to severe impairment of function. As King Benjamin stated, we are "subject to all manner of infirmities in body and mind" (Mosiah 2:11). Jesus healed many persons with nervous system diseases. Scriptures record, for instance, that "the multitude wondered, when they saw the dumb to speak, the maimed to be whole, the lame to walk, and the blind to see: and they glorified

the God of Israel" (Matt. 15:31). "And they brought unto him all sick people that were taken with divers diseases and torments, and those which were possessed with devils, and those which were lunatick, and those that had the palsy; and he healed them" (Matt. 4:24; cf. 3 Ne. 17:7–9). It seems clear from such accounts that Jesus healed persons with both physical and mental disorders.

Some of Jesus' most impressive miracles occurred when he healed paralytics. Outstanding examples are of the cripple in Galilee who was let down through the roof on his litter (Mark 2:3–12) and of the halt man afflicted for thirty-eight years who awaited a cure at the pool of Bethesda in Jerusalem (John 5:5–9). When Christ saw them, he took compassion upon each and told them to take up their beds and walk, which they immediately did. Though there may have been other causes for their disabilities, it seems possible that both had sustained damage to their spinal cords which resulted in paraplegia or quadriplegia.

A woman with a bent-over, hunchbacked spine (kyphosis) was healed after eighteen years of paralysis (Luke 13:11–13). Although her back could have been broken or the deformity may have been caused by aging (arthritis), her case fits the description of tuberculosis of the spinal column with compression of the spinal cord (spinal caries and Pott's paraplegia).

The centurion's servant who was paralyzed apparently represents a case of acute spinal meningitis,[16] because he was "racked with pain" (Matt. 8:5–13 New English Bible [NEB]). Jesus healed him from a distance. The man whose withered arm was healed on the Sabbath day (Mark 3:1–5) may well have contracted polio, resulting in his useless arm. This explanation is more likely than others. Polio is still common today in the Middle East. In this connection, Jesus' disciples also healed many who were lame, presumably from damage to nerves (Acts 3:1–10; 8:7; 9:33–34; 14:8–10).

Divine Intervention as a Cause of Paralysis

Lameness came upon Jacob while wrestling with the angel when he was struck "on that nerve in the hollow of the thigh" (Gen. 32:32 NEB). Trauma to the sciatic nerve could have produced partial weakness in one of Jacob's legs, inducing a limp (Gen. 32:31).

In a different account, when Jeroboam demanded that God's messenger be seized for prophesying against him, "immediately the hand which [Jeroboam] had pointed at him became paralyzed so that he could not draw it back" (1 Kgs. 13:4, 6 NEB). Though this may have been the result of nerve damage, it could also be caused by a conversion reaction (hysteria), a type of mental paralysis caused when nerve sensation or motor activity is blocked without demonstrable physical changes in the nerve.[17] When the prophet subsequently prayed for Jeroboam to be healed, the king was healed.

A similar mechanism may have been responsible in part for Zacharias's inability to speak (psychophonasthenia) when Gabriel announced that his wife, Elizabeth, would bear John (Luke 1:20, 22). Related to this phenomenon may be the temporary "paralysis" of Alma the Younger (Mosiah 27:19; Alma 36:10), and later, of King Lamoni, his queen, Ammon, and the servants of the king (Alma 18:42; 19:13–16), and in a separate incident, of Lamoni's father (Alma 22:18). All were overcome by both the spirit of the Lord and intense fear or joy and as a result fell to the ground (see also Hel. 9:14).

Epilepsy

In Mark 9:17–22, a man said to Jesus, "I have brought unto thee my son which hath a dumb spirit; and wheresoever he taketh him, he teareth him: and he foameth and gnasheth with his teeth, and pineth away." When the child was brought before Jesus, "straightway the spirit tare him: and he fell on the ground, and wallowed foaming." The father told Jesus that this affliction had come on him when he was "a child. And ofttimes it had cast him into the fire, and into the waters, to destroy him."

This picture is virtually identical to that seen in grand mal epilepsy (seizures, convulsions, fits). The seizure focus is often found in a localized region of diseased brain tissue. The underlying cause may be infection, tumor, trauma, hemorrhage, infarction, certain drugs, or a metabolic imbalance. Currently, these disorders are generally well controlled with anticonvulsant agents such as phenytoin, phenobarbital, and newer drugs. Often, surgical resection of diseased brain tissue will remove the convulsive center and cure the condition.

