Published in *Equus*, 285, p12, 2001

A THEORY TO CHEW ON

Robert Cook

In her important article ('Wake-up call', Equus, 283, p 42), Dr. Lynn Caldwell offers six suggestions on how to stay awake at the wheel. All of her excellent advice is in accord with the polite version of the old army axiom …'proper planning prevents poor performance.' However, another military maxim reminds us that …'no plan survives contact with the enemy.' So it is that, even in civilian life, reality proves the enemy of scheduling. Inevitably, there are times when the brain's insistence on sleep is difficult to deny, yet drive we must … at least until we can reach a rest-stop for a nap.

As someone who has always found it extraordinarily easy to nod off at inconvenient moments, may I please add a seventh suggestion? I refer to the value of chewing gum. Any negativity concerning the social unacceptability of this practice is far outweighed by the positive contribution it makes to staying alert and avoiding fatal accidents.

Some years ago, I discovered for myself the benefits of chewing gum as an aid to staying awake. I later realized that this was not an original discovery. Nevertheless, it does not seem to be widely known about or practiced, perhaps because no reason has been given for its peculiar effectiveness. It was while I was observing a horse grazing that a possible reason became apparent. Let me explain.

A sick horse that is standing still, not eating, and hanging its head, quickly develops a serious degree of venous congestion (stagnation of blood) in the nasal cavity. This engorgement can rapidly progress to the point that breathing itself becomes difficult. As the horse is an obligate nose-breathing animal, obstruction of its only airway can be life threatening. When the muzzle is held in a low position at times when the horse is not grazing, the heart on its own seems to have insufficient strength to pump venous blood from the head back to the chest, against the force of gravity.

So the question arises as to how the healthy horse in the wild surmounts this problem when it spends at least 16 hours of every 24 with its muzzle at grass level? The answer proves to be delightfully simple and also ingenious. Every time a grazing horse chews, a pulsation of blood occurs in its jugular vein. This surge of blood is large enough to be easily seen by an observer standing some feet away. The chewing reflex appears to act like an auxiliary pump and assists the heart in keeping the blood circulating.[1]

The auxiliary pump idea also provided me with a satisfactory explanation for the existence of a rather curious feature concerning the veins of the horse's head. Embedded within the powerful cheek muscle of the horse[2] there are three veins[3] that, for a distance

[1] In a similar way, steady walking prevents the hind limbs of a horse from 'stocking-up' because regular contraction of the powerful muscles of the hind quarters serves as another auxiliary pump for the circulation

[2] The masseter muscle

of several inches, are expanded into sizeable lakes[4] (Fig 1)[5]. During chewing, each squeezing contraction of the cheek muscle would empty these lakes and pump their contents into the jugular vein from where the blood flows back to the heart. It is as though the horse has a six-cylinder 'auxiliary heart' in its cheeks that is brought into use when the head is lowered for grazing.

So what possible relevance does this have to man's problem of how to stay awake at the wheel? Well, although the anatomy of the facial veins in man is not identical to the horse, it is possible that a similar mechanism exists. The deep facial vein in man does not have a venous sinus but it does connect to a complex network of veins[6] embedded between muscles of mastication. Furthermore, this network connects freely with venous sinuses in the brain. It seems possible that chewing generates a pulsation of venous blood in this network and that this, in turn, stimulates the circulation of blood in the brain.

If this hypothesis is correct, it explains why the chewing of gum would help to maintain an adequate supply of oxygen to our brain, and enable us to stay awake when our bodies are otherwise immobile in the driving seat. I chew at the rate of 80 times a minute, which is faster than my heart rate. At each chew, perhaps the circulation of blood in my brain receives a little boost, over and above what my heart pump provides. Whether or not this is the correct explanation for the phenomenon of alertness that the chewing of gum invokes, I bear witness that, by this means, I stay awake in the driving seat and a number of other seats.

I hope that these thoughts, stimulated by the horse, may help to save a human life or two and perhaps that of some horses.

W.Robert Cook FRCVS. PhD.
Professor of Surgery *Emeritus*
Tufts University, School of Veterinary Medicine.

Home address:
206, Birch Run Road
Chestertown, MD 21620
Ph: (410) 778 9005
E-mail: drwrcook@aol.com

---

[3] The transverse facial, deep facial and buccal veins
[4] venous sinuses
[5] The illustration is reproduced by permission of Equistar Publications, Ltd. P.O. Box 311, Marysville, Ohio. Ph; (937) 642 1055
[6] the pterygoid plexus