Ministère de la culture et de la communication

Concours réservé « loi Sauvadet » pour l'accès au corps de conservateur du patrimoine, spécialités « archéologie », « monuments historiques et inventaire » et « musées », organisé au titre de l'année 2015

SESSION 2015

Épreuve orale d'admission n°2 : épreuve d'anglais

3 octobre 2016

La seconde épreuve d'admission consiste en une conversation dans une langue vivante étrangère à partir d'un texte.
La langue vivante étrangère faisant l'objet de cette épreuve est choisie par le candidat lors de l'inscription parmi les langues suivantes: allemand, anglais, arabe, chinois, espagnol, italien, japonais, russe, portugais, polonais.
(Préparation de l'épreuve : 30 minutes ; durée de l'épreuve : 30 minutes ; coefficient 1).

Avertissement :

- avant de commencer, vérifiez que le sujet qui vous a été remis comporte toutes les questions ; signalez aux surveillants tout de suite les anomalies éventuelles (page manquante, page illisible...).

Ce document comporte 2 pages au total.

SUJET n°1

Climate change

Stopping the big burp

HAMILTON

Researchers in New Zealand are trying to prevent livestock belching methane

MENTION the phrases "greenhouse gases" and "global warming" in the same breath and most people will think of the carbon dioxide produced by burning fossil fuels such as coal and oil. But CO_2 is not the only greenhouse gas and fossil fuels are not the only source of such gases. A surprising and neglected one is the world's ruminant livestock—cattle, sheep and so on. Ruminants play host to bacteria that digest the otherwise undigestible grass and other cellulose-rich plants those animals eat, making nutrients such as fatty acids available to the beasts the bacteria inhabit.

But the complicated ecosystem of a ruminant's stomach includes other creatures, too. Many are methanogens—organisms that react carbon dioxide with hydrogen made by the cellulose-digesting bugs, to create water and methane. A lot of methane. A hundred million tonnes of it a year for all the world's domesticated ruminants, according to the United Nations' Food and Agriculture Organisation. And methane is a greenhouse gas 25 times more powerful than CO_2. Altogether, according to estimates by Andy Reisinger, of the New Zealand Agricultural Greenhouse Gas Research Centre, methane emitted from livestock is responsible for about 14% of global warming since the beginning of the Industrial Revolution.

Pardon me for being rude!

New Zealand is one of the guilty parties. Its 40m head of sheep and cattle mean that a third of its contribution to global warming is ruminant-belched methane. But Peter Janssen of AgResearch, the country's main farming-science institute, hopes to change this. He and his colleagues are looking for ways to reduce the amount of methane the country's animals burp up.

Their first approach is to develop methanogen-specific drugs. Though methanogens look like bacteria, they belong to a completely different branch of life, the archaea. That means their enzymes are different from bacterial ones (and also, of course, from mammalian ones), so there is a reasonable hope of finding chemicals which interfere with methanogen enzymes while leaving those of both bacteria and host animal unaffected. Dr Janssen and his team have thus been screening thousands of compounds that might block the action of enzymes methanogens need to survive. A handful seem to, and are now being put through their paces—firstly in bubbling bottles of rumen contents (the rumen is one of the animals' stomach chambers), and then in real cattle and sheep. So far, the best of them reduce methane emissions by 20-30%, with no apparent detriment to the animal.

The problem with this approach is that it requires animals to be treated continuously, to stop the methanogens returning to full strength. This is fine when beasts are being farmed intensively, as is often the case in Europe (indeed, DSM Nutritional Products, a European firm, is working along the same lines). But cattle in New Zealand, and sheep everywhere, are normally put out to pasture, so Dr Janssen has a second string to his bow: vaccination.

To do this, his team identified and synthesised proteins found on the surface of ruminant methanogens, and injected these into sheep and cattle, to try to raise antibodies to those proteins. In that they have succeeded. The desired antibodies turn up in both the blood and the saliva of injected animals. At the moment, however, these antibodies work against methanogens only in test tubes. The vaccinations that raise them do not seem to reduce methane output.

A third approach is to breed animals with a lower propensity to burp methane. Among sheep, for example, some animals emit as much as 10% less of the gas than others. These low emitters have smaller rumens, meaning the contents pass through faster. This limits production of the hydrogen that is methanogens' food source without, apparently, limiting that part of the digestive process which feeds animals—for sheep with small rumens do not grow more slowly than those with large ones. Rumen size, moreover, is heritable. This means that a breeding programme for low-emission sheep is a plausible idea.

Dr Janssen's fourth approach is to alter what animals eat. Certain food plants—forage rape and fodder beet, in particular—curb methane emission by as much as 25% compared with the belchings of animals fed on grass and clover. However, though rape and beet are planted by some farmers as supplementary food crops, particularly for winter forage, they do not, unlike grass and clover, keep growing after being grazed. They also have a mixture of nutrients different from grass and clover, and take more effort to establish. Most farmers, therefore, would require quite a lot of persuading to use them more widely.

It was not me, it was my food...

In New Zealand, such persuasion is being discussed. Its most probable form would be what is known memorably, though inaccurately, as a fart tax (most ruminant methane is belched, not farted). Whether such a tax could actually pass through the political process of a country so dependent on farming is moot. But if an effective way of dealing with methanogens were developed, farmers might find it in their interests to adopt it anyway. Some microbial ecologists think methanogens exclude other microbes which could produce yet more fatty acids for the host animal to turn into milk or meat. If that were true, and someone such as Dr Janssen were to come up with an effective way to suppress them, no persuasion at all would be needed.

One of the simplest answers, though, may just be better husbandry. Clever pasture management, and the breeding and victualling of animals so that they produce more milk and meat for less fodder, means New Zealand's production of milk has trebled since 1990 while methane emissions from dairy cattle have only doubled over that period. Similarly, the number of sheep in the country has almost halved, with a concomitant emissions reduction, yet as much lamb and mutton is produced as ever. Reduced release of methane may only be a by-product of these gains in efficiency, but it is a welcome one. ■