Blush brings warmth in the cold

Reindeer actually have red noses, says s ananthanarayanan

IT'S the week before Christmas and Santa Claus will soon set out in his sleigh drawn by reindeer. The story has it that the leader of the pack is Rudolf, the one who was "kept out of reindeer games" by the others because of his red nose, till Santa said one Christmas eve, "Rudolph with your nose so bright, won't you guide my sleigh tonight?" Scientists in The Netherlands and Norway have found that all reindeer do have noses that are red, and for good reason.

Professors Anne-Marije van Kuijen, Wytske J Fokkens, Arnoldus S Blix and researchers Dan M J Milstein, Koray Yüriük and Lars P Folkow note in their paper in the Christmas issue of *BMJ*, the journal of the British Medical Association, that the detailed blood supply in the human nasal region has not been studied, despite the importance of the area in health and disease. The group has, hence, harnessed currently available technology of "hand-held video microscopy" to delve into the blood flow in the tissues of the nose, both of humans and of reindeer, and conclude that Rudolf's legendary proboscis is because of "the presence of a highly dense and rich nasal microcirculation".

Microcirculation

Circulation of blood takes place through macrocirculation, or blood flow to and from organs, and within organs in finer blood vessels, the capillaries, which can be as narrow as 10 microns in diameter. It is at this "delivery end" of circulation that the finest blood vessels communicate with cell tissue to regulate blood pressure, fluid levels, exchange of nutrients and gases and temperature. These finest blood vessels have a specific structure to help these functions, to permit smooth blood flow, transfer of water and dissolved material through the vessel wall and arrangements to constrict the vessels, to regulate blood pressure.

A part of the body that is well provided with such blood vessels is the lining of the nose. "The nasal microcirculation has important physiological roles such as heating, filtering and humidifying inhaled air, controlling inflammation, transporting fluid for mucous formation and delivering oxygen to the main, functional nasal cells and also in the uptake of drugs and responses to allergens," say the authors of the paper.

It is the nasal blood-tissue interface that senses and regulates much of the body's adaptation to the environment through continuous contact with inhaled air and the role of regulating temperature and humidity of the air that passes through. Extreme adaptation of the role of the nose in animals is well appreciated — the apparatus of scent of the cold nose of the dog, the great reliance on smell and even heat-sensing organs, to locate prey, in the nose-like region of the snake, are examples. But the area in humans has been less studied, largely because of difficulty of access *in vivo*, say the authors in the paper. The development of versatile devices that allow microscopy and even video imaging within organs has proved to be a powerful diagnostic tool. It is found that the microcirculation in the nose is the most sensitive indicator of outcome and response to treatment and also a key factor in a wide range of other diseases, including help in diagnosis and monitoring progress in cancer.

The researchers used adult volunteers to assess the nature and responses of the microcirculation in the human nose. The circulation was imaged using probes that allowed a lens to be inserted into the nasal cavity and the data was analysed offline, using software that the group developed, and conclusions were arrived at using statistical methods. The imaging revealed dense capillary formations in loops or circles, with hairpin-like branching and the absence of larger vessels. The analysis allowed assessment of how the blood flow changes when different drugs are administered or changes in the layout of capillaries in a volunteer with diseased nasal tissue.

The study has brought the focus on an anatomical area and an investigating procedure that is the most sensitive to internal and external factors. The importance of the nasal area has been noted in the context of different kinds of adaptation. An instance is that of the Arabian Ibex, an animal that is able to survive in desert conditions of heightened temperature and very low humidity. The animal economises on the use of water for cooling by allowing its body temperature to rise but still ensures temperature regulation of blood supply to the brain with the help of a moisture-saving, evaporative cooling mechanism located in the nasal passage. The Netherlands/Norway study has found parallel adaptation of the reindeer nose to the sub-zero conditions of the Tundra.

