**Review of: Busby, D. & Rutland, C. (2019). The Horse. A Natural History. Brighton: Ivy Press.** 224 pages, 225 figures (partly colour), hard cover. ISBN 978-1-78240-565-8.

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This richly illustrated book is a well-presented compendium of the horse, its biology, evolution and its history with humanity. Clearly structured and organised, it is a compelling account of an exceptional species. Throughout, the authors' regard and respect for horses is apparent but does not hinder the scientific narrative. On the contrary, the positive approach to communication, in combination with plenty of high-quality photographs and schematics, supports the reader's interest and inspires to learn more.

It is largely written in a straightforward and adequately flowing language, with a clear sentence structure. Technical terms are mostly explained using the same easy-to-understand and approachable way and helped by illustrations and infographics. The book is organised into different sections and subsections, following a logical progression. The first chapter covers evolution and the taxonomy of the genus Equus. Chapter 2 explores the anatomical aspects of horses, whilst chapter 3 explains their complex social organisation and behaviour. Finally, the last two chapters are dedicated to the interaction of horses and humans, including an extensive, though by no means exhaustive, catalogue of modern breeds. Subsections within chapters are well structured and divided into bite-sized blocks of a specific topic, usually encompassing 2 to 4 pages. The text is never overwhelmingly dominant but interspersed with illustrations or broken up into separate infographics. This organisation makes it easy to read up on a specific topic without having to search for it in long passages of unbroken text. Though brief, the text sections communicate knowledge concisely without seeming crammed or overbearing.

After a rather short introduction, the reader is taken back in time to the very beginning of the horse's evolution some 50 to 55 million years ago. The authors acknowledge not only past mistakes in evolutionary research but also that further advances in technology and techniques will impact on our current understanding of equine evolution.

Though the focus is on horses, the text also delves briefly into the taxonomy of the Equidae family and even the wider Perissodactyla order. Each of the extant species within the Equid family are described, and differences to horses highlighted. The origins of the modern domestic horse are explored in depth, portraying the tarpan as its ancestor and Przewalskis as the sole wild horse species still in existence. However, this is now outdated knowledge as has been shown by new research, published in the last two years. Gaunitz et al (2018) and Fages et al (2019) examined and reviewed DNA samples of horses from a variety of periods and regions in order to investigate the genetic origin of the modern horse. Their research clearly shows that Przewalski horses are not the last living species of wild horses previously thought, but in fact descendants of some of the earliest domesticated horses. The Eneolithic site of Botai in modern Kazakhstan yielded some of the earliest evidence of horse husbandry and domestication (Outram et al., 2009). Genetic analysis of the Botai horses shows that they are direct ancestors of Przewalski horses but a minimal component in modern domestic horses. This makes Przewalski horses the only living descendants of the first domestic horses and as such very much still worthy of conservation. The exact source of the modern domestic lineage is still the subject of further analyses, but a variety of tarpan remains a key contender.

While it is understandable that the most recent of the two studies has not featured in this book due to the coinciding publication dates, Gaunitz et al.'s study from 2018 is listed in the bibliography. That begs the question why the authors have not related these new discoveries but chose to present the reader with an obsolete scenario that has now come into question.

The chapter finishes off on a short note on the impact of horses and horse riding on human society that would have profited from more in-depth information.

The biological background of both authors becomes clear in the following chapter. The reader is introduced to equine anatomy in several detailed sections looking at the different body parts in a horse. Most of these sections assume no prior knowledge of anatomy in the reader and are therefore easy to understand. Although, on occasion, the word choice causes confusion that hinders good communication of the intended subject, and, in one case, the erroneous use of *deciduous* for permanent rather than milk teeth creates misunderstanding.

As part of the equine life cycle, the concept of maturity is explored. There are two types of maturity: sexual and skeletal. Arguably, mental maturity needs to be viewed separately too. Unfortunately, the authors are not clear on which type they are referring to when connecting maturity to training.

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While some bones will fuse at around 15-18 months, horses do not reach full skeletal maturity until 3 to 4 years. The vertebrae bodies fuse even later at 4-5 years (Silver, 1969; Habermehl, 1975). Furthermore, some breeds are late bloomers and take even longer to mature, both physically and mentally. Since the weight of the rider has severe direct impact on the spine it is essential that young horses are started with utmost care and, ideally, only after the vertebral plates are fully fused. The mental state of the horse should also be considered before any human intervention. Sexual maturity is unrelated to a horse's readiness to begin work under saddle.

