



**Professor Colin Orpin**

*5 July 1943 – 19 February 2026*

## ***Book of Remembrance***

---

## **FOREWORD**

*This document has been compiled by the Anaerobic Fungi Network in remembrance of Prof Colin Orpin, who sadly passed away on 19 February 2026.*

*The contents of this document include:*

- (i) a summary of his research career,*
- (ii) an overview of his education and the research positions he held,*
- (iii) an interview he gave to AFN in 2018*
- (iv) a comprehensive list of his peer reviewed research papers, book and book chapters*

## Career Summary

Professor Colin Orpin was a pioneering microbiologist whose groundbreaking discoveries in the 1970s fundamentally changed our understanding of ruminant microbiology. During his career, spanning different continents and several decades, he made key contributions to rumen microbiology. From culturing elusive rumen microbes like Eadie's Oval in the lab, to unveiling the true nature and importance of anaerobic fungi in herbivores, exploring reindeer rumen microbes in the Arctic, and advancing the biotechnological applications of rumen microbes in agriculture and industry.

---

### Early Breakthrough: Eadie's Oval and Rumen "Ovals"

In 1969, fresh from his PhD at the University of Bangor in Wales, Orpin joined the Institute of Animal Physiology in Babraham as a young postdoc. In his own words: "I was told that I was now a rumen microbiologist, and [to] find something to work on!".

Orpin's first success came with the culture of "Eadie's Oval" – an unusual, large microbe from the sheep rumen. Orpin established the first continuous *in vitro* cultures of Eadie's Oval, determining the strict anaerobic conditions and nutrients required for its growth<sup>1</sup>. He also collaborated with Ed Munn on electron microscopy studies to reveal Eadie's Oval's structure, confirming it was a giant Gram-negative bacterium despite its atypical size<sup>2</sup>.

---

### Pioneering the Study of Anaerobic Fungi in the Rumen

In 1975, Orpin made a startling observation. While examining rumen fluid under the microscope, he saw a wriggling, mature zoosporangium float into view and suddenly burst open, releasing a cloud of flagellated zoospores. What Orpin referred to as his 'eureka' moment. This was the first clear evidence that rumen "flagellates" – such as *Neocallimastix frontalis* – were actually fungi<sup>3</sup> and not protozoa as had been the long-held belief.

Orpin demonstrated that these organisms possessed chitin in their cell walls<sup>4</sup>, a chemical signature unique to true fungi. Orpin's persistence and passion were crucial in order to gain recognition of these unusual anaerobic fungi, as in the 1970s the accepted dogma of the time was that all fungi respired.

Over the next decade, Orpin became the foremost explorer of anaerobic fungi. He elucidated their life cycles and reproductive triggers<sup>5</sup>, showed that zoospores exhibit chemotaxis toward plant carbohydrates<sup>6</sup>, and described how they invade fibrous plant tissues in the rumen<sup>7</sup>. In collaboration with Ed Munn, he also used ultrastructural studies to describe the flagellar apparatus and organelles of *Neocallimastix* zoospores<sup>8</sup>. One of the strains of fungi he studied



extensively was *Neocallimastix patriciarum*, named in honor of his wife, Patricia<sup>9</sup>. Sadly, Patricia passed away in 2002.



*Prof Colin Orpin with his wife, Patricia, at a research conference in Aberdeen, UK in 1974.*

---

### **Rumen Microbes & Reindeer**

Whilst still based at Babraham, Orpin became Professor at the University of Tromsø in Norway (1983-1987). Orpin was pivotal in the establishment of Norway's first anaerobic rumen laboratory. Together with the team in Norway, he studied the rumen microbiology of Svalbard reindeer. He and his collaborators documented how the reindeer's rumen microbes adapted seasonally to drastic changes in diet quality and daylight<sup>11</sup>. These findings not only expanded the ecological scope of anaerobic microbial research but also underscored the resilience and adaptability of gut microbiota in extreme environments.

---

### **Toward Biotechnology**

In 1988, Orpin moved to Australia to lead a CSIRO program on applying biotechnology to rumen microbes. There, he led pioneering efforts to explore the biotechnological potential of rumen microbes, particularly anaerobic fungi, in improving agricultural productivity. His work focused on the genetic manipulation of rumen microorganisms, aiming to enhance their ability to degrade plant cell walls and improve feed efficiency in ruminant livestock<sup>12</sup>. Orpin and his team investigated the use of recombinant DNA techniques to clone and express cellulase and xylanase genes from anaerobic fungi, revealing the modular structure and bacterial-like origins of these enzymes<sup>13</sup>. These studies not only deepened understanding of fungal enzymology but also opened new avenues for industrial applications, including biofuel production and sustainable livestock nutrition.