In this biblical account, the apparent epilepsy was attributed to demonic possession, for Jesus said, "Thou dumb and deaf spirit, I charge thee, come out of him, and enter no more into him. And the spirit cried, and rent him sore and came out of him: and he was as one dead. . . . But Jesus took him by the hand, and lifted him up; and he arose" (Mark 9:25–27). According to the scriptures, dumbness, deafness, and blindness, in addition to lunacy and epilepsy, could also result from possession by evil spirits (Matt. 9:32–34; 12:22–32). On the other hand, Jesus healed many blind, deaf, dumb, and insane persons without mentioning or rebuking evil spirits.

Leprosy

It is impossible to know whether the leprosy noted in the Bible is the same disease called leprosy (Hansen's disease) today. It was apparently infectious, perhaps syphilitic in nature or due to multiple causes. In this light, it is possible that some of the biblical cases were identical with our modern disease.[18]

Hansen's disease is caused by a bacterial infection of peripheral nerves. The inflammation produced by the bacillus *M. leprae* thickens and destroys nerve trunks. The loss of sensation leads to damage and disfigurement of the extremities and face. This condition is augmented by a spread of the inflammatory process into adjacent soft tissues and by erosion of underlying bone.[19] For millennia, this disease was incurable, but it is now amenable to antibiotics. Over fifteen million people currently suffer from Hansen's disease worldwide.[20]

Although the Hebrew term *ṣara'at* is translated as leprosy in English,

> *ṣara'at* is obviously a broad category that included conditions ranging from psoriasis to ringworm, and perhaps even dandruff. And it likely included leprosy. *ṣara'at* was a generic term for many skin conditions at a time when specific medical diagnosis was very limited and terminology was very general. Most modern diseases are not named in the Bible, not even those that we know existed at the time.[21]

Jesus healed a single leper on one occasion and sent him to the priest for purification (Matt. 8:2–4; Mark 1:40–44; Luke 5:12–14), and he cleansed ten other lepers at once, only one of whom showed gratitude (Luke 17:12–19). In the Old Testament, several cases of

leprosy are mentioned. In order to demonstrate his power to Moses, the Lord rendered Moses' hand leprous, then forthwith healed it (Exod. 4:6–7). Later, Moses' prayer aided in cleansing his sister Miriam of leprosy (Num. 12:10–15). Naaman, the leper, was cured by following Elisha's priesthood instruction to bathe seven times in the Jordan River (2 Kgs. 5:1–14).

In an important sequel to Naaman's story, Gehazi, Elisha's servant, attempted to collect a "medical" fee from Naaman for this cure. Elisha struck him with leprosy and cursed his descendants with the same condition (2 Kgs. 5:17). Joab and his descendants were also punished with leprosy for his revenge killing of Abner (2 Sam. 3:29). The Lord struck Uzziah, king of Judah, with leprosy when he usurped priestly functions in the temple (2 Kgs. 15:5; 2 Chron. 26:20–21). Four unnamed persons were afflicted with leprosy in 2 Kings 7. Leviticus 13–14 deals in great depth with leprosy, including the skin manifestations that permit a priest to declare the bearer "unclean," the afflicted person's expulsion from the community, and his ritual cleansing when healed. Taken together, these instances show that divine powers can both cause and heal leprosy and like diseases.

Nervous System Trauma

In addition to the peripheral nerve trauma suffered by Christ during his crucifixion, other important cases of trauma to the nervous system are reported in the scriptures, particularly head trauma. Several Bible and Book of Mormon characters met their death through head or neck injury.

For instance, Sisera, an enemy captain, was exhausted after battle and sought refuge in the tent of Jael, a woman loyal to Israel. She "took a tent-peg, picked up a hammer, crept up to him and drove the peg into his skull as he lay sound asleep. His brains oozed out on the ground, his limbs twitched and he died" (Judg. 4:17–22 NEB). The unscrupulous Abimelech, who ascended to the throne of Shechem by killing his seventy half brothers, received a mortal head wound while besieging a city: a woman threw a millstone on his head from a tower and fractured his skull. So that he would not die from his head wound, he called hurriedly to his young armor-bearer and said, "Draw your sword and dispatch me, or men will say of me:

A woman killed him. So the young man ran him through and he died" (Judg. 9:52–54 NEB).

Later, the vile queen Jezebel, a Baal worshipper and killer of prophets, met an ignominious death as foretold by Elijah. She was thrown from a high window (almost certainly sustaining a head injury), spattering her blood; afterward she was trodden underfoot by horses and eaten by dogs (2 Kgs. 9:30–37). Many of the Philistines slain by Samson with the jaw bone of an ass (Judg. 15:15)—and innumerable other victims of Old Testament and Book of Mormon wars—must also have died of lethal head injuries.[22]

Moreover, in the Old Testament, Eli the priest died suddenly when he fell backwards from his stool at the shocking news that his two sons had been killed and that the Ark of the Covenant had been captured (1 Sam. 4:15–18). Eli broke his neck in the fall, damaging vital centers in his cervical spinal cord.