Early in the second chapter, horse types are introduced: hot, warm and cold blooded. Despite the names, these terms do not refer to the blood temperature of the horses but their general temperament. These terms are therefore entirely unrelated to climate, contrary to the authors' claim. Cold-blooded horses are not from colder northern areas but were bred for a specific purpose, usually as strong working animals, as were all other types and breeds of domestic horse. Hot-blooded horses on the other hand were bred for speed and endurance. Warmbloods, most commonly used in the plentiful areas of equestrian sport, are of moderate temperament somewhere in between the other two. Additionally, there are half-breeds that are the offspring of two horses from different types, usually one hot and one warm-blooded. The vast majority of modern sport horse breeds have Arabian or English Thoroughbred crossed in for refinement. Ponies are considered a separate type and are not divided based on their temperament.

The chapter finishes with a section on genetics in extant equid species and applications for genetics in modern horse breeding. It seems partly outdated as testing for specific coat colours is mentioned as a thing of the future when it is common practice to test breeding stock for specific genes involved in coat colour inheritance, such as splash (Veterinary Genetic Services, 2019). The bibliography lists Castle's "The ABC of Colour Inheritance in Horses" from 1948 as the only publication on this topic.

In 2009, Arne Ludwig and colleagues published a paper on the origin of coat colour variation. The research team found that diversity in horse coat colours increased quickly after domestication as a result of human selection, and was able to identify the wild type colour from fossil horses (Ludwig et al., 2009).

Chapter 3 presents an informative overview of horse behaviour and society. Although, by nature, some of the subtopics are highly complex and difficult, the reader is guided through them expertly. From social organisation and communication to modern horse management, this chapter explores the behavioural baseline in which all human-horse interaction is grounded. Based on the natural structure of horse society, the authors point out issues in modern horse keeping and management which disregard horses' natural predispositions in favour of human needs and wishes. Looking at the horse's different senses as well as its basic needs, such as sleep, food and physical contact with conspecifics, the book explains how human behaviour influences a horse's mental and physical well-being, which in turn has a huge impact on its behaviour and performance. In better understanding equine nature, we will be able adapt horse management strategies in a way that is beneficial to both humans and horses. Creating a pleasant experience for both partners of this interspecies relationship is even more crucial in a world where horses are overwhelmingly used for recreation.

In an excellent section explaining sentience and emotions in horses, the authors explore the aspects of learning and interspecies communication even further. While no one who has handled horses could doubt that they have individual personalities and experience emotions very similar to humans, it is nonetheless an important subject that needs further research. Perhaps even more important is to implement that research in practice and make it accessible to the public, especially to those who are handling equids regularly.

Chapter 4 picks up on the human-horse relationship that was briefly introduced at the end of the very first chapter. Right at the beginning of this fourth chapter, the reader is introduced to "three distinct and primitive types" (p. 112) of horses, namely the Asiatic wild horse, the tarpan, and a heavier northern European type. A similar concept is described in the next chapter. There, the 3 subtypes are tarpan, domestic horse and the Przewalski, and they are extended by 3 prototypes of horses which are warmblood, draft, and oriental.

It is true that the tarpan and the horse of the Central Asian steppes are two different types of horses. The modern domestic horse's relationship to the former is currently being studied intensively. A common ancestor connects Przewalskis with the modern domestic horse which may therefore be counted as a separate type. However, there is no evidence of a northern European horse as described by the authors.

*Breed*, defined as "a particular type of animal […] developed by people in a controlled way" (Oxford Learner's Dictionary, n.d., definition 1), is a highly ambiguous term, often used interchangeably

with type. The detailed definition and precise use of the term is unclear, and zooarchaeologists tend to shy away from it in any pre-studbook contexts, i.e. pre-modern times. The term *type* in a biological sense refers to "qualities common to a number of individualsthatdistinguishthemasanidentifiableclass" (Merriam-Webster, n.d., definition 1e [1]) and allows for animals (within a species) to be grouped by shared characteristics such as morphology, physiology or ecology (Merriam-Webster, n.d., definition 1e [1]). Type as a biological concept is therefore the preferred way for zooarchaeologists to refer to animals with similar morphological traits.

Though breeding is as old as domestication, its intensity has varied throughout the millennia and only became very intense and selective more recently in the medieval period. The Romans were well known for their highly selective breeding of different types for specific purposes, for example racing or mule-production (White, 1970). In the Middle Ages, with the rise of knighthood and chivalry, horses were bred for highly specialised purposes even within one occupation (mainly cavalry) and people started interbreeding horses from different geographic regions to continuously improve the breeding outcome. Spanish horses were especially highly valued as warhorses, but other European regions were recognised as excellent breeding centres as well and their stock was exported all over the continent (Hyland, 1996; 1998; 1999). Due to the nature of Western medieval mounted combat, horses used as chargers, or in similar positions, had to be sturdy and relatively large animals. Additionally, with the introduction and spread of the horse collar, horses progressively replaced cattle as plough and traction animals. This line of work required similar animals to those used as chargers in warfare which resulted in the appearance of heavier draft horses, similar to a modern cob or light cold blood. Huge and massive horses like Shire Horse or Suffolk Punch are a much later development.