---

## Legacy

In addition to the 60+ peer reviewed papers he published during his career, Orpin also co-edited a book entitled “*Anaerobic Fungi: Biology, Ecology, and Function*”. The book is still a foundational text for the field, and he also contributed several anaerobic fungi related chapters to leading rumen microbiology books over the years.

Orpin’s research legacy lives on through the scientists that continue to work on the unusual anaerobic fungi which he discovered over 50 years ago.

## References

1. Orpin, C.G. (1972). *The culture of the rumen organism Eadie’s Oval in vitro*. Journal of General Microbiology, 70(2), 321–327.
2. Munn, E.A., & Orpin, C.G. (1975). *The fine structure of Eadie’s Ovals isolated from sheep rumen*. Journal of General Microbiology, 90(1), 41–54.
3. Orpin, C.G. (1975). *Studies on the rumen flagellate Neocallimastix frontalis*. Journal of General Microbiology, 91(2), 249–262.
4. Orpin, C.G. (1977). *The occurrence of chitin in the cell walls of the rumen organisms Neocallimastix frontalis, Piromonas communis, and Sphaeromonas communis*. Journal of General Microbiology, 99(1), 215–218.
5. Orpin, C.G. (1977). *On the induction of zoosporogenesis in the rumen phycomycetes*. Journal of General Microbiology, 101(1), 181–189.
6. Orpin, C.G., & Bountiff, L. (1978). *Zoospore chemotaxis in the rumen phycomycete Neocallimastix frontalis*. Journal of General Microbiology, 104(1), 113–122.
7. Orpin, C.G. (1977). *Invasion of plant tissue in the rumen by the flagellate Neocallimastix frontalis*. Microbiology, 98(2), 423–430.
8. Munn, E.A., Orpin, C.G., & Hall, F.J. (1981). *Ultrastructural studies of the free zoospore of the rumen phycomycete Neocallimastix frontalis*. Journal of General Microbiology, 125(2), 311–323.
9. Orpin, C.G., & Munn, E.A. (1986). *Neocallimastix patriciarum sp. nov., a new member of the Neocallimasticaceae inhabiting the rumen of sheep*. Transactions of the British Mycological Society, 86(1), 178–181.
10. Orpin, C.G. (1981). *Isolation of cellulolytic phycomycete fungi from the caecum of the horse*. Journal of General Microbiology, 123(2), 287–296.
11. Mathiesen, S.D., Blix, A.S., & Orpin, C.G. (1984). *Rumen microbial adaptation to fiber digestion in Svalbard reindeer*. Canadian Journal of Animal Science, 64(5), 261–262.
12. Orpin, C.G., Hazlewood, G.P., & Mann, S.P. (1988). *Possibilities of the use of recombinant-DNA techniques with rumen micro-organisms*. Animal Feed Science and Technology, 21(2–4), 161–174.
13. Gilbert, H.J., Hazlewood, G.P., Laurie, J.I., Orpin, C.G., & Xue, G.P. (1992). Homologous catalytic domains in a rumen fungal xylanase: evidence for gene duplication and prokaryotic origin. Molecular Microbiology, 6(15), 2065–2072.

## Education & Organisations

- BSc (Hons) Biology & Soil Science, University of Bangor, Wales, UK (1962-1966)
- PhD, University of Bangor, Wales, UK (1966-1969)
  - Thesis entitled: 'Microbial metabolism of some Bipyridyls and their derivatives'.
- Postdoctoral Researcher, ARC Institute of Animal Physiology, Babraham, Cambridge, UK (1969-1987)
- Professor, Department of Arctic Biology, University of Tromsø, Norway (1983-1987)
- Program Manager in Applications of Biotechnology, CSIRO Division of Tropical Crops & Pastures, Australia (1988-1993)
- Honorary Doctor of Science, Nathan University, Brisbane, Australia (1993)
- Sabbatical (1993-1994)
- Visiting Professor in Veterinary Microbiology, Oregon State University, USA (1994-1995)

## AFN Interview

*In 2018, Dr Joan Edwards visited Prof Colin Orpin at his home in England and asked him '10 Questions'.*

### ***1. When did you know you'd become a scientist and what made you do so/triggered it?***

I was raised on my parent's farm in Kent, where we grew hops and fruit and kept numerous types of animals: cattle, pigs, sheep, poultry and also a horse. As a child, I always had my head in a hedge or was off tracking anything that moved. Natural history was my thing when I was younger, and I had considered a career as an entomologist. When I didn't get into the Zoology degree course I had applied for, I undertook a degree course in Biochemistry and Soil Science at the University of Wales, in Bangor. The course appealed to me almost as much as the wildlife and areas of natural interest around Bangor.

