The effect of SUCRAM® and Molasweet on Glucose, Na and water absorption in the lower GIT.

Background

For many years SUCRAM®, a high intensity sweetener has been considered to improve the taste profile of both monogastic and ruminant animal feed and has consistently shown to increase feed intakes. These results as summarized in Table 1, details 3 field studies, 20 private research studies and 9 university studies done in Europe, USA and Australia spanning over a period 6 years demonstrating that in 69% of the studies, SUCRAM® exhibited a positive effect on body weight gain and elected an intake response of 4.3% over control.

Table 1: Worldwide overview of SUCRAM® for piglets

Parameter	Control	SUCRAM	Difference
Average no Piglets/treatment	89	89	
Average inclusion rate of Sucram/ton feed	0	271	
Average study period (days)	18.8	18.8	
Average start weight (kg)	6.6	6.6	
Average end weight (kg)	12.4	12.6	101.80%
Average Feed intake (grams/piglet)	366	375	102.50%
Average body weight gain (grams)	303	317	104.30%
FCR	1.22	1.19	97.40%

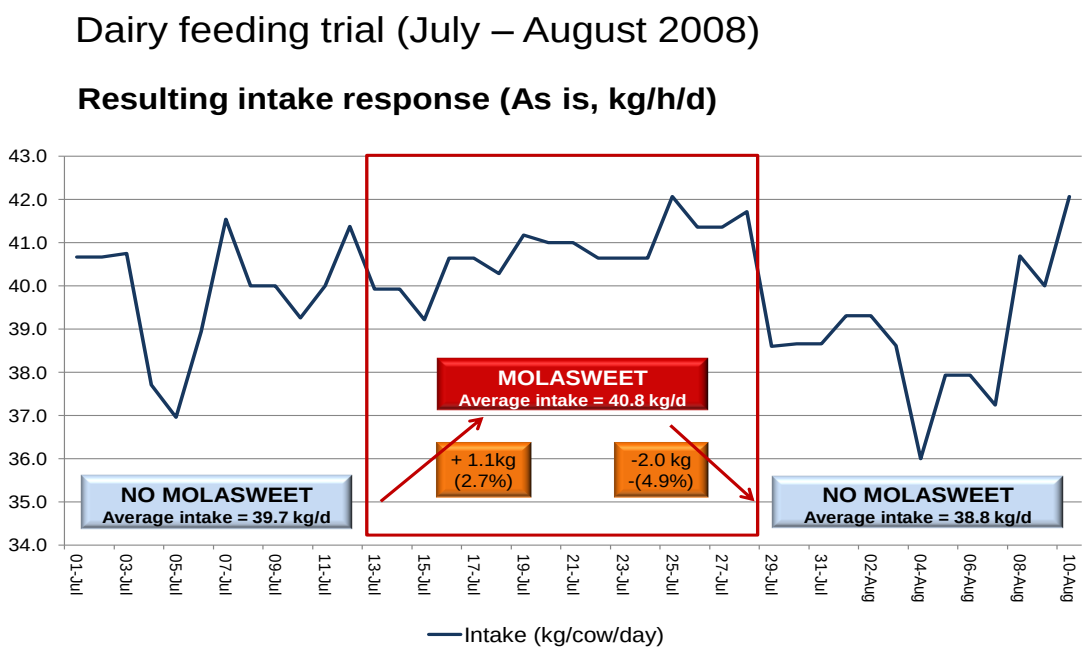
It is well documented that dairy calves and receiving feedlot cattle have a high affinity for SUCRAM® and the receiving cattle data can be summarized in Table 2 by two unique pieces of research done by Galyean et al, 2004 from Texas Tech University and Brown et al, 2004 from West Texas A&M University. From the table it can be concluded that not only does SUCRAM® improve intake but the response is also demonstrated in improved body weight gains and resultant reduction in the number of pulls and repulls.

