# Anaerobic fungi are a key unexplored taxon for optimizing fibre utilisation in equines

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## Introduction: *The Dietary Challenge*

- The hindgut microbiota of equines enables animals to utilize forage/grazing based diets, however the presence of lignin within lignocellulosic fibres restricts gut bacterial access to (hemi)cellulose and other plant nutrients.
- Equine species differ in their ability to utilise dietary fibre (Figure 1) despite similar numbers of cellulolytic bacteria in their hindgut (*1*).
- The diet of many equines is supplemented with energy-dense concentrate feeds however this can change the equine hindgut microbiome, and lead to the development of gut-mediated diseases (i.e. fermentative acidosis, laminitis, colic and stomach ulcers) (*2*).
- Novel nutritional strategies are required to enable an increased dietary forage:concentrate ratio in combination with an optimised fibre degrading capacity of the equine gut microbiota.



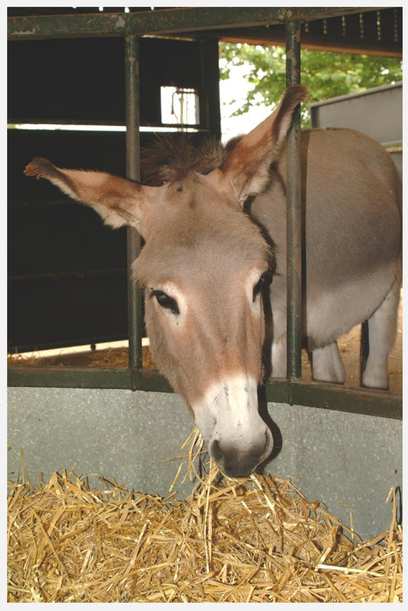


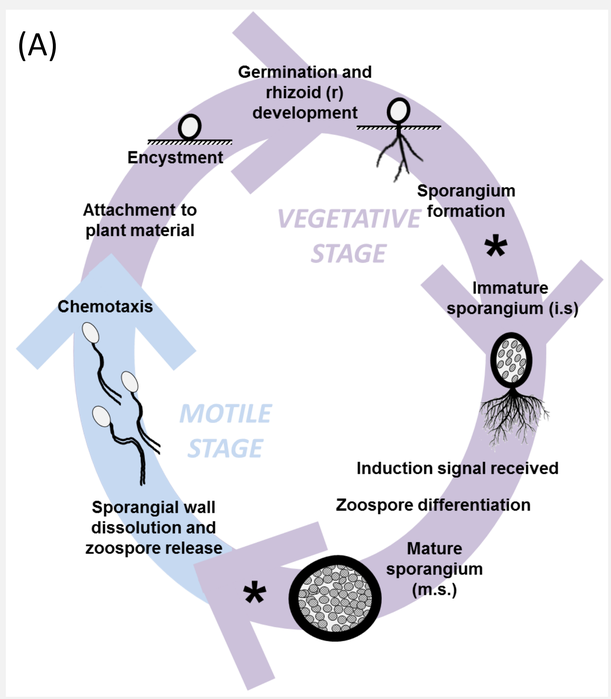
**Figure 1.** Horses and donkeys differ in their nutritional and dietary energy requirements, with donkeys having evolved to utilise highly fibrous forages typical of the semi-arid regions they originate from.

## EQUIANFUN Project: *Focus & Aims*

- ***EQUIANFUN*** is a 2.5 year multi-disciplinary project that ***will establish new baseline knowledge about anaerobic fungi in the equine hindgut*** (Figure 3).
  (a) The ***taxonomy*** of equine anaerobic fungi will be determined and compared to those previously described in ruminants.
  (b) The ***physiological characteristics*** of equine anaerobic fungi will be determined, and compared to ruminal anaerobic fungal type strains.
  (c) The ***effect of equine host species*** on anaerobic fungal hindgut ecology will be assessed.
  (d) The nutritional impact of anaerobic fungi in terms of ***feed degradation*** will be evaluated using an *in vitro* equine hindgut model.
- EQUIANFUN will generate new insights into equine anaerobic fungi, and facilitate the development of future strategies to maximise the fibre degrading capacity of the equine gut microbiota.