### ***2. What was the most significant/exciting/memorable (Eureka) moment in your career?***

That's an easy question. It had to be the time when I was doing my early microscopy work investigating what caused the spike in ruminal numbers of flagellated protozoa soon after feeding. I was looking down the microscope when a mature, differentiating zoosporangium (broken off from the particulate material) floated into view. It was a wriggling mass that burst open in front of my eyes – releasing all of its flagellated zoospores – obviously it was not a protozoan. As well as luck, the key to this eureka moment was having a microscope with a heated stage – it helped to keep the rumen contents alive and kicking. I used to sit mesmerised looking down the microscope at all the rumen microbes milling around – there was just so much activity going on – I could do it all day.

### ***3. What was the most exciting place you travelled to for your research?***

Oooh – now – which one, there were lots. Hmm, Barrow – along the coast of Alaska, was probably the most exciting. I was up there with Eskimos riding snow machines over the ice in order to get to our whale hunting location. In the aftermath of the Exxon Valdez oil spill, we had secured some research funding to look into the possibility of whale gut microbes having the ability to degrade crude oil in the beach at Albert Sound. After taking samples from a whale that had been hunted by the Eskimos, I went to the edge of the ice to wash my hands in the sea water that was rising up and down with the waves. As I walked back to the others and the whale, the part of the ice that I had just been standing on broke off – and floated away into the Arctic Ocean. Another close shave happened when I was based in a hut on the tundra in Svalbard. I was ferrying equipment from the track across the open tundra to the hut (research station!) using a snow machine and sledge, when a white-out blizzard started when I was half-way back to the hut. I drove round blindly in increasing circles and eventually found a landmark, a stay cable for the distant Longyearbeyen airport beacon pylon. Luckily I knew in which direction the wind was blowing relative to the beacon and the hut, and managed to find the hut, much to my intense relief. Otherwise I might not be here now.



**4. Which is your favourite fungus?**

Haha, well that has to be *Neocallimastix patriciarum* of course. It was named after my lovely wife. Patricia.

**5. Is there any question on anaerobic fungi that you didn't answer during your career and that still makes you ponder?**

I wanted to know about the phylogeny and the taxonomy of the anaerobic fungi. The tools just weren't available then to do the work. It's great to see how far things have come now in our understanding of this, and that they have now been recognised as being a distinct phylum.

**6. What did you use to do to wind down after one of those days in the lab that raised more questions than it answered?**

I don't think I ever had a particular way of winding down on days like that. Normally I suppose I would just tell Pat about it, a problem shared being a problem halved. Having two kids meant that there was normally plenty of distractions at home though to take my mind off things.

**7. If you had the chance to meet one (late) scientist for dinner, who would it be, what would you have and what would you ask or talk to him/her about?**

Let me think. Well I remember meeting Professor Hans Krebs, University of Oxford, and he glanced at a set of molecules I had listed as being chemotactic signalling and their respective competitive inhibitors. He told me that it was interesting and warranted further investigation, but I never had the chance to speak to him more about this. For a more current scientist though it would have to be David Attenborough – I am still a naturalist at heart! What to eat – hmmm – lobster thermidor I think. Not sure what it is, but it sounds posh. Or maybe beef wellington – that would be nice too. What would I talk to him about? Well it would have to be anaerobic fungi of course, because he probably wouldn't know anything about them.

**8. What type of music do you listen to?**

I like relaxing music. Sea shanties and the like – traditional folk music I suppose.

