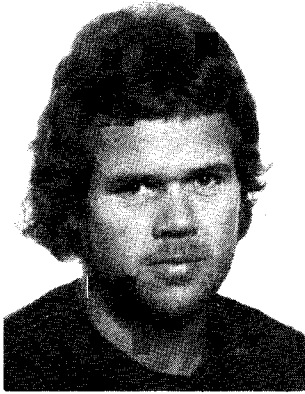


## Doktordisputaser Dissertations

**Bjørn Gjerde** forsvarte den 13. juni 1986 si avhandling «Studies on the sarcocyst morphology and life cycles of six species of *Sarcocystis* from reindeer (*Rangifer tarandus tarandus*)» for den veterinærmedisinske doktorgraden ved Norges veterinærhøgskole, Oslo.

**Bjørn Gjerde** successfully defended his thesis «Studies on the sarcocyst morphology and life cycles of six species of *Sarcocystis* from reindeer (*Rangifer tarandus tarandus*)» for the degree of doctor medicinae veterinariae (Dr. med. vet.) at the Norwegian College of Veterinary Medicine, Oslo, on June 13, 1986.



### Samandrag

Medlemmer av genus *Sarcocystis* er eincella parasittar (protozoar) med ein to-verts livssyklus, d.v.s. dei treng to ulike vertsdyr, kalla endevert og mellomvert, for å kunna fullføra heile sin utviklings-syklus. I endeverten (rovdyr, menneske) utviklar parasitten seg i tarmveggen, og dannar såkalla oocyster og sporocyster, som vert skilde ut med avføringa. Mellomverten blir smitta med *Sarcocystis* ved inntak av sporocyster gjennom fôr eller drikkevann. I mellomverten utviklar *Sarcocystis* seg fyrst i karveg-gene, noko som kan gje alvorleg sjukdom, og seinare i muskulaturen, der parasitten dannar såkalla sarkocyster inne i muskelcellene. Sarkocystene er små, sekkliknande strukturar som inneheld tusenvis av eincella organismar. Kvar *Sarcocystis*-art dannar sarkocyster med ein karakteristisk morfologi, slik at ulike arter i ein mellomvert kan skiljast frå kvarandre på grunnlag av sarkocystemorfologien. Ein har lenge hevda at *Sarcocystis*-artene er sterkt spesifikke med omsyn til mellomvert, slik at ei gitt *Sarcocystis*-art berre skulle kunna førekoma hos ei mellomvertsart. Endeverten vert smitta med *Sarcocystis* ved å eta kjøtt som inneheld sarkocyster.

Avhandlinga er ein studie over sarkocystemorfolo-gien og deler av livssyklusane til 6 ulike *Sarcocystis*-arter som nyttar norsk rein som mellomvert. Arbeidet vart utført ved Parasittologisk avdeling, Institutt for indremedisin I, Norges veterinærhøgskole. Då arbeidet tok til rekna ein med at det fannst berre ei *Sarcocystis*-art hos rein (*S. grueneri*), og endeverten for denne var ukjend. Sarkocystemorfologien vart fyrst studert i histologiske snitt, men seinare gjekk ein over til ein betre metode, der mange ferske parasittcyster vart isolert (fripreparert) frå muskulaturen hos rein og undersøkt med lysmikroskop. Ein fann då at cystene kunne inndelast i 7 ulike typar etter form, storleik og veggstruktur, og ein rekna med at dei ulike cystetypane representerte ulike arter. Ein avgrensa bruken av det gamle artsnamnet *S. grueneri* til ei av dei nydefinerte artene (med sarkocyster i hjertemu-skulaturen), medan dei 5 andre artene (med cyster i skjelettmuskulaturen) fekk nye namn (*S. hardangeri*, *S. rangi*, *S. rangiferi*, *S. tarandi*, *S. tarandivulpes*). To av artene (*S. hardangeri*, *S. rangiferi*) hadde makroskopisk synlege cyster. Hos rein i Nord-Noreg førekom alle 6 *Sarcocystis*-artene, medan 4 av artene vart påviste hos rein frå Sør-Noreg. Sarkocyster av alle dei 6 artene vart også undersøkt med transmisjons- og skanningelektronmikroskopi for å få meir detaljert kunnskap om strukturen til cystene og organismane inni dei, slik at dei ulike artene lett vil kunna identifiserast og skiljast frå kvarandre seinare. Ved overføringsforsøk (føring av potensielle endevertar med muskulatur eller isolerte sarkocyster) fann ein at rev var endevert for artene *S. grueneri*, *S. rangi* og *S. tarandivulpes*. Vidare viste ein at mårhund var endevert for *S. grueneri*, og for minst ei art til (truleg *S. tarandivulpes*). Hund fungerte også som endevert for somme *Sarcocystis*-arter frå rein, men då muskulatur som inneheldt cyster av fleire arter vart gitt til forsøkskundane, kunne ein ikkje sikkert avgjera kva arter det dreia seg om (truleg *S. grueneri* og *S. tarandivulpes*).