Table 2: Summarized performance of receiving cattle fed SUCRAM®

Parameters	West Texas A&M University	Texas Tech University
Feed Intake	+17%	+4%
Body weight gain	+23%	+7%
FCR	+6%	+4%
Pulls	-7%	-3%
Repulls	-20%	-22%

Utilizing SUCRAM® as a base product for multi sensory high intensity flavouring palatants to create products such as Molsweet, similar intake responses have also been achieved with dairy, beef and sheep feeds. Figure 1 illustrates work done (on farm trial, 2009) on dairy cattle where Molasweet was added to a typical TMR diet to the high producing group and monitor intake patterns over a 6 weeks period. It becomes evident that not only does Molasweet elect an intake response, it also minimizes fluctuation in feed intake patterns. This in itself will lead to a stable rumen pH and this will translate into improved VFA production and so to milk production.

Figure1: Feed intake patterns of dairy cows fed Molasweet over a 6 week period.



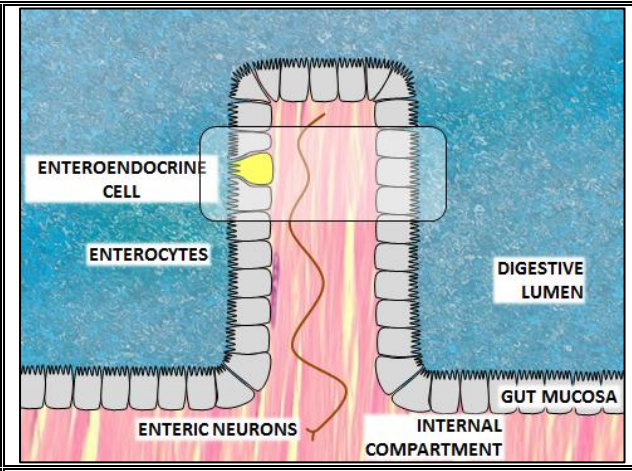
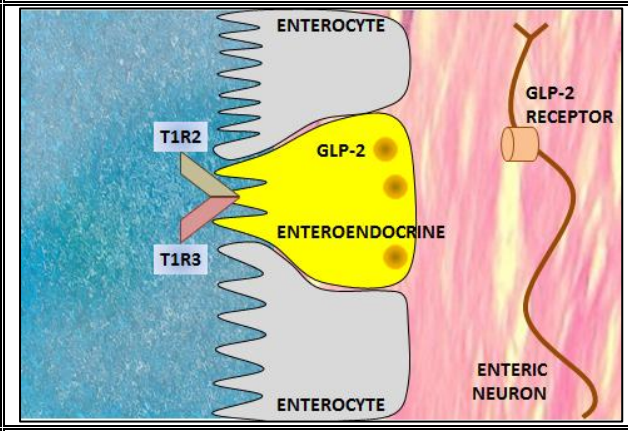
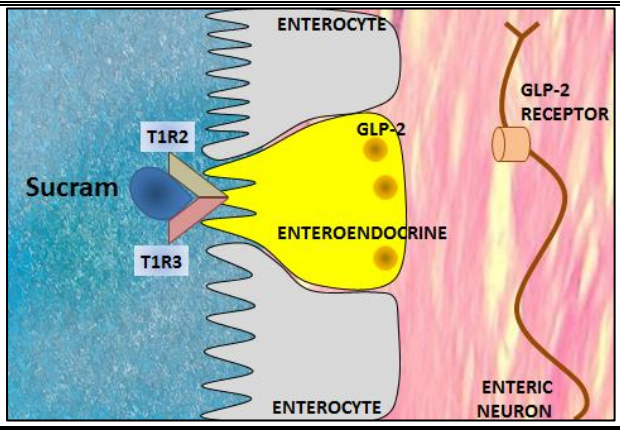
As scientists move to answer why there are elected intake responses and what may happen at Gastro Intestinal Tract (GIT) level, new and exciting discoveries in the field of human nutrition indicated that there is a functional and independent mode of action for SUCRAM® and Molasweet, within the lower GIT of both monogastic and ruminants.