**9. Is there anything about today's science that you would change if you could?**

The research done these days is too targeted. There is no opportunity to 'follow your nose'. Exploratory curiosity driven research seems to be a thing of the past. I guess it is the nature of the funding bodies now. When I started at the Institute of Animal Physiology at Babraham (Cambridge) – now The Babraham Institute – I was given a bench and was told that I was now a rumen microbiologist, and find something to work on! No real direction, but I was located in Geoff Coleman's lab – he was working on the rumen ciliate protozoa – and I was told to find a rumen microbiological area to work in. I had about six feet of bench and a couple of microscopes (one inverted one which was invaluable for examining cultures) and a phase contrast microscope and access to a couple of rumen -cannulated sheep.



It took me a month or two to make up my mind (lots of reading and hiding in the library!) which area to work in, but no-one had done much with the flagellated protozoa, so even though their apparent biomass was small, I thought I would give them a go – and look what happened: most were not protozoa at all and (debatably) perhaps the most important group of rumen micro-organisms.

***10. Do you have a motto/mantra or a piece of advice for (young) scientists these days?***

Keep your nose to the grindstone. Perseverance pays off. Keep an open mind. I had a lot of challenges getting the anaerobic fungi accepted in those days; I thought it was never going to happen. One last thing, never talk yourself out of doing an experiment because you think you know the answer – the result could be very unexpected. And don't forget the big picture! I'm afraid that's more than one piece of advice, sorry, but it's all relevant!

## Publications

*Listed in this section are research papers, book chapters and a book that Prof Colin Orpin (co)authored during his research career*

### Bacteria & Bacteriophages

- Orpin, C. G.**, Knight, M. & Evans, W. C. (1972) The bacterial oxidation of picolinamide, a photolytic product of Diquat. *Biochemical Journal*, 127: 819–831.
- Orpin, C. G.**, Knight, M., & Evans, W. C. (1972) The bacterial oxidation of N-methylisonicotinate, a photolytic product of paraquat. *Biochemical Journal*, 127: 833–844.
- Orpin, C. G.** (1972) The culture of the rumen organism Eadie's Oval *in vitro*. *Journal of General Microbiology*, 70: 321–327.
- Orpin, C. G.** (1972) The Culture *in vitro* of the Rumen Bacterium Quin's Oval. *Journal of General Microbiology*, 73:523–530.
- Orpin, C. G.** (1973) The intracellular polysaccharide of the rumen bacterium Eadie's Oval. *Archiv für Mikrobiologie*, 90: 247–254.
- Orpin, C. G.**, & Munn, E. A. (1974) The occurrence of bacteriophages in the rumen and their influence on rumen bacterial populations. *Experientia*, 30: 1018–1020.
- Munn, E. A., & **Orpin, C. G.** (1975) The Fine Structure of Eadie's Ovals Isolated from Sheep Rumen. *Journal of General Microbiology*, 90: 41–54.
- Orpin, C. G.** (1976) The characterization of the rumen bacterium Eadie's oval, *Magnooovum* gen. nov. *eadii* sp. nov. *Archives of Microbiology*, 111: 155–159.
- Hazlewood, G. P., **Orpin, C. G.**, Greenwood, Y., & Black, M. E. (1983) Isolation of proteolytic rumen bacteria by use of selective medium containing leaf fraction 1 protein (ribulosebisphosphate carboxylase). *Applied and Environmental Microbiology*, 45: 1780–1784.
- Mann, S. P., Hazlewood, G. P., & **Orpin, C. G.** (1986) Characterization of a cryptic plasmid (pOM1) in *Butyrivibrio fibrisolvens* by restriction endonuclease analysis and its cloning in *Escherichia coli*. *Current Microbiology*, 13: 17–22.
- Mann, S. P., **Orpin, C. G.**, & Hazlewood, G. P. (1986) Transformation of *Bacillus* spp.: an examination of the transformation of *Bacillus* protoplasts by plasmids pUB110 and pHV33. *Current Microbiology*, 13: 191–195.