Another case from the Old Testament concerns Mephibosheth, Jonathan's son, who was dropped by his nurse when he was five years old; he became permanently lame (2 Sam. 4:4). Because a simple bone fracture should have healed well at this age, he probably suffered spinal cord or brain damage. In his compassion, King David saw to it that this son of his beloved, deceased friend was well cared for throughout life.

In the New Testament, Eutychus suffered a fall from a very high perch but survived. He was seated on a window ledge in the third loft and fell asleep while Paul was preaching a long sermon. He plummeted to the ground and was knocked unconscious. Paul raced downstairs, learned that he was still alive, and embraced him, and Eutychus awoke from his concussion (Acts 20:9–10, 12).

Striking cases of decapitation are described in the scriptures. One famous beheading is that of the Philistine giant Goliath (1 Sam. 17:48–51).

> And it came to pass, when the Philistine arose and came and drew nigh to meet David, that David hasted, and ran toward the army to meet the Philistine. And David put his hand in his bag, and took thence a stone, and slang it, and smote the Philistine in his forehead, that the stone sunk into his forehead: and he fell upon his face to the earth. So David prevailed over the Philistine with a sling and with a stone and smote the Philistine, and slew him: but there was no sword in the hand of

> David. Therefore David ran, and stood upon the Philistine, and took his sword, and drew it out of the sheath thereof, and slew him, and cut off his head therewith.

This text relates twice that David slew Goliath, once when the stone hit Goliath and again when he cut off Goliath's head. The fact that this statement was repeated in conjunction with the beheading indicates that David's sword may have supplied the actual *coup de grâce* while the stone may have produced a simple concussion that knocked Goliath out.

It is possible, though less likely, that David's rock caused even more severe damage. Goliath may have sustained a depressed frontal skull fracture and spicules of bone may have lacerated his brain. If he sustained only blunt trauma and not a fracture, there still may have been contusions and subdural and/or subarachnoid hemorrhage over the surface of the brain. But even severe head injuries rarely result in sudden death,[23] though they may ultimately prove fatal.

The Book of Mormon reports two decapitations. Both stories are riveting. The first, concerning Nephi and Laban (1 Ne. 4:7–18), is well known and frequently cited. The second, reporting the apparent decerebrate rigidity of Shiz (Ether 15:31), finds striking verification in medicine:

> And it came to pass that when they had all fallen by the sword, save it were Coriantumr and Shiz, behold Shiz had fainted with the loss of blood. And it came to pass that when Coriantumr had leaned upon his sword, that he rested a little, he smote off the head of Shiz. And it came to pass that after he had smitten off the head of Shiz, that Shiz raised upon his hands and fell; and after that he had struggled for breath, he died. And it came to pass that Coriantumr fell to the earth, and became as if he had no life. (Ether 15:29–32)

Though the combatants in this story were well acquainted with wholesale carnage, Shiz's unique death struggle was so astonishing that his throes were reported in grisly detail. Perhaps Ether and Coriantumr interpreted this astounding incident as a sign of Shiz's indomitable fighting spirit or refusal to die. However, Shiz's death struggle illustrates the classic reflex posture that occurs in both humans and animals when the upper brain stem (midbrain/mesencephalon) is disconnected from the brain. The extensor muscles of the arms and legs contract, and this reflex action could cause Shiz to

raise up on his hands.[24] Of course, Shiz would not have remained long in this position, and he would have bled to death rapidly through the severed arteries that go to the head.[25]

The brain stem is located inside the base of the skull and is relatively small. It connects the brain proper, or cerebrum, with the spinal cord in the neck. Coriantumr was obviously too exhausted to do a clean job. His stroke evidently strayed a little too high. He must have cut off Shiz's head through the base of the skull, at the level of the midbrain, instead of lower through the cervical spine in the curvature of the neck. It is worth noting that critics have questioned this story in the Book of Mormon. But this extraneous detail provides another solid indication that the Book of Mormon is an accurate record. Significantly, this nervous system phenomenon (decerebrate rigidity) was first reported in 1898, long after the Book of Mormon was published.[26]

Conclusion

This article has sketched the main clinical characteristics of several cases in the scriptures that involve injury to or disease of the nervous system. These cases invite students of the scriptures to consider the physiology of the brain, the physical effects of intense suffering, and the conditions of paralysis, leprosy, and nervous system trauma. Although the scriptures give only limited information about most of these cases, making it impossible to diagnose them completely, enough information is provided that their symptoms can be reasonably described and assessed. Such analysis leads to a clearer understanding of the physical realities of the actual, often miraculous, events reported in these scriptural records, which in turn helps modern readers to appreciate more deeply the spiritual significance of these sacred writings.

