

Warm up

Horses for courses

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Some of you may have read the paper in the *Journal* from a few years ago discussing the human athletes in professional horse racing and the risks they face in the course of their occupation.¹

But the jockey is not the only athlete in this sport and for some folks the horse is a far more important determinant of pecuniary return. There are many parallels in equine sports medicine that make interesting reading for the human sports clinician. Horses it turns out get stress fractures, cruciate ligament injuries, as well as a whole raft of other musculoskeletal pathology. They even have their own alternative practitioners in addition to the sports veterinarians.

One critical area where equine science far outstrips human sports medicine is genetics. In part, this reflects the historical culture of the sport where selective breeding in racehorses has long been developed.

It turns out that more than one-third of the entire gene pool of the current thoroughbred horse population in the United Kingdom derives from just four horses imported from the Middle East and North Africa in the 17th Century. Further, approximately 50% of the gene pool is provided from 10 horses whilst 80% is made up from only 31 horses.²

It is not just thoroughbreds where this is seen. In the US, 13 of the top 15 quarter horses are descendants of a single horse called "Impressive". This horse had a particular genetic abnormality that was passed on to his offspring, which was a sodium channel mutation that enabled far greater and quicker power to be generated by muscle contraction. While improving his horse-power it also placed horses with this mutation at risk of a form of paralysis that can be fatal.³

One criticism that arises from such figures is the concern as to whether this type of breeding significantly reduces the gene pool of race horses thereby restricting their ability to evolve over generation into ever more faster beasts. Certainly thoroughbred horses have low fertility rates when compared with wild

horses; however, only minimal inbreeding has occurred (at least over the past five generations) and the reduced fertility may have alternative causes.⁴ Despite this, an analysis of winning times from the English St Ledger, Oaks, and Derby races from 1840 to 1980 demonstrated improvements of approximately 0.6% per generation, which suggests that horses will continue to improve their racing performance.³

Another answer to this question is given by data from Ireland tracking horse racing performance from 1961 to 1985. This study analysed 31 263 3 year old racehorses to see whether the performance of related horses was different to randomly selected non-related horses. The results suggested that only 35% of the variance in racing performance could be explained by genetic factors with the remainder being attributed to nutrition, training, riding skill, and other environmental factors.⁴

It may be stating the blindingly obvious but horses do have some physiological differences to elite human athletes. One anatomical constraint is the fact that because of the attachment of the horse's foreleg muscles to its ribcage, when the horse is galloping, the ground impact creates a bellows effect where the ribs are forced upwards and the abdominal contents move forward forcing the air out of the lungs. Thus the horse can only take one breath per stride, which in turn creates an upper limit to physiological oxygen delivery. If the horse tries to increase its stride length without changing the stride frequency, it does not have the ability to commensurately increase its breathing frequency.⁵⁻⁷

As a consequence of this process, many horses have blood in their windpipe after a race with the vast majority having blood in their lungs. This blood may further interfere with oxygen transfer to the blood and hence effect oxygen delivery to the muscles.^{6,7}

Because of this physiological limitation, unscrupulous individuals may attempt to modify oxygen delivery and transfer by pharmacological means.

Once again, veterinarians are at the forefront of drug detection and testing in order to keep the sport honest.

We could do a whole lot more I believe by rediscovering comparative anatomy as part of our sports medicine training. Two hundred and fifty years ago, the celebrated John Hunter became the father of modern scientific surgery by following this route. Those visiting or living in London should take the time to pay a visit to the newly re-opened Hunterian Museum at the Royal College of Surgeons in Lincoln Inn Fields and discover where much of our current anatomical and surgical knowledge derives. Those of you who are not in London should read his newly published biography, *The Knife Man*, to gain an insight into his work.⁸

With all the recent fuss about identity cards, perhaps there is an undiscovered benefit that could be utilised namely tracking gene cheats in sport. We can take another leaf out of our veterinary colleague's book here.

It may be of interest to folks to know that since 1791, when James Weatherby established 'The Stud Book', the intricate details of genetic breeding has been meticulously documented for more than 20 equine generations in the UK making this record the quintessential guide for horse breeders.^{2,3} Can you imagine a world designed to stamp out gene cheats with the combination of a biometric sporting passport with a DNA sample as well as physiological data coupled with an elite athlete stud book to monitor breeding. Do I hear some antediluvian cries of eugenics?

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