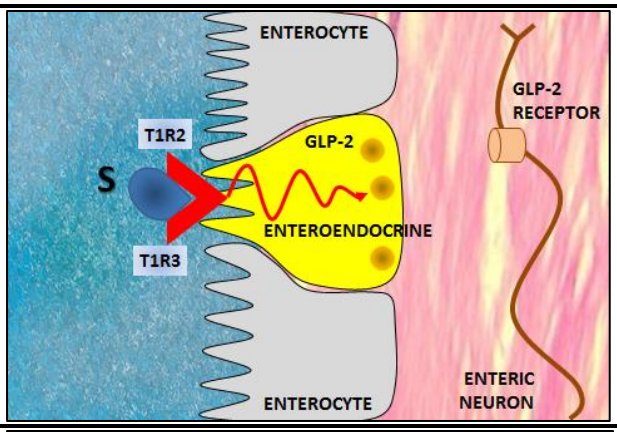
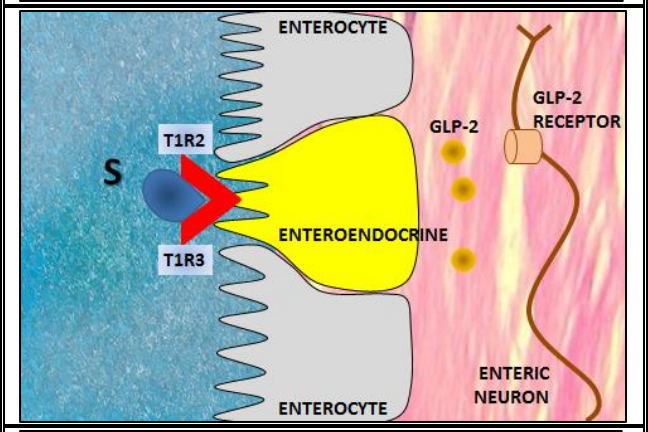
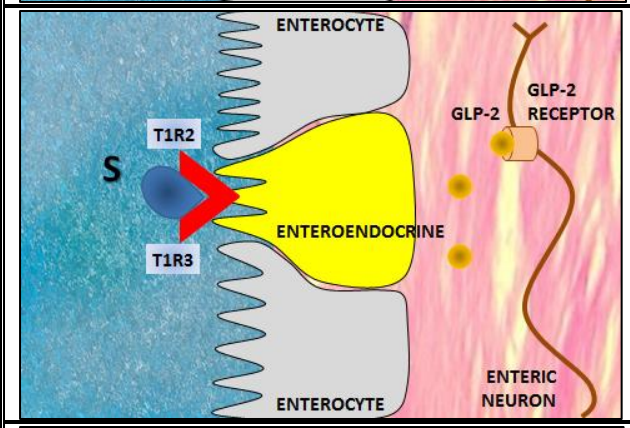
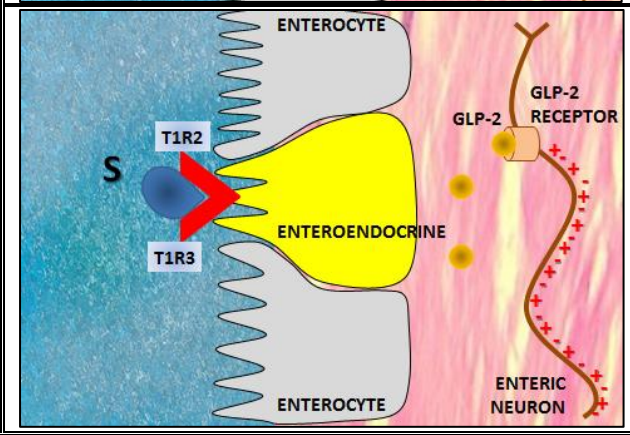
2nd Brain theory