M. Gary Hadfield, M.D., is Professor of Pathology (Neuropathology) at the Medical College of Virginia, Virginia Commonwealth University, in Richmond, Virginia. The author wishes to thank the editors and staff of *BYU Studies* for their assistance in preparing this article.

NOTES

[1] Hopefully, scientists will someday understand these disorders anatomically. New, sophisticated techniques are being employed to study these conditions. See, for example, W. A. Wegener and A. A. Alavi, "Positron Emission Tomography in the Investigation of Neuropsychiatric Disorders: Update and Comparison with Magnetic Resonance Imaging and Computerized Tomography," *International Journal of Radiation Applications and Instrumentation* 18 (1991): 569–82; evidently, both King Nebuchadnezzar (Dan. 4:30–34, 36) and King Saul (1 Sam. 16: 14–23; 18:10–12) suffered from insanity.

[2] J. Adams and L. W. Duchen, eds., *Greenfield's Neuropathology* (New York: Oxford University Press, 1992), 1557.

[3] A. C. Allen, *The Skin: A Clinicopathological Treatise,* 2d ed. (New York: Grune and Stratton, 1967), 745–47; A. B. Baker and L. H. Baker, *Clinical Neurology,* 3 vols. (New York: Harper and Row, 1975); E. R. Bloomquist, "A Doctor Looks at Crucifixion," *Christian Herald* (March 1965): 35, 46–48; J. Snowman, *A Short History of Talmudic Medicine* (New York: Hermon, 1974), 54; R. L. Sutton, *Diseases of the Skin* (St. Louis: C. V. Mosby, 1956), 1393; and Russel J. Thomsen, *The Bible Book of Medical Wisdom* (Old Tappan, N. J.: Fleming H. Revell, 1974), 160.

[4] Stanley W. Jackson, *Melancholia and Depression* (New Haven: Tale, 1986), 29–30. In some cases surgery was performed on the skull, as evidenced by the "trephined" skulls from the eighth century B.C. found at Lachish, a site southwest of Jerusalem. One also thinks of examples of surgically altered skulls from western Europe and South America. See R. K. Harrison, "Disease," in *Interpreter's Dictionary of the Bible,* ed. George Arthur Buttrick, 4 vols. (New York: Abingdon, 1962), 1:847–48.

[5] Frank L. Meshberger, "An Interpretation of Michelangelo's *Creation of Adam* Based on Neuroanatomy," *Journal of the American Medical Association* 264 (1990): 1837–41.

[6] For summaries of what can be known from scriptures and other inspired sources, see "Eternal Progression," "Godhood," "Intelligence," and "Premortal Life," in *Encyclopedia of Mormonism,* ed. Daniel H. Ludlow, 4 vols. (New York: Macmillan, 1991).

[7] Wegener and Alavi, "Positron Emission," 569–82.

[8] Other scriptural sources affirm that Jesus bled in this manner (D&C 19:18; Mosiah 3:7). See "Gethsemane," in *Encyclopedia of Mormonism.* While some of the earliest New Testament manuscripts omit verses 43–44 of Luke 22, stylistic and logical evidence "favors Lucan authorship." Raymond E. Brown, "The Lucan Authorship of Luke 22:43–44," *Society of Biblical Literature 1992 Seminar Papers,* ed. Eugene H. Lovering (Atlanta: Scholars Press, 1992), 159.

[9] Pierre Barbet, *A Doctor at Calvary: The Passion of Our Lord Jesus Christ as Described by a Surgeon,* trans. Earl of Wicklow (Garden City, N.Y.: Doubleday Image, 1953), 213; and Sutton, *Diseases,* 1393:

> **Hemathidrosis** [*sic*] **(Bloody Sweat)** is an extremely rare disorder characterized by excretion of blood or blood pigment through the coil [sweat] glands. When it does occur, it is usually a manifestation of purpura. The majority of the reported examples have occurred in

> the newborn and in highly emotional or hysterical subjects. The disorder may involve limited areas on the face, ears, umbilicus or limbs, and the discharge may be preceded or accompanied by pain of a neuralgic character.

