European travelers in Africa in the mid-19th century encountered environments quite unlike those of their native lands. These provided many new and unanticipated health challenges. The ophthalmological consequences of exposure to such climates, as recorded incidentally in travelogues, are of potential interest. In this article, the almost-contemporaneous narratives of 3 travelers with considerable medical training, David Livingstone and his sometime companion John Kirk, who journeyed in southern Africa, and Gustav Nachtigal, who traveled in northern Africa, are examined for information on ophthalmological problems, both observed and personally experienced. This affords an opportunity to compare observations made in Saharan and sub-Saharan Africa.

At present I’m spending time with good old Livingstone in darkest Africa. The monotony of his endless and virtually pointless journey, the constant obsession with barometric pressure and meals that rarely arrive, and the silent, calm unfolding of vast landscapes—all this makes for truly wonderful reading.1(p8)

The French author Alphonse Daudet (1840-1897) perfectly captures the tedium and excitement, the attraction and repulsion, of reading through David Livingstone’s accounts of his African journeys. Similar feelings might be aroused by reading the lengthy travel narratives in which other 19th-century Europeans recorded their encounters with Africa. From within these travelogues, however, one may excavate much material of interest to students of history, geography, ethnography, meteorology, geology, botany, zoology, and medicine—even, as this article hopes to demonstrate, ophthalmology.

LIVINGSTONE (1813-1873)

David Livingstone (Figure 1) made 3 major expeditions in southern Africa during the last 20 years of his life: the Transcontinental Expedition of 1853-1856, the Zambesi Expedition of 1858-1864, and the final journey of 1866-1873, the ostensible aim of which was to search for the sources of the Nile River. These travels passed through the territories of modern Botswana, Namibia, Angola, Zambia, Malawi, Mozambique, Tanzania, and Zaire. During these years, Livingstone kept daily journals that gave rise to 3 major works: Missionary Travels and Researches in South Africa2 (1857), Narrative of an Expedition to the Zambesi and Its Tributaries3 (1865), and The Last Journals of David Livingstone in Central Africa, published posthumously in 1874 by Livingstone’s friend Horace Waller.4 In addition to these volumes, which total more than 750000 words,5 Livingstone maintained a large correspondence, much of it now published.6-13 Although his life and career have been endlessly anatomized since his death, it is these rich primary sources that form the basis for this account.

Most of Livingstone’s travels were without European companions; the propensity for European fellow travelers to quarrel in Africa (eg, James Richardson and Heinrich Barth; John Hanning Speke and Sir Richard Francis Burton6(p26,58,30)) was also true of Livingstone. The partial exception to this was the Zambesi Expedition, sponsored by the British gov-
Livingstone described an illness experienced by Kirk in June 1860 that is also relevant to fever:

Here we remained a couple of days in consequence of the severe illness of Dr Kirk. He had several times been attacked by fever; . . . he had been trying different medicines of reputed efficacy with a view to ascertain whether other combinations might not be superior to the preparation we generally used; in halting by this water, he suddenly became blind, and unable to stand from faintness. The men, with great alacrity, prepared a grassy bed, on which we laid our companion, with the sad forebodings which only those who have tended the sick in a wild country can realize. We feared that in experimenting he had overdrugged himself; but we gave him a dose of our fever pills; on the third day he rode the one of the two donkeys . . . and on the sixth day he marched as well as any of us.3(p207),18(pp172-173)

Regrettably we have no account of this incident from Kirk because his journal for this period was lost in an accident at Kebrabassa Rapids a few weeks later.

Regarding ophthalmological problems per se, we might expect Livingstone, traveling as he did in regions where leprosy, smallpox, and trachoma were prevalent, to have made some pertinent observations. Indeed, as early as 1850, before his major explorations got under way, he had noted the similarity between the experimental eye disease in dogs given a diet of wheat glu-

ten, starch, and sugar or olive oil, reported by the French physiologist François Magendie in 1816, and the blinding corneal disease seen in malnourished tribespeople:

The chief vegetable food is the manioc and lotsa [Pennisetum typhoideum] meal. These contain a very large proportion of starch, and when eaten alone for any length of time produce most distressing heartburn. As we ourselves experienced in coming north, they also cause a weakness of vision, which occurs in the case of animals fed on pure gluten or amylaceous matter only. I now discovered that when these starchy substances are eaten along with a proportion of ground-nuts, which contain a considerable quantity of oil, no injurious effects follow.2(pp389,431)

This was probably xerophthalmia from vitamin A deficiency.23(p380)

