Homo sapiens are “wired to run”

By O’S News Service

Running and other forms of aerobic activity involving production of anandamide—the neurotransmitter that THC imitates—in the brains of certain mammals, including people. The authors of a study published this spring in the Journal of Experimetnal Biology suggest that the brain’s reward system provided a neurobiological incentive for our remote ancestors to run for long distances to increase their chances of survival and thus helped shape the evolution of the human body.

“Cursorial” refers to animals that run long distances — wolves, horses, pronghorn, etc.

The JEB paper by David Raichlen of the University of Arizona, Gregory Gerdenma of Springfield College, and colleagues is called “Wired to run: exercise-induced endocannabinoid signaling in humans and cursorial mammals with implications for the ‘runner’s high.” Endocannabinoid signalling in the hypothalamus, the nucleus accumbens and other areas of the brain associated with reward is at least partly responsible for the “high” reported by many athletes during and after a vigorous workout.

Previous studies at UC Irvine had provided some unexpected support for this idea, using mice that had been bred over many generations to engineer in very high levels of wheel-running exercise. Mice are not naturally “cursorial,” but these specially-bred mice would cover several kilometers every night. When the Irvine researchers used the drug Rimonabant to block their endocannabinoid systems, the mice reverted to more typical, low-exercise behavior.

These findings suggested that artificial selection through a laboratory breeding program could lead to the evolution of running behaviors by specifically boosting genes of the brain’s endocannabinoid system that get blocked by Rimonabant.

Raichlen and Gerdenman got a grant from the National Science Foundation to study whether a similar phenomenon occurs in dogs (running长途意味着feral) and horses (running长途意味着feral), and Homo sapiens (running长途意味着feral for countless eons as we evolved, but increasingly sedentary in recent generations). Did natural selection also work through the genes of the endocannabinoid system to promote the evolution of running behaviors? Are human beings “wired to run?”

Their team took blood samples from the test subjects before and after vigorous workouts on a treadmill. They determined that anandamide levels rose significantly in people and dogs, but not in ferrets. In humans, the concentrations of anandamide in blood were tightly correlated to subjects’ states of elevated mood. The authors conclude: “Thus, a neurobiological reward for endurance exercise may explain why humans and other cursorial mammals habitually engage in aerobic exercise despite the higher associated energy costs and injury risks, and why non-cursorial mammals avoid such locomotor behaviors.”

The authors note that the same system that might have motivated distance running would also mitigate the pain and damage involved. Anthropologists have long wondered Gerdenman adds in an email, “why early hominids, for whom running would have been much more difficult based on their skeletal anatomy, would have engaged in behaviors that are energetically taxing and increase the chance of injury in a predator-rich world?” He proposes an answer: “The endocannabinoid system as an engine driving evolutionary change. Analgesia, anti-inflammatory, enhancing bone density — it all fits this model.”

Add to the Glossary: “Cursorial”

The word “cursorial” is related to “course,” meaning as a verb, “to run through” (as, for example, “a river courses through the valley”), and as a noun, the ground covered (as in a race course). It’s ironic that a word long used by anthropologists (and nobody else) to describe animals capable of running long distances, now evokes the image of an animal sitting on its butt while manipulating a little icon on the computer screen. I had just encountered “cursorial” in a piece about pronghorn (Antilocapra Americana).

According to pop-sci writer Rob Dunn, pronghorn “at medium distances... may well be the fastest animal ever to have lived.” Dunn’s book “The Wild Life Of Our Bodies,” describes some intriguing but unproven hypotheses about how interacting species have co-evolved. His opening chapter discusses the possibility that the wipe-out of our intestinal parasites by the “runner’s high.”

According to Dunn’s book “The Wild Life Of Our Bodies,” describes some intriguing but unproven hypotheses about how interacting species have co-evolved. His opening chapter discusses the possibility that the wipe-out of our intestinal parasites by modern hygiene and antibiotics has led to a rising incidence of Crohn’s disease (because under-employed digestive juices attack the lining of the gut).

Dunn continues: “There was precedent for the idea that one species, such as a human, might miss another species, even one or more thousand years ago were bigger, badder, and faster than anything we know today. There were pondering dogs (Bo raphagus sp.) short-legged dogs (Proto cynus sp.), dire wolves (Canus dirus), giant cats (Panthera atrocorax), giant sabre-toothed cats, giant short-faced bears (Arctodus simus), and other toothy monsters, many of them fast. The cave lion grew to twelve feet in length. The saber-toothed cat could weigh 1,000 pounds and the giant short-faced bear as much as 2,500 pounds. Most relied on the story of the pronghorn, though, was the American cheetah (Machinonax trumanii), a big, long, fast cat built to chase and catch at high speeds. Analogies with modern African cheetahs suggest that the American cheetah would have loved to catch pronghorns, the way African cheetahs love antelope…

The pronghorn once had something to flee. American cheetahs evolved to be fast enough to pursue faster pronghorn and pronghorn evolved to be even faster in return. Then humans arrived in the Americas and, one way or another, killed off sixty large mammal species, including the cheetah, but also lions, mammoths, mastodons, and even camels. The extinction of these great beasts and, in particular, of the American cheetah, left the pronghorn anachronistically and irrevocably fast. The pronghorn had evolved to flee predators — even the shape of the uterus has been designed for slenderness. But now that the predators are gone, Dunn speculates, traits related to speed “may be costly… The individuals that run the fastest may die younger, exhausted from fleeing ghosts but unable to slow down.”

On the other hand, human sapiens are way more lethal than the dire wolf and the atroscopic panther.)

The Pronghorn Principle

“The pronghorn principle,” Dunn generalizes, “has two elements: First, all species have physical characteristics and genes that relate to the ways in which they interact with other species. Second, when those other species are removed, such features become anachronistic or worse. Plants have evolved toxins to defend their leaves, nectar to entice animals to carry their pollen, and fruits to attract other animals to carry their seeds. Animals, in turn, evolved long tongues to reach nectar or better smells ofsmell to detect fruit carnivores have long, sharp teeth to kill their prey. Intestinal parasites have appendages that mirror, in their contours, the guts of their hosts, to interact with, be they predators (as in the case of the cheetah), mutualists like the animals that once dispersed the giant American fruits [papayas, avocados, guava, chirimoya et al] or even parasites and disease.”

Add to the Glossary: “Pronghorn”

Pronghorn are not antelope, deer or sheep but a species unto themselves. Photo by Mark Gocke