Reindeer

The mammalian, or reptile, nose needs to be kept moist and irrigated, apart from being temperature-regulated, to respond to gases and other factors in the environment. The moist nose of the dog is a great example of the organ being both sensitive and cool for the best response. In the case of the reindeer, which inhabits ice-bound areas, cooling for better response may not be relevant. But at sub-zero temperatures, there would be both lesser olfactory response as well at the real possibility of the moist reindeer nose getting covered with frost! The need of the hour is, thus, warming — which means flow of warm blood.

The study in the *BMJ* paper also carried out a hand-held video microscopy study of the nasal cavity of reindeer in Norway. The results were that reindeer nose mucous tissue is a good 25 per cent richer in capillary structures than the human nose. Infra-red light studies of reindeer showed that the nose of the animal is indeed red, and this is a result of a concentration of blood supply, as an adaptation to extreme cold. The study also revealed gland-like structures in the mucous lining of the reindeer nose, which may be for maintaining humidity and fluids. But there were limitations to the study, because of the dimensions of the probes, and better devices would enable more detailed understanding.

But the study brings Christmas cheer as we know now that Rudolf's red nose is for real!

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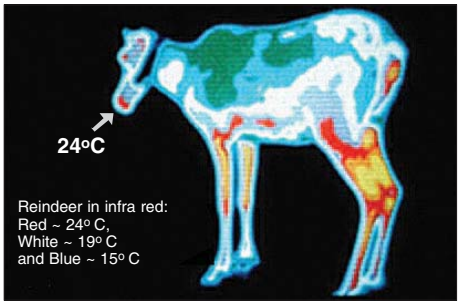

A stiff drink does the trick

AN effect of alcohol is that the peripheral capillaries, or the outermost fine blood vessels of the body, get dilated or widen. There is, thus, increased blood flow and rise in the body surface temperature. This is the reason that a shot of brandy gives a feeling of warmth, particularly if one is well covered or indoors. Conversely, the body adapts by constricting peripheral capillaries when it is cold. Swigging brandy when out in the cold could, thus, result in more loss of body heat. Or worse, a well-covered person could feel warm and unbutton a coat, resulting in exposure.

Readers of *Asterix* comics would recollect the dipsomaniac legionnaire, Tremensdelirious, whom Caesar wanted to put in his place by gifting him the one village in all of France that the Romans could not control (*Asterix and Caesar's Gift*). The images of Tremensdelirious show him with a nose that is beetroot red – all because of the capillaries of his nose, wide open because of wine!

A key nutritional development

Stone Age people, writes steve connor, were making cheese more than 7,000 years ago

STONE Age people living in northern Europe were making cheese more than 7,000 years ago, according to scientists who believe they have found the first direct evidence of dairy processing. Chemical traces of processed milk have been found on pieces of perforated pottery unearthed at an archaeological site in Poland dating to two millennia before people began to build the first monument at Stonehenge in Britain.

Archaeologists had suggested more than 30 years ago, when the shards were first discovered in the Polish region of Kuyavia, that the perforated pots may have been used as Stone Age cheese strainers to separate the solid milk curds from the liquid whey.

A detailed chemical analysis of the inner surfaces of the pots has now confirmed the pottery has a thin residue of fatty acid deposits showing that the sieves were indeed used for processing milk into cheese. The discovery shows that prehistoric people must have experimented with ways of preserving milk far earlier than previously thought.

Making cheese was important because it could be transported more easily than milk and could also be eaten more easily by people who would otherwise not be able to digest the lactose in milk.

"Before this study it was not clear that cattle were used for their milk in northern Europe around 7,000 years ago," said Melanie Salque of the University of Bristol, who helped to conduct the study published in the journal *Nature*. "The presence of milk residues in sieves — which look like modern cheese strainers — constitute the earliest direct evidence for cheese-making. So far, early evidence for cheese-making were mostly iconographic, that is to say murals showing milk processing which date to several millennia later than the cheese strainers," Salque said.

Peter Bogucki, one of the archaeologists who first suggested that the perforated pots much have been cheese strainers, said that being able to process milk was a key nutritional development at a time when most people would not have been able to digest the lactose in milk.