Ophthalmia is mentioned by Livingstone several times (it has its own subheading in chapter 6 of Missionary Travels and Researches in South Africa); he himself experienced “a touch of it,” apparently caused by the dust created during a march.4(vol 2:p29) However, of greater importance to public health was the epidemic form of ophthalmia: “Every year the period preceding the rains is marked by some sort of epidemic. Sometimes it is general ophthalmia, resembling closely the Egyptian.”21(p13)

At Libonta, in December 1853, “much fever prevailed and ophthalmia was rife, as is generally the case before the rains begin.”22(p217) Perhaps taking up Livingstone’s theme, contemporaries believed “ophthalmia very prevalent” in Africa.24(p248)

Livingstone also described the indigenous treatment of ophthalmia:

In ophthalmia the doctors cup on the temples, and apply to the eyes the pungent smoke of certain roots, the patient at the same time taking strong draughts of it up his nostrils. Cupping is performed with the horn of a goat or antelope, having a little hole pierced in the small end. In some cases a piece of wax is attached, and a temporary hole made through it to the horn. When the air is well withdrawn, and kept out by touching the orifice at every inspiration with the point of the tongue, the wax is at last pressed together with the teeth, and the little hole in it closed up, leaving a vacuum within the horn for the blood.
to flow from the already scarified parts. . . . the doctor . . . by separating the fibrine [sic] from the blood in a basin of water by his side, and exhibiting it, pretends that he has extracted something more than blood. He can thus explain the rationale of the cure by his own art, and the ocular demonstration given is well appreciated.25

An almost identical description is given in a passage written almost 10 years later when Livingstone was traveling farther north and east. This time the surgeon was a woman, the patient her own child; in addition, “after cupping her child’s temples for sore eyes, [she] threw the blood over the roof of her hut as a charm.”4(vol 1:p98) Native understanding of the possible causes of eye inflammation included the “mere sight” of an alligator2(p222) and drops of a clear fluid distilled by a “curious insect” on trees of the fig family.2(p338)

In September 1866, Livingstone reached a village where “[t]he headman had been suffering from sore eyes for four months, and pressed me to stop and give him medicine, which I did.”4(vol 1:p108) Regrettably, Livingstone does not mention what treatment he gave nor what effect it had. Likewise, he cured Señor Joao of Portugal of his eye problem, “inflammation of the choroid,” which developed after carrying the image of the Virgin Mary in a procession.11(p163)

It is difficult to extrapolate from Livingstone’s 19th-century disease categories to our own when considering what exactly he meant by “ophthalmia.” Generally, 3 broad categories of ophthalmia were recognized at this time: catarrhal, purulent, and sympathetic.29(pp80,490) Catarrhal ophthalmia probably corresponds to acute conjunctivitis, presumably what Livingstone had “a touch of” during his march, whereas purulent ophthalmia, sometimes called Egyptian ophthalmia, was known to be contagious—commonly occurring in overcrowded circumstances, perhaps related to intense heat, glare, and high winds; and sometimes causing blindness. This condition was presumably bacterial conjunctivitis and may coincide with Livingstone’s “epidemic ophthalmia.” However, only once is a man “blind from ophthalmia” mentioned.9(vol 2 pp200)

Blind individuals are frequently mentioned in Livingstone’s narrative, and it is the social consequences of visual loss that draw his attention rather than its medical causes: “The elder brother of Sechele’s father, becoming blind, gave over the chieftainship to Sechele’s father.”21(p30) However, blindness was not always an insurmountable disadvantage: “[A]n ugly but rich old fellow, who was so blind that a servant had to lead him along the path” was able to marry young and pretty wives, much to the chagrin of younger, poorer, and sighted males.3(p289) The blind might be recognized simply from their behavior: a “poor blind woman, thinking we were Mazitu [a tribe of marauders], rushed off in front of us with outspread arms, lifting the feet high, in the manner peculiar to those who have lost their sight. . . .”3(p609) A similar description is given of the running of a buffalo that apparently had ophthalmia.2(p199) A 1-eyed chief was also encountered, but no cause was stated.4(vol 1:p112) The paucity of references to blindness may not be a true reflection of its frequency; in a lengthy footnote,2(p293,436) Livingstone gives details from the 1854 census for the district of Gulongo Alto in Portuguese Angola, in which there were reportedly 54 blind men and women among a population totaling 40797 (0.1%).