## Anaerobic Fungi

- Orpin, C. G.** (1974) The Rumen Flagellate *Callimastix frontalis* : does Sequestration Occur? Journal of General Microbiology, 84:395-395.
- Orpin, C. G.** (1975) Studies on the rumen flagellate *Neocallimastix frontalis*. Journal of General Microbiology, 91: 249–262.
- Orpin, C. G.** (1976) Studies on the rumen flagellate *Sphaeromonas communis*. Journal of General Microbiology, 94: 270–280.
- Orpin, C. G.** (1977) The occurrence of chitin in the cell walls of the rumen organisms *Neocallimastix frontalis*, *Piromonas communis*, and *Sphaeromonas communis*. Journal of General Microbiology, 99: 215–218.
- Orpin, C. G.** (1977) The rumen flagellate *Piromonas communis*: its life-history and invasion of plant materials in the rumen. Journal of General Microbiology 99: 107–117.
- Orpin, C. G.** (1977) On the induction of zoosporogenesis in the rumen phycomycetes *Neocallimastix frontalis*, *Piromonas communis*, and *Sphaeromonas communis*. Journal of General Microbiology, 101: 181–189.
- Orpin, C. G.** (1977) Invasion of plant tissue in the rumen by the flagellate *Neocallimastix frontalis*. Microbiology, 98: 423-430.
- Orpin, C. G.** & Bountiff, L. (1978) Zoospore chemotaxis in the rumen phycomycete *Neocallimastix frontalis*. Journal of General Microbiology, 104: 113–122.
- Orpin, C. G.** & Letcher, A. J. (1979) Utilization of cellulose, starch, xylan and other hemicelluloses for growth by the rumen phycomycete *Neocallimastix frontalis*. Current Microbiology, 3: 121–124.
- Munn, E. A., **Orpin, C. G.** & Hall, F. J. (1981) Ultrastructural studies of the free zoospore of the rumen phycomycete *Neocallimastix frontalis*. Journal of General Microbiology, 125: 311–323.
- Orpin, C. G.** (1981) Isolation of cellulolytic phycomycete fungi from the caecum of the horse. Journal of General Microbiology, 123: 287–296.
- Orpin, C. G.** (1981) Fungi in ruminant degradation. In Agricultural Science Seminar: Degradation of Plant Cell-wall Material, pp. 36-47. London : Agricultural Research Council
- Kemp, P., Lander, D. J. & **Orpin, C. G.** (1984) The lipids of the rumen fungus *Piromonas communis*. Journal of General Microbiology, 130: 27–37.

- Orpin, C. G.**, & Letcher, A. J. (1984) Utilization of cellulose, wheat straw and other polysaccharides *in vitro* by the rumen chytridiomycete fungus *Neocallimastix frontalis*. *Journal of General Microbiology*, 130:1367–1373.
- Orpin, C. G.** (1984) The role of ciliate protozoa and fungi in the rumen digestion of plant cell walls. *Animal Feed Science and Technology*, 10: 121-143
- Orpin, C. G.** (1984). Microbial attack on lignocellulose in the rumen. *Applied Biochemistry and Biotechnology*, 9: 327-328.
- Kemp P., Jordan D. J., **Orpin C. G.** (1985) The free- and protein-amino acids of the rumen phycomycete fungi *Neocallimastix frontalis* and *Piromonas communis*. *Journal of Agricultural Science*, 105: 523-526.
- Orpin, C. G.**, & Greenwood, Y. (1986) Nutritional and germination requirements of the rumen chytridiomycete *Neocallimastix patriciarum*. *Transactions of the British Mycological Society*, 86: 103-109.
- Orpin, C. G.** & Munn, E. A. (1986) *Neocallimastix patriciarum* sp. nov., a new member of the *Neocallimasticaceae* inhabiting the rumen of sheep. *Transactions of the British Mycological Society*, 86: 178–181.
- Orpin, C. G.** & Greenwood, Y. (1986) The role of haems and related compounds in the nutrition and zoosporogenesis of the rumen chytridiomycete *Neocallimastix frontalis* H8. *Journal of General Microbiology*, 132: 2179–2185.
- Yarlett, N., **Orpin, C. G.**, Munn, E. A., Yarlett, N. C., & Greenwood, C. (1986) Hydrogenosomes in the rumen fungus *Neocallimastix patriciarum*. *Biochemical Journal*, 236: 729-739.
- Yarlett, N. C., Yarlett, N., **Orpin, C. G.** & Lloyd, D. (1986) Cryopreservation of the anaerobic rumen fungus *Neocallimastix patriciarum*. *Letters in Applied Microbiology*, 3: 1–3.
- Munn, E. A., Greenwood, C. A. & **Orpin, C. G.** (1987) Organization of the kinetosomes and associated structures of zoospores of the rumen chytridiomycete *Neocallimastix patriciarum*. *Canadian Journal of Botany*, 65: 456–465.
- Williams, A. G., & **Orpin, C. G.** (1987) Polysaccharide-degrading enzymes formed by three species of anaerobic rumen fungi grown on a range of carbohydrate substrates. *Canadian Journal of Microbiology*, 33: 418-426.
- Williams, A. G., & **Orpin, C. G.** (1987) Glycoside hydrolase enzymes present in the zoospore and vegetative growth stages of the rumen fungi *Neocallimastix patriciarum*, *Piromonas communis*, and an unidentified isolate, grown on a range of carbohydrates. *Canadian Journal of Microbiology*, 33: 427-434.