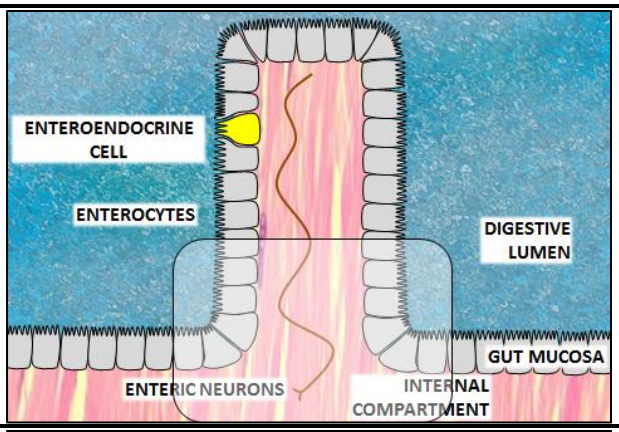
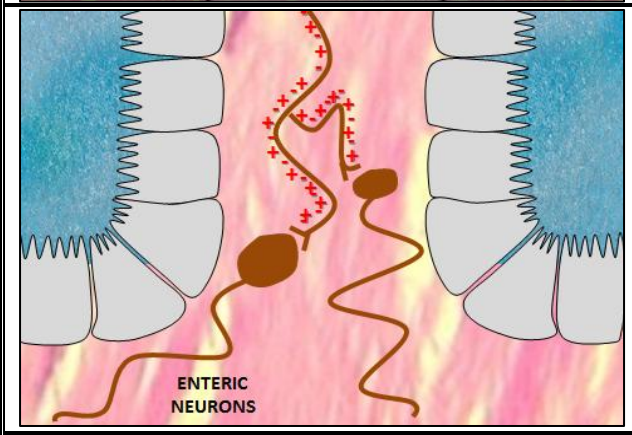
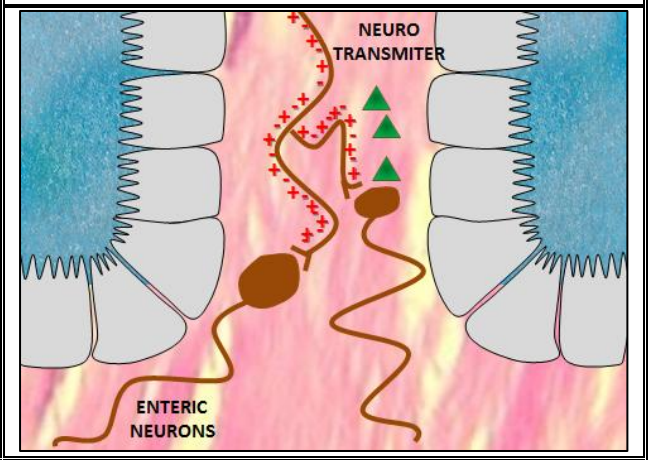
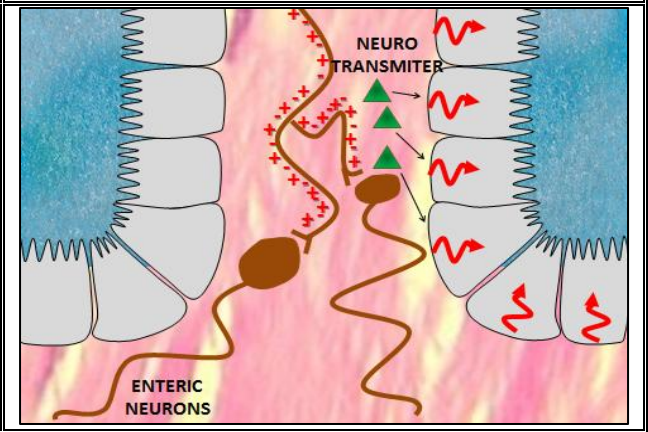
For some time it is known that the GIT is a highly refined organ with its own sensory system and could act as a "2nd brain". Within the GIT wall, but not entering the gut mucosa, is a network of enteric neurons that operates independently of the central nervous system. This system directly controls the GIT system (Berthoud et al, 1995). The link between the GIT content and the enteric neurons is made up by a particular category of cells: the enteroendocrine cells (EEC's). These EEC's account for about 1% of the gut mucosa (cells outlining the GIT) (Rehfeld, 1998) and are described as specialized sensors. It means that they can sense the content of the gut and then pass the information to the enteric neurons. This message is being conveyed by the secretion of different peptides or "gut hormones", for example GLP-1 (Glucose like peptide 1), GLP-2 , serotonin etc (Sternini et al, 2008). This is why EEC's are important drivers for the regulation of gastrointestinal secretion and motility, food intake and satiety, and glucose homeostasis. This is done by the sensing of different compounds in the gut.