Nowhere does Livingstone discuss the causes of blindness, but possibilities such as smallpox and leprosy spring to mind. He mentions a disease, probably smallpox, that “comes every three or four years, and kills many of the people.”4(vol 2:p28) Livingstone thought that this disease was more common on the African coast and was acquired from Arab traders.2(p110) Some of whom died from the condition in Africa along with a “loathsome skin disease,”4(vol 1:p320) presumably syphilis. On the Zambesi Expedition, Kirk observed that smallpox was very common and had the vaccine sent by a colleague in Scotland, the plan being to vaccinate a cow and then use the cow as a source of further material for vaccination.3(p176) Although he did manage to vaccinate some individuals, the vaccine started to become inert before its administration,17(pp117,327,390,400) but this case was apparently without ocular involvement.3(p278) No descriptions that might be consistent with trachoma or onchocerciasis can be found in Livingstone’s works, nor any mention of cataracts, although there is 1 mention of an “insect in the aqueous chamber.”4(vol 2:p233)

When describing the salubrity of the southern African climate, Livingstone assured his readers, “[Y]ou may sleep out at night, looking up to the moon till you fall asleep, without a thought or sign of moon-blindness.”2(p177) The exact nature of this moon-blindness is unclear, but a curious incident is reported at Tette in 1860, which may shed some light on it:

Four or five of our men were affected with moon-blindness at Tette; though they had not slept out of doors there, they became so blind that their comrades had to guide their hands to the general dish of food; the affection is unknown in their own country. When our posterity shall have discovered what it is which, distinct from foul smells, causes fever, and what, apart from the moon, causes men to be moon-struck, they will pity our dulness [sic] of perception.29(p136)

Peculiarly, no mention of this alarming occurrence appears in the relevant journal.11 It took place when some of the Makololo tribesmen who had traveled across Africa with Livingstone (1853-1856), and then waited at Tette for his return from furlough in Great Britain to guide them back to their homeland, were on the point of departure. Having settled for 4 years in the new location, many had developed commercial interests and taken new wives; hence, there was understandable reluctance to go, and many absconded from Livingstone’s party.

*References 2 (p 112, 431), 4 (vol 2: p 166).
†References 2 (p 519), 4 (vol 2: pp 40, 41), 11 (pp 100, 186, 197).
when he did set off. Evidently men so blind that their hands had to be guided to their food could not travel across the terrain of Africa. One wonders if this was a functional illness.

Livingstone also mentions a phenomenon called stone-blindness:

“[Every flash of the intensely vivid lighting leaves you with the impression of stone-blindness]... the intervals between the flashes [of sheet lighting] were so densely dark as to convey the idea of stone-blindness.”2(p441)

The implication is one of complete blindness, as in the axiom “There are no such stone-blind men as those who will not see” (as in Charles Dickens’ novel of 1857, *Little Dorrit*2(vol 2:pp 279, 273), which is distinct from partial or sand-blindness, an affliction experienced by Old Gobbo in Shakespeare’s *The Merchant of Venice*.

Although not described in detail, surgical procedures seem to have been performed by Livingstone and Kirk. When listing his instruments at the outset of his journey from Loanda on the western coast of Africa, Livingstone mentions only a sextant, chronometer watch, thermometer, compass, and telescope2(p201) but during the subsequent rainy season he reports that the “surgical instruments become all rusty.”2(p261)

Whether surgery included cataract extraction is not clear. Kirk reported on August 7, 1863, that “the Banyan’s eye on which I operated has gone wrong,”17(p528) but no details of the procedure are given. One surgical operation lead to unexpected ophthalmological complications; when asked by a young woman to excise a “large cartilaginous tumour between the bones of the forearm, which, as it gradually enlarged, so distended the muscles as to render her unable to work,”2(p17) Livingstone undertook the procedure (having first obtained the consent of the husband). While removing the tumor, “one of the small arteries squirted some blood into my eye,”2(p17) an accident that unwittingly rendered the explorer a blood relation of the patient.

Ocular trauma was a consequence of the long grasses, through which the expeditions often passed, rubbing the eyes.2(p238),4(vol 1:pp 238, 239) Livingstone himself sustained an accident to one of his eyes by a blow from a branch when passing through a forest.2(p238) Other plants could also prove hazardous, such as a species of *Euphorbia* that “when wounded” exuded a milky juice that could endanger the eyes.11(p69-98) One tribe was “much addicted to smoking the mutokwane (*Cannabis sativa,*),”2 and although Livingstone never tried it, he was able to report the effects it sometimes induced: “Some view everything as if looking in through the wide end of a telescope, and others, in passing over a straw, lift up their feet as if about to cross the trunk of a tree.”2(p69)

These metamorphopsias (micropsia and macropsia) are reminiscent of some of Alice’s experiences in Wonderland.