- Munn, E. A., **Orpin, C. G.**, & Greenwood, C. A. (1988) The ultrastructure and possible relationships of four obligate anaerobic chytridiomycete fungi from the rumen of sheep. *Biosystems*, 22: 67-81.
- Orpin, C. G.** (1988) Nutrition and biochemistry of anaerobic Chytridiomycetes. *Biosystems*, 21: 365-370.
- Orpin, C. G.** & Joblin, K. N. (1988). The rumen anaerobic fungi. In P.N. Hobson (ed.), *The Rumen Microbial Ecosystem*, 1st ed. (London: Elsevier Applied Science), pp. 129–150.
- Teunissen, M. J., Op den Camp, H. J. M., **Orpin, C. G.**, Huis in 't Veld, J. H. J. & Vogels, G. D. (1991). Comparison of growth characteristics of anaerobic fungi isolated from ruminant and non-ruminant herbivores during cultivation in a defined medium. *Journal of General Microbiology*, 137: 1401–1408.
- Gilbert, H. J., Hazlewood, G. P., Laurie, J. I., **Orpin, C. G.**, & Xue, G. P. (1992) Homologous catalytic domains in a rumen fungal xylanase: evidence for gene duplication and prokaryotic origin. *Molecular Microbiology*, 6: 2065-2072.
- Xue, G. P., Gobius, K. S., & **Orpin, C. G.** (1992) A novel polysaccharide hydrolase cDNA (celD) from *Neocallimastix patriciarum* encoding three multi-functional catalytic domains with high endoglucanase, cellobiohydrolase and xylanase activities. *Microbiology*, 138: 2397-2403.
- Xue, G. P., **Orpin, C. G.**, Gobius, K. S., Aylward, J. H., & Simpson, G. D. (1992) Cloning and expression of multiple cellulase cDNAs from the anaerobic rumen fungus *Neocallimastix patriciarum* in *Escherichia coli*. *Microbiology*, 138: 1413-1420.
- Theodorou, M. K., Davies, D. R., Jordan, M. G., Trinci, A. P., & **Orpin, C. G.** (1993) Comparison of anaerobic fungi in faeces and rumen digesta of newly born and adult ruminants. *Mycological Research*, 97: 1245-1252.
- Williams, A. G., Withers, S. E., & **Orpin, C. G.** (1994) Effect of the carbohydrate growth substrate on polysaccharolytic enzyme formation by anaerobic fungi isolated from the foregut and hindgut of nonruminant herbivores and the forestomach of ruminants. *Letters in Applied Microbiology*, 18: 147-151.
- Zhou, L. I. Q. I. N. G., Xue, G. P., **Orpin, C. G.**, Black, G. W., Gilbert, H. J., & Hazlewood, G. P. (1994) Intronless *celB* from the anaerobic fungus *Neocallimastix patriciarum* encodes a modular family A endoglucanase. *Biochemical Journal*, 297: 359-364.
- Black, G. W., Hazlewood, G. P., Xue, G. P., **Orpin, C. G.**, & Gilbert, H. J. (1994) Xylanase B from *Neocallimastix patriciarum* contains a non-catalytic 455-residue linker sequence comprised of 57 repeats of an octapeptide. *Biochemical Journal*, 299: 381-387.

Mountfort, D. O. & **Orpin, C. G.** (Editors) (1994) Anaerobic Fungi: Biology, Ecology, and Function. Marcel Dekker, New York. ISBN: 9780824789480.

**Orpin, C. G.** & Joblin, K. N. (1997) The rumen anaerobic fungi. In P.N. Hobson & C.S. Stewart (eds.), The Rumen Microbial Ecosystem, 2nd ed. (London: Chapman & Hall), pp. 140–195.

### Protozoa

**Orpin, C. G.** (1977) Studies on the defaunation of the ovine rumen using dioctyl sodium sulphosuccinate. Journal of Applied Bacteriology, 43: 309-318.