[10] Barbet, *A Doctor at Calvary,* 213; William D. Edwards, Wesley J. Gabel, and Floyd E. Hosmer, "On the Physical Death of Jesus Christ," *Journal of the American Medical Association* 255 (1986): 1455–63; R. G. Gadzhiev and A. M. Listengarten, "On the Problem of Hematidrosis (Blood Sweat): A Female Case Report," *Vestnik Dermatologii i Venerologii* 41 (1967): 86–88; Charles T. Scott, "A Case of Haematidrosis," *British Medical Journal* 1 (1918): 532–33; Sutton, *Diseases,* 1393–94.

[11] G. Härtel, "Psychological Factors in Cardiac Arrhythmias," *Annals of Clinical Research* 19 (1987): 104–9.

[12] See "Atonement" and "Grace," in *Encyclopedia of Mormonism.*

[13] Barbet, *A Doctor at Calvary,* 213; Bloomquist, "A Doctor Looks at Crucifixion," 46–48; C. T. Davis, "The Crucifixion of Jesus: The Passion of Christ from a Medical Point of View," *Arizona Medical* 22 (1965): 183–87; Edwards, Gabel, and Hosmer, "On the Physical Death of Jesus Christ," 1455–63; C. D. Johnson, "Medical and Cardiological Aspects of the Passion and Crucifixion of Jesus, the Christ," *Boletin Asociación Médica de Puerto Rico* 70 (1978): 97–102; and R. Lumpkin, "The Physical Suffering of Christ," *Journal of Medical Association of Alabama* 47 (1978): 8–10, 47. For the most recent assessment of the archaeological evidence about crucifixion, see Joe Zias and James H. Charlesworth, "Crucifixion: Archaeology, Jesus, and the Dead Sea Scrolls," in *Jesus and the Dead Sea Scrolls,* ed. J. Charlesworth (New York: Doubleday, 1992), 273–89, discrediting the articles by Edwards, Gabel, and Hosmer and by N. Haas, "Anthropological Observations on the Skeletal Remains from Giv'at ha-Mivtar," *Israel Exploration Journal* 20 (1970): 38–59.

[14] On the scourging, see Matthew 27:26; Mark 15:15; and John 19:1. Matthew 27:29 and Mark 15:17 mention the crown of thorns. See also note 13.

[15] See references cited in "Gethsemane," in *Encyclopedia of Mormonism.*

[16] Thomsen, *The Bible Book of Medical Wisdom,* 116.

[17] Thomsen, *The Bible Book of Medical Wisdom,* 35–36; and M. Sussman, "Sickness and Disease," in *The Anchor Bible Dictionary,* ed. David N. Freedman (New York: Doubleday, 1992), 6:11.

[18] Stanley G. Browne, "Leprosy in the Bible," in *Medicine and the Bible,* ed. Bernard Palmer (Exeter, Devonshire: Paternoster, 1986): 101–25; Kenneth V. Mull and Carolyn Sandquist Mull, "Biblical Leprosy: Is It Really?" *Bible Review* (April 1992): 33–39, 62; Snowman, *A Short History,* 81–85; Thomsen, *The Bible Book of Medical Wisdom,* 160; and D. P. Wright and R. N. Jones, "Leprosy," *Anchor Bible Dictionary* 4:277–82.

[19] Adams and Duchen, *Greenfield's Neuropathology,* 1557.

[20] Mull and Mull, "Biblical Leprosy: Is It Really?" 33–62.

[21] Barbet, *A Doctor at Calvary,* 213.

[22] The Nephites seem to have been the first in their society to cover their heads with "shields" or "head-plates" for protection (Alma 43:19–21, 38); at times, even those who wore them suffered serious, even fatal, head injuries (Alma 43:44).

[23] Adams and Duchen, *Greenfield's Neuropathology,* 1557; Baker and Baker, *Clinical Neurology* 2:23.

[24] Baker and Baker, *Clinical Neurology* 1:40, 65.

[25] In a surviving person who suffers such a massive infarct (an area of necrosis in a tissue resulting from obstruction of the local circulation), hemorrhage, tumor, or traumatic section involving the upper brain stem, the arms and legs remain permanently outstretched, rigid, and fixed. In many patients, it is the sparing of vital respiratory and blood pressure centers in the central (pons) and lower (medulla) brain stem that permits survival. Such patients remain in a vegetative state because the brain has been effectively cut off from the body. For the brain, see Adams and Duchen, *Greenfield's Neuropathology,* 195–200.

[26] C. S. Sherrington, "Decerebrate Rigidity, and Reflex Coordination of Movements," *Journal of Physiology* 22 (1898): 319.