Insects too could be hazardous. Midges were sometimes so numerous that the eyes and mouth had to be kept closed,2(p373) and one particular hornet apparently tried to inflict its sting near the eye.2(p260)

Several individuals are mentioned with squint. The chief Casembe had “an outward squint in each eye,”4(vol 1:pp 238, 239) and the Arab Theni bin Suellim had a “disagreeable outward squint of the right eye.”4(vol 1:pp 10) Moenempanda, Casembe’s brother, had “a defect in his eyes, which makes him keep them half shut or squinting.”4(vol 1:pp 10) Albinos were noted to be uncommon; Livingstone thought that they were murdered but did observe 1 boy: “The pupil of the eye was of a pink colour, and the eye itself was unsteady in vision.”2(p93) This unsteadiness may perhaps represent a description of pendular nystagmus.

**NACHTIGAL (1834-1885)**

Gustav Nachtigal (Figure 3) made his African odyssey almost contemporaneously with Livingstone’s last journey. He had come to northern Africa from Germany in 1862 when pulmonary hemorrhages suggested that he had tuberculosis, an illness that had previously killed his father and a brother.28,29 His hopes of recovering his failing health in the warmer and drier climate were fulfilled, first in Algiers and then in Tunis, where he acted as physician to the bey.

On the threshold of returning to Germany, the opportunity arose for extensive travel in the interior of Africa. Nachtigal’s 5-year journey (1869-1874) followed a commission to deliver gifts from Kaiser Wilhelm of Prussia to the sultan of Bornu, a state on the shores of Lake Chad. It eventually took him more than 10000 kilometers through territories now within the borders of modern Libya, Chad, Niger, Nigeria, Cameroon, Sudan, and Egypt. He kept a daily journal that was subsequently published in 3 volumes as *Sahara und Sudan.* Some 100 years later, this was translated into English as *Sahara and Sudan,* in 4 volumes.30 Like Livingstone’s books and journals, Nachtigal’s work is a rich resource for scholars of African history. Of particular pertinence to this article, Nachtigal’s credentials as an informed observer of ophthalmological conditions are strong. He had received excellent clinical training in Germany, including a period with Rudolf Virchow in Würzburg; although no details of specific ophthalmological training survive,30 he did claim a particular interest in eye diseases. From 1867 onward, prior to undertaking his journey, he made inquiries about the possibility of returning to Germany as an eye specialist.30 Perhaps his nearsightedness, causing incapacity without glasses, enabled him to empathize with people who were visually impaired.

*Reference 11 (pp 164-167, 169, 249-252).*

*References 2 (p 238), 4 (vol 1: pp 25, 197).*

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**Figure 3. Gustav Nachtigal, 1881.**
Nachtigal devoted parts of chapters in his narrative to diseases, and specific reference is made to ophthalmological conditions. For example, in the desert in Fezzan (southern Libya), Next to rheumatism . . . and chronic digestive disturbances, inflammations of the outer structure of the eye with their sequelae make the most important contribution to the list of diseases. Affections of the inner eye, cataract and amaurosis, affections of the retina and the choroid membrane, of the optical nerve and the vitreous humour, are not exactly numerous, but the number of people with their cornea and conjunctiva intact is still smaller.30(vol 4:p138)

In Bornu, on the shores of Lake Chad, Ailments of the conjunctiva and cornea were of course predominant. Simple catarrh of the conjunctiva, proliferation of the conjunctiva to the most enormous extent, scarred contractions with their secondary conditions, fresh and cicatrised circumscribed corneal ulcers, general inflammation and opacity of the cornea, perforations or complete destruction of the cornea with protruding iris, were of such a frequency that the countries of the north coast of Africa, notorious with us on account of their eye ailments, could sustain no comparison with it.30(vol 3:p201)

In addition to encounters with and reports of blind individuals,* many 1-eyed or “half-blind” people are also mentioned.† In Bornu, Nachtigal states, I went . . . to Yin, curious to get to know this so-called Beled el-Amian, that is literally the village of the blind, a designation of which I was unable to discover.30(vol 2:p360)

Inflammation of the eyes ascribed to the effects of sand-laden winds in the desert was a common affliction for both Nachtigal‡ and those traveling with him,§ causing pain, supputation, and intolerance to light and necessitating bandaging. Rubbing painful eyes might also lead to transmission of diseases of the eyelids and conjunctiva. Antimony powder, or kohl, was used by Nachtigal and local healers for the treatment of ophthalmia, for example in Tibesti. Other indigenous remedies mentioned for eye disease include a powder mixed from sugar candy, myrrh, and raven’s bile.30(vol 1:p138) In Darfur, rancid butter “had a reputation as an outstanding remedy for eye diseases.”30(vol 4:p140)