**Orpin, C. G.**, & Letcher, A. J. (1978) Some factors controlling the attachment of the rumen holotrich protozoa *Isotricha intestinalis* and *I. prostoma* to plant particles *in vitro*. Microbiology, 106: 33-40.

**Orpin, C. G.**, & Hall, F. J. (1983) Surface structures of the rumen holotrich protozoan *Isotricha intestinalis* with particular reference to the attachment zone. Current Microbiology, 8: 321-325.

**Orpin, C. G.**, & Letcher, A. J. (1984) Effect of absence of ciliate protozoa on rumen fluid volume, flow rate and bacterial populations in sheep. Animal Feed Science and Technology, 10: 145-153.

**Orpin, C.G.** (1985) Association of rumen ciliate populations with plant particles *in vitro*. Microbial Ecology, 11: 59–69.

### Orkney Sheep

Greenwood, Y., Hall, F. J., **Orpin, C. G.**, & Paterson, I. W. (1983) Microbiology of seaweed digestion in Orkney sheep. Journal of Physiology, 343: 121P

Greenwood, Y.; **Orpin, C. G.**; Paterson, I. W., (1983) Digestibility of seaweeds in Orkney sheep. J. Physiology-London, 343: 120.

**Orpin, C. G.**, Greenwood, Y., Hall, F. J., Paterson, I. W. (1985) The rumen microbiology of seaweed digestion in Orkney sheep. Journal of Applied Bacteriology, 58: 585–596.

### Reindeer

Mathiesen, S. D., Blix, A. S., & **Orpin, C. G.** (1984) Rumen microbial adaptation to fiber digestion in Svalbard reindeer. Canadian Journal of Animal Science, 64: 261-262.

- Orpin, C. G.**, Mathiesen, S. D., Greenwood, Y., & Blix, A. S. (1985) Seasonal changes in the ruminal microflora of the high-arctic Svalbard reindeer (*Rangifer tarandus platyrhynchus*). Applied and Environmental Microbiology, 50: 144-151.
- Orpin, C. G.**, & Mathiesen, S. D. (1986) *Microcetus lappus* gen. nov., sp. nov.: new species of ciliated protozoon from the bovine rumen. Applied and Environmental Microbiology, 52: 527-530.
- Mathiesen, S. D., **Orpin, C. G.**, Greenwood, Y., & Blix, A. S. (1987) Seasonal changes in the cecal microflora of the high-arctic Svalbard reindeer (*Rangifer tarandus platyrhynchus*). Applied and Environmental Microbiology, 53: 114-118.
- Orpin, C. G.**, & Mathiesen, S. D. (1990) Microbiology of digestion in the Svalbard reindeer (*Rangifer tarandus platyrhynchus*). Rangifer, 187-199.
- Cheng, K. J., McAllister, T. A., Mathiesen, S. D., Blix, A. S., **Orpin, C. G.**, & Costerton, J. W. (1993) Seasonal changes in the adherent microflora of the rumen in high-arctic Svalbard reindeer. Canadian Journal of Microbiology, 39: 101-108.

### Miscellaneous

- Orpin C. G.** , Huskisson N. S., Ward P. F. V. (1976) Molecular structure and morphology of glycogen isolated from the cestode, *Moniezia expansa*. Parasitology, 73:83-95.
- Hazlewood, G. P., Mann, S. P., **Orpin, C. G.**, & Romaniec, M. P. M. (1987) Prospects for the genetic manipulation of rumen microorganisms. In Recent Advances in Anaerobic Bacteriology: Proceedings of the fourth Anaerobic Discussion Group Symposium held at Churchill College, University of Cambridge, July 26–28, 1985 (pp. 162-176). Dordrecht: Springer Netherlands.
- Orpin, C. G.**, Hazlewood, G. P., & Mann, S. P. (1988) Possibilities of the use of recombinant-DNA techniques with rumen micro-organisms. Animal Feed Science and Technology, 21: 161-174.
- Laredo, M. A., Simpson, G. D., Minson, D. J., **Orpin C. G.** (1991) The potential for using n-alkanes in tropical forages as a marker for the determination of dry matter by grazing ruminants. The Journal of Agricultural Science, 117: 355-361.
- Dehority, B. A. & **Orpin, C. G.** (1997) Development of, and natural fluctuations in, rumen microbial populations. In P.N. Hobson & C.S. Stewart (eds.), The Rumen Microbial Ecosystem, 2nd ed., pp. 196–245.