### Summary

Protozoan parasites belonging to the genus *Sarcocystis* (the sarcosporidia) have an obligatory two-host life cycle, which includes a sequence of different life cycle stages in both a definitive host (a predator) and an intermediate host (a prey animal). The sarcosporidia develop in the intestinal wall of the definitive host, producing oocysts and sporocysts, which are shed with the faeces. The intermediate host becomes infected through ingestion of sporocysts via contaminated feed or water. In the intermediate host, the sarcosporidia first multiply within endothelial cells of small blood vessels, which may cause severe disease, and thereafter they form sarcocysts within striated muscle cells. The sarcocysts are sac-like structures, which eventually contain thousands of infective single-celled organisms. The mature sarcocysts of a

given species of *Sarcocystis* have a characteristic morphology (size, shape, surface structure), which distinguishes them from the sarcocysts of other *Sarcocystis* species occurring in the same species of intermediate host. *Sarcocystis* species have generally been considered to have a rather strict intermediate host specificity. The definitive host becomes infected with sarcosporidia through ingestion of musculature containing sarcocysts.

Prior to the investigation reported in the present thesis, reindeer was considered to be the intermediate host of only one species of *Sarcocystis*, i.e. *S. grueneri*, which had been incompletely described and whose definitive host was unknown. The thesis consists of 14 separate papers published in 4 different journals, and an Introduction and a General Discussion. The investigations reported in the different papers included: (1) an examination of sarcocysts in histological sections; (2) a light microscopic examination of the morphology of numerous live sarcocysts isolated from the musculature of reindeer (under a dissection microscope); (3) a transmission electron microscopic examination of the different types (species) of sarcocysts identified by light microscopy; (4) a scanning electron microscopic examination of the surface structure of isolated sarcocysts of the different species occurring in reindeer; (5) transmission experiments, in which infected musculature or isolated sarcocysts of certain species were fed to prospective definitive hosts (silver and blue foxes, dogs, raccoon dogs, cats).

The investigations showed that domestic reindeer in northern Norway may harbour 6 morphologically distinct types of sarcocyst, and thus may act as intermediate host for 6 species of *Sarcocystis*. Wild reindeer in southern Norway were found to act as intermediate host for 4 of these species. The morphology of the sarcocysts of each of the 6 species, as revealed by light microscopy and transmission and scanning electron microscopy, was described in detail, which should allow the different species to be unequivocally identified by other investigators later. The old species name *S. grueneri* was assigned to one of the newly differentiated species, having cysts only in cardiac muscle, whereas the 5 other species, with cysts confined to the skeletal musculature, each was given a new species name (*S. hardangeri*, *S. rangi*, *S. rangiferi*, *S. tarandi*, *S. tarandivulpes*). The sarcocysts of *S. rangiferi* and *S. hardangeri* were macroscopic in size, whereas the cysts of the other species in general were difficult to detect with the unaided eye. The sarcocysts of some of the species were morphologically similar to sarcocysts of presumably other *Sarcocystis* species described from other species of intermediate host, mainly from other cervids. These findings might suggest that some of the *Sarcocystis* species described from reindeer are not strictly specific to this host, but may infect related species of hosts.

The transmission experiments showed that foxes (*Vulpes vulpes* and *Alopex lagopus*) were suitable definitive hosts for the species *S. grueneri*, *S. tarandivulpes* and *S. rangi*. It is highly probable that other canines also act as definitive hosts for these 3 species. One experiment showed that raccoon dogs (*Nyctereutes procyonoides*) acted as definitive host for *S. grueneri* and for at least one other species. Dogs were also found to serve as definitive hosts for *Sarcocystis* spp. of reindeer, but it could not be conclusively determined which species (presumably *S. grueneri* and *S. tarandivulpes*), developed in this host as musculature containing cyst of more than one species was used to infect the experimental dogs.

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**Arne Skorping** forsvarte avhandlingen «The population dynamics of *Elaphostrongylus rangiferi* in the intermediate host - an experimental study» («Populasjons-dynamikk hos *Elaphostrongylus rangiferi* i mellomverten - en eksperimentell undersøkelse») for den filosofiske doktorgrad (Dr. philos) ved Universitetet i Tromsø 12. september 1986. Arne Skorping er født i 1948 i Bergen, og tok sin utdannelse dels ved Universitetet i Bergen og dels ved Universitetet i Oslo. Han har siden 1981 vært ansatt som amanuensis ved Universitetet i Tromsø.

**Arne Skorping** successfully defended the thesis «The population dynamics of *Elaphostrongylus rangiferi* in the intermediate host - an experimental study» for the Dr. philos degree at the University of Tromsø, Norway, September 12 1986. Arne Skorping was born in 1948 in Bergen, and was educated at the Universities of Bergen and Oslo. He has since 1981 been employed as a lecturer at the University of Tromsø.