At their request, Nachtigal attempted to treat the illnesses of the locals.¶

My medical efforts were limited almost entirely to combatting fresh inflammations of the conjunctiva and cornea—only some few times did I find opportunity for tridektomy—and I achieved my chief successes in dealing with purulent eye inflammations of a specifically contagious character, which generally had already destroyed the one eye, and where I then succeeded by energetic action in saving the other.30(vol 3:p201,202)

That blindness was often a result of suppuration is clear.30(vol 3:p316)

In Kuka, the capital of Bornu, where Nachtigal stayed on 3 occasions totaling several months,27 blind people were evident in “unbelievable number”30(vol 2:p160).

The innumerable blind people, whose eyeballs had decayed to the most pitiful stumps, and who nevertheless were still seeking medical aid, were nearly always the victims of purulent inflammations of the conjunctiva of a specifically infectious character, and most of the completely opaque corneas evidently resulted from smallpox.30(vol 3:p201)

That smallpox was frequently to blame for “destroyed or darkened corneas” is suggested elsewhere.30(vol 1:p138) Unlike Livingstone, Nachtigal implies that smallpox was more prevalent in the interior of Africa than on the coast.¶

Leprosy was also common, discoloration and atrophy of the skin being the most frequent manifestation,29 although it might have accounted for some of the corneal ulceration Nachtigal saw. Glaucoma is also mentioned.30(vol 4:pp38,315)

Ritual blinding was a feature of political life in some of the states Nachtigal visited. For example, in Bagirmi, [I]t is the first concern of the ruler on ascending the throne to make his brothers unfit to exercise kingly authority by mutilating them, for in Bagirmi, as in most of the other Sudan countries, custom requires that the king be unblemished physically as well as intellectually. As in Wadai, blinding has been the chosen mutilation, but it is applied in a more humane way than in the neighbouring country, in that the cruel operation is limited to one eye.30(vol 3:p277)

In Wadai, the melancholy task of blinding fell to the head chief of the smiths (sultan el-haddadin), a man who had to be well read in the Qur’an and who was also the physician for the whole royal family. Here, nephews and cousins as well as brothers are stated to be candidates for blinding.30(vol 4:pp175,179) Boiling butter was used for blinding in Bagirmi,30(vol 3:p142) whereas in neighbouring Wadai a hot iron was passed over the eyes, a custom apparently dating from the beginning of the 19th century.30(vol 4:pp174,175)

In some traditional African societies, it is still the blacksmith who performs surgical procedures such as circumcision.32(p143)

Although kings had to be “blemished physically,” blindness only excluded a man from ascending the throne in Wadai; if acquired later, it did not make a man unfit to rule according to the law.30(vol 4:p223) However, such affliction might lead to a deterioration in the ability to govern, as demonstrated by Burkmanda, a ruler in Bagirmi: “During the last five years of his life and his reign, his vicious character was made still worse by the blindness which set in following a serious eye disease.”30(vol 3:p141) Likewise, King Hasin of Darfur was blind, apparently from glaucoma, for the last years of his reign. During this time, “he became . . . weaker and weaker in directing the domestic administration of the country.”30(vol 4:p315)

CONCLUSIONS

In the travel accounts of Livingstone, Kirk, and Nachtigal, the ophthalmological consequences of exposure to tropical climates and
environments are documented incidentally rather than systematically, and the details given are often infuriatingly brief. This is perhaps unsurprising because the main object of these journeys was travel and exploration. Longitudinal clinical observations were not compatible with a peripatetic lifestyle. Moreover, the authors had a clear agenda: Livingstone, for instance, was keen to encourage migration to and commerce with Africa and may have underemphasized, wittingly or not, the hazards of disease.

Accepting the difficulty of extrapolating from 19th-century disease categories to our own, it seems clear that “ophthalmia,” presumably viral and bacterial eye infection, was common—particularly in the desert environment. A correlation of this, also suggested by a comparison of the texts, is that blindness was more commonly observed in the Saharan environment as opposed to southern Africa. A modern estimate is that the prevalence of blindness in sub-Saharan countries is around 1.2% as a result of cataracts, glaucoma, trachoma, and onchocerciasis. Smallpox has, of course, been eradicated since these travelers made their journeys.

These narratives “expose the relentless empiricism of the early tropical doctor” and thus are far from ideal sources. For these reasons, one could not claim Livingstone, Kirk, or Nachtigal as “pioneers of tropical ophthalmology,” a sobriquet that has Nachtigal as “pioneers of tropical ophthalmology,” a sobriquet that has

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