It is clear that types such as warmblood or draft horse are the result of intensive and very selective breeding to fit a specific purpose. Some horse breeds have undoubtedly also adapted to the environments they were brought into by humans, for example the Arab, the Shetland or the Yakutian horse. However, all horse breeds are descendant from the same common ancestor that is shared by all domestic horses. While this ancestor is still rather elusive from a genetic point of view, studies have traced patrilines and matrilines of modern and archaeological horses in search of it, and to explore the genetic development of breeds (Cieslak et al., 2010; Lindgren et al., 2004).

The chapter further explores domestication, and its distinction from exploitation. Horse domestication is still not fully understood, and the authors introduce the different current views. In this context, they also briefly look into the evidence for first riders, such as pathologies and bit wear. The brief discussion of whether horses were first ridden or driven leads on to a short exploration of the enormous diversity of activities humans have used horses for. Further along in the chapter the authors offer a more detailed insight when, in connection with breeding, they portray several ways in which horses have benefitted humans. This diversity has naturally led to an equally varied assortment of tack, which has been developed, refined and adapted continuously throughout history. The authors focus on the most crucial pieces: saddle and bit. They are necessary to control the animal and aid in communication, but also, in the case of the saddle, to make the unnatural situation of a rider on a horse's back comfortable for both parties. In recent years, there has been a notable movement towards bit-less or even tack-less riding to minimise the impact on a horse's well-being as well as to return to a more "natural" interaction between species. Regardless of the style of riding or nature of the task, both horse and human need to be trained in order to work together and communicate successfully. *The Horse – A Natural History* explores not only the origin and development of horse training but also the various contemporary branches, and casts a critical eye on historic as well as modern methods.

The decent though short section on cavalry development reflects the limited information that is presently available, particularly on medieval warhorses. A variety of current research projects is aiming to remedy this situation. Within this exploration of horses in warfare, a brief text is dedicated to size changes in horses throughout history. While it is correct that the Roman as well as the Medieval periods saw an increase in horse size it also mentions that "Saxons and Danes imported larger breeds from the Continent" (p. 134). Apart from the fact that at this point in history we can hardly speak of breeds yet, neither the Saxons nor the Danes had any such larger horses brought to England. In fact, horses from Feddersen Wierde, a Germanic site in modern Germany, are distinctly smaller than those we find in Anglo-Saxon British sites (Benkert, Rizzetto, in prep.). A study conducted by Richard Thomas and colleagues is currently analysing horse measurements from sites all over Britain to investigate the size changes on a larger time scale (Thomas, pers. comm.) and will

be able to shed some more light on the situation in post-Roman/early medieval times.

In our present day, much value is placed on economic contribution and profit of companies, industries, people, and animals. As such the horse, and with it the extensive equestrian industry, plays an important role in modern economies. The authors relate the considerable impact of the horse world through comparative portraits of various regions of the world. Though some areas, notably Africa and South America, are absent from this report this may be explained by the difficulty to measure the economic impact in countries where horses are still working animals and no standardised registration system is in place (p. 151). It is even more important, therefore, to inform people of the continuous bilateral influence of economy and equestrianism and the impact this relationship has on equine and human welfare. However, this section quickly developed into a mere listing of numbers and figures which are likely irrelevant to the average reader. Instead, a clear and concise graph, comparing the differences and similarities in economies around the world would have been a more sensible approach to engage the readership in an active examination of the topic.

Picking up on subtle points made throughout the book, the authors use the connection between economic value and animal welfare to further explore ethics and ethology, particularly in the modern world. This excellent analysis is kept neutral and scientific throughout, leaving every reader to make up their own mind about how we treat animals and how this needs to change.

The last chapter is dedicated entirely to horse breeds around the world, including a directory of modern British and some major non-British breeds. A small number of rare breeds is also portrayed. Each portrait is accompanied by a high-quality coloured photograph, a brief description and a short list of facts, such as geographical origin, size and permitted coat colours.

The directory is preceded by an introduction focussing heavily on the British Isles. Regrettably, the style of writing lends this overview a rather unfortunate, dismissive tone, especially towards continental Europe. Though particularly modern sports breeds from the Mainland are praised for their athletic qualities, the authors leave no doubt that the English Thoroughbred played a major role in their success. The Arabian horse, and the Barb for that matter, are only credited in passing despite their own massive impact on modern horse breeds, most notably the English Thoroughbred.

