arm employing 4.8 million units of intramuscular penicillin G benzathine was not included.

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Rift Valley Fever Caused the Fifth Plague of Egypt and That of 1977

To the Editor.—Gombert et al[1] suggested that the Fifth Plague of Egypt (Exodus 9:3-6) was caused by babesiosis. Subsequently, Jacoby[2] mentioned more likely candidates for the plague, namely, epidemic viral diseases such as foot and mouth disease and rinderpest.

It should, however, be emphasized that the Bible mentions a wide spectrum of animal species that were severely affected and died due to the "very grievous murrain," namely, "cattle which is in the field, horses, asses, camels, oxen and sheep" (Exodus 9:3). The two viral diseases suggested by Jacoby do not affect the complete range of the mentioned species. Both viruses are not pathogenic for horses and asses; rinderpest does not affect camels.

More likely candidates are anthrax, as suggested by Shoshan,[3] and Rift Valley fever (RVF), as suggested by me.[4] There are some factors supporting the candidacy of RVF, an insect-borne zoonosis confined to the African continent, which may affect, with a relatively high mortality rate, the species mentioned in the Bible. The epizootic was preceded by the fourth plague, a "swarm of flies," which was confined to the land of Egypt and which did not affect Goshen. The subsequent murrain did not affect the cattle of Israel, which were kept in Goshen. It thus seems likely that the biblical epizootic was insect borne, and its selective distribution was due to the fact that the "swarm of flies" was limited to Egypt.

The later appearance of the plague affecting the firstborn of "both man and beast" could be attributed to a zoonotic outbreak, such as RVF.

A very severe outbreak of RVF, affecting humans, sheep, goats, cattle, and camels, was reported in Egypt in 1977.[5]

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Early Use of X-ray Machines and Electrocardiographs at the Pennsylvania Hospital

To the Editor.—Dr Howell's[1] article on the early use of the x-ray machine and electrocardiograph at the Pennsylvania Hospital provides valuable data on the dawn of technology in American institutional medicine. Although Dr Howell chose to emphasize nontechnical aspects of the subject, a few historical notes on electrocardiography may add perspective to his remarks.

The electrocardiograph as manufactured in 1921 was an enormous machine weighing at least 350 kg and occupying 4 m^2 or more of floor space. Only standard limb leads (I, II, and III) were recorded. The usual practice was for the subject, seated, to immerse both arms and the left leg in jars of saline, which served as electrodes. These facts probably explain why, at the Pennsylvania Hospital, a separate room was set aside to house the first electrocardiograph.

Then, as now, the essential element in the electrocardiograph was a galvanometer, so arranged as to detect and measure electrical events in the heart. Nowadays electronic amplification of the minute responses of the galvanometer to these events makes possible direct-writing (stylus) machines, but in the 1920s the responses had to be amplified mechanically. A mirror or lens mounted on the galvanometer string was made to deflect a beam of light, which, passing then through a narrow slot, created a linear tracing on a moving strip of photographic paper.

This photographic feature accounted in part for the great bulk of the equipment. Moreover, it meant that in order to obtain a readable tracing one needed a darkroom with developing, fixing, and washing tanks. Since every hospital x-ray department already had these, the fledgling field of electrocardiography was in many places subsumed under the established one of radiology, and the reading of electrocardiograms unceremoniously added to the duties of the radiologist. Such an arrangement no doubt favored the acceptance of the new technology by hospital administrations and may also explain why accounting and other policies and procedures were so similar for x-ray and electrocardiographic services at the Pennsylvania Hospital and elsewhere.

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To the Editor.—Dr Howell[1] is to be commended for his systematic examination of patient records at the Pennsylvania Hospital to determine the application of new technology. Such an approach is obviously the "gold standard" in any assessment of how often such technologies (roentgenography and electrocardiography) were actually used in patient care. However, it *is* possible to infer usage from "how they [the technologies] were described in the published literature," especially when that literature emanates from the hospital being studied. When your attending physician wrote the book, you tend to order tests described in that book. Such a situation existed at The Johns Hopkins Hospital in the early 1900s. Comparisons between the two hospitals in their application of x-ray machines, electrocardiographs, and chart formats therefore seem possible and useful.

The early utilization of x-ray machines at The Johns Hopkins Hospital was similar to that described at the Pennsylvania Hospital. After urging by Osler, the medical board voted on April 7, 1896, to procure "an apparatus for Roentgen Rays."[2] A resident physician was to be responsible for its usage. Harvey Cushing took the first recorded film, for presentation at a conference on May 3, 1897. The patient had a gunshot wound to the spinal cord. Management of this case was not recorded, but given Cushing's extreme self-confidence, it is hard to imagine his not attempting to extract the bullet, since he now knew exactly where it was.

In May 1902, The Johns Hopkins Hospital did what the Pennsylvania Hospital did in 1912—appointed a full-time physician for roentgenography. Dr Frederick Howard Baetjer became responsible for both diagnostic and therapeutic use of x-rays, at a salary of $75 per month. He remained chief radiographer for decades, initiating many changes as the department grew. Although I am unsure when separate reports began, I have a copy of a page from a chart dated July 17, 1911, onto which a 4×8-in separate "X-Ray Report" was glued. It has no clinical information and even the patient's