"Making cheese allowed them to reduce the lactose content of milk, and we know that at that time, most of the humans were not tolerant to lactose. Making cheese is a particularly efficient way to exploit the nutritional benefits of milk, without becoming ill because of the lactose," Dr Bogucki said.

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Making cheese is a particularly efficient way to exploit the nutritional benefits of milk, without becoming ill because of the lactose.

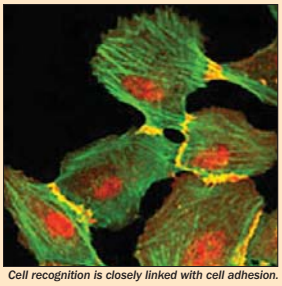
Food poisoning & 'bad bugs'

tapan kumar maitra elaborates on cell surface connections

CELL adhesion and cell recognition play important roles during the construction of normal tissues in the body as well as in the normal functioning of cells in the adult human body, such as blood cells. Surprisingly, foreign invaders that attack the human body can use the very same proteins that healthy cells require for cell adhesion to gain entry into the body.

Here, let us consider one example of how bacteria attach to and infect human cells:

■ Enteropathogenic bacteria use normal cell adhesion proteins to infect host cells One good example of this sort of "molecular hijacking" of normal cell adhesion processes occurs when pathogenic bacteria enter the digestive tract (such bacteria are called enteropathogenic bacteria; entero — comes from the Greek word for "intestine"). Such bacteria are responsible for several types of food poisoning and their combined effects have a substantial impact on



Cell recognition is closely linked with cell adhesion.

public health. Although some pathogenic bacteria can use multiple methods for gaining entry into the gut, in several well-studied cases, they attach to cell adhesion molecules such as integrins or cadherins.

One of the best-studied examples of such a subversion of cell adhesion is the enteric pathogen *Yersinia pseudotuberculosis*. Infection by bacteria of the genus *Yersinia* typically results in gastroenteritis with diarrhoea and vomiting

Bacteria that invade the lining of the human digestive tract attach to cell adhesion receptors on the surface of intestinal cells (a). Species in the genus Yersinia *express a protein called* invasin *that attaches to integrins on gut cells that have b1 subunits (b).* Listeria monocytogenes *expresses a protein called* internalin A *that binds to* E-cadherin *on intestinal cells (c).*

24-48 hours after exposure, which usually occurs via contaminated water and food. *Y. pseudotuberculosis* uses a 986 amino acid outer membrane protein, called *invasin*, to penetrate mammalian cells. Surprisingly, the cellular receptors for invasin are integrins that contain b_1 sub-units on the surface of cells lining the gut.

The identification of the cellular receptor for *Yersinia* was an important discovery because it showed that bacteria could invade cells by targeting common mammalian cell surface proteins.

As the molecular pathways used by other bacteria to invade host cells have been identified, such co-opting of normal cell surface proteins has emerged as a common theme in pathogenesis. A second enteropathogenic bacterium, *Shigella flexneri*, also attaches to an integrin via proteins on its surface. *Shigella* infection results in dysentery and usually results from the contamination of raw foods by food handlers. Approximately 300,000 cases of shigellosis occur annually in the USA, making it a significant health problem.

Another well-studied example of the subversion of cell adhesion is *Listeria monocytogenes*. *Listeria* infection can occur through exposure to improperly prepared raw foods, such as raw milk and hamburger. Although the incidence of *listeriosis* in the USA is not high (about 2,000 people annually develop symptoms), once infection occurs it is very serious. Approximately 25 per cent of those infected die; many of these contract bacterial meningitis.

Listeria expresses a protein called internalin A on its surface that can bind to E-cadherin on the surface of cells in the gut. Binding of pathogenic bacteria to cells in the intestine results in dramatic changes in the cytoskeleton of the infected cells. We now know that just as these bacteria "hijack" the normal cell adhesion machinery of gut cells, they can do the same with the cytoskeleton once they are inside an infected cell.

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