Overall, *The Horse – A Natural History* is a beautifully arranged book offering a detailed overview of the modern horse, its anatomy, behaviour, and evolution in a well-structured and clear layout. It is largely concentrating on Britain, and Europe in extension. The book also touches on some very important but controversial points, such as sentience and emotions in horses, the discrepancy between equine nature and modern management, and ethics in the equestrian world. Unfortunately, the archaeological and historical aspects are frequently lacking information and are even faulty at times. Several smaller mistakes or regrettably phrased points will likely be passed over by readers without prior understanding of the related topic but will not go unnoticed by the more advanced readers.

The quality of writing and information varies quite considerably between sections and chapters, from poor to excellent. For the most part, the writing style and illustrations are easily understandable by the layperson but also demanding enough for readers with various degrees of background knowledge.

The bibliography reveals a clear bias towards the fields of the authors' expertise and a severe lack of archaeological publications.

It is ideal as an introduction to this important species, for equestrians looking to learn more about their sports partner or (zoo-)archaeologists wanting to discover the living animal behind the bones in their trenches. For readers who are interested in the long-standing relationship between humans and horses, however, other publications will be of more help.

A second edition, revised and edited in light of new scientific developments, would hold the potential to transform this book into a truly valuable compendium for equestrians, academics and amateurs alike.

## References

Benkert, H. & Rizzetto, M. (in prep). The horse in Roman and Early Anglo-Saxon Britain. In V. Aniceti, M. Bormetti & M. Rizzetto (eds.). *PZAF 2018. Proceedings of the 7th meeting of the Postgraduate ZooArchaeology Forum, Palermo (Sicily, Italy), 27th-29th June 2018.* BAR International Series. Oxford: B.A.R.

Cieslak, M., Pruvost, M., Benecke, N., Hofreiter, M., Morales, A., Reissmann, M., & Ludwig, A. (2010). Origin and history of mitochondrial DNA lineages in domestic horses. *PLoS ONE, 5(12)*, e15311.

Fages, A., Hanghøj, K., Khan, N., Gaunitz, C., Seguin-Orlando, A., … Orlando, L. (2019). Tracking Five Millennia of Horse Management with Extensive Ancient Genome Time Series. *Cell, 177(6)*, 1419-1435.

Gaunitz, C., Fages, A., Hanghøj, K., Albrechtsen, A., Khan, N., ... Orlando, L. (2018). Ancient genomes revisit the ancestry of domestic and Przewalski's horses. *Science, 360*, 111-114.

Habermehl, K.-H. (1975). *Die Altersbestimmung bei Haus- und Labortieren* (2nd ed.). Berlin: Parey.

Hyland A. (1998). *The Warhorse: 1250–1600.* Phoenix Mill: Sutton Publishing.

Hyland, A. (1999). *The Horse in the Middle Ages.* Stroud, Gloucestershire: Sutton Publishing.

Hyland, A., & Prestwich, M. (1996). *The Medieval Warhorse: From Byzantium to the Crusades.* Bridgend: Sutton Publishing.

Lindgren, G., Backström, N., Swinburne, J., Hellborg, L., Einarsson, A., … Ellegren, H. (2004). Limited number of patrilines in horse domestication. *Nat. Genet., 36(4)*, 335–336.

Ludwig, A., Pruvost, M., Reissmann, M., Benecke, N., Brockmann, G., ... Hofreiter, M. (2009). Coat Color Variation at the Beginning of Horse Domestication. *Science, 324(5926)*, 485.

Merriam-Webster. (n.d.). *Type.* In merriam-webster.com dictionary. https://www.merriam-webster.com/dictionary/type [16.12.2019].

Outram, A. K., Stear, N.A., Bendrey, R., Olsen, S., Kasparov, A., … Evershed, R. P. (2009). The earliest horse harnessing and milking. *Science, 323*, 1332–1335.

Oxford Learner's Dictionary. (n.d.). *Breed.* In oxfordlearnersdictionaries.com dictionary. https://www.oxfordlearnersdictionaries.com/definition/english/breed_2 [12.12.2019].

Silver, I. (1969). The Ageing of Domestic Animals. In D. R. Brothwell, E. S. Higgs, & G. Clark (eds.), *Science in archaeology: a survey of progress and research* (pp. 283-302). London: Thames & Hudson.

Veterinary Genetic Services (2019): *Equine Coat Colour.* https://www.vetgen.com/equine-coat-color.html [16.12.2019].

White, K. D. (1970). *Roman Farming.* London: Thames & Hudson.

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