## Acknowledgements

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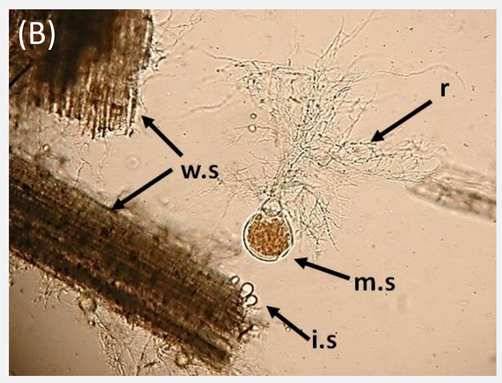




**Figure 2.** A schematic of the anaerobic fungal life cycle model (A) and a light microscopy image of a monocentric anaerobic fungus[#] (B) cultured on wheat straw (w.s.). The stages where 'resistant' structures tolerant of oxygen and desiccation (that have been reported to date) may be formed are also indicated on the life cycle (*).

## Anaerobic Fungi: *Effective Fibre Degraders*

- The most effective of the fibre-degrading gut microbes are anaerobic fungi (phylum Neocallimastigomycota), and they undergo a life cycle (Figure 2) which contains both a motile and vegetative phase (*3*).
- During their vegetative phase, ***anaerobic fungi directly degrade fibre*** using their rhizomycelium and potent fibrolytic enzymes to both physically and enzymatically degrade fibrous feed particles.
- Anaerobic fungi also ***indirectly improve feed particle degradation by increasing the surface area available for bacteria to colonise.***
- Anaerobic fungi have been largely overlooked in equine gut microbiology studies, however findings to date suggest that ***anaerobic fungi in the equine hindgut are likely to be taxonomically and physiologically distinct from those previously characterised*** in ruminants (*4, 5*).

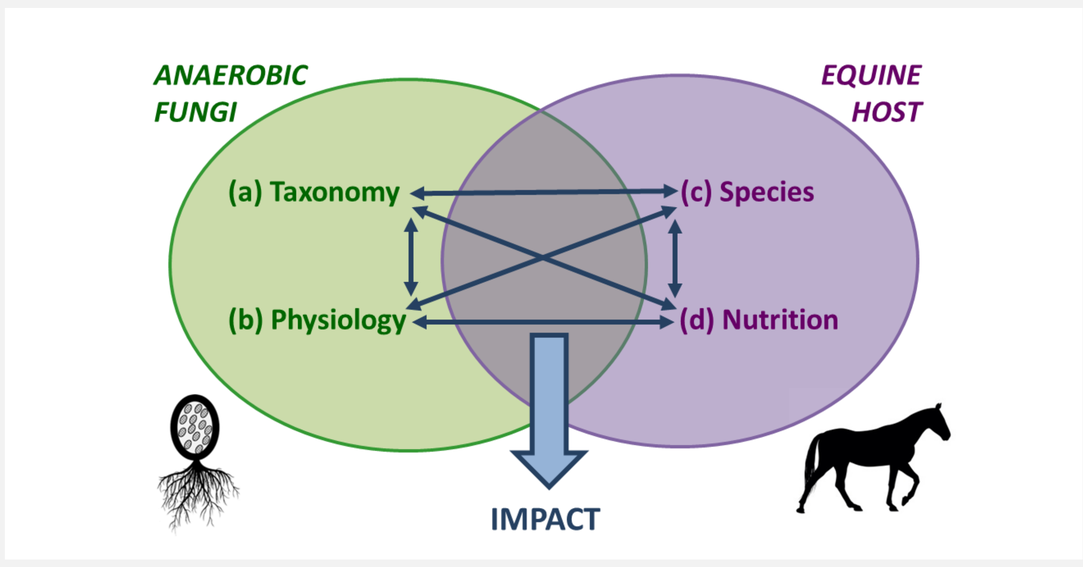



**Figure 3.** Schematic overview of the EQUIANFUN project.

## References

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# Microscopy image kindly provided by Dr Tony Callaghan (Aberystwyth University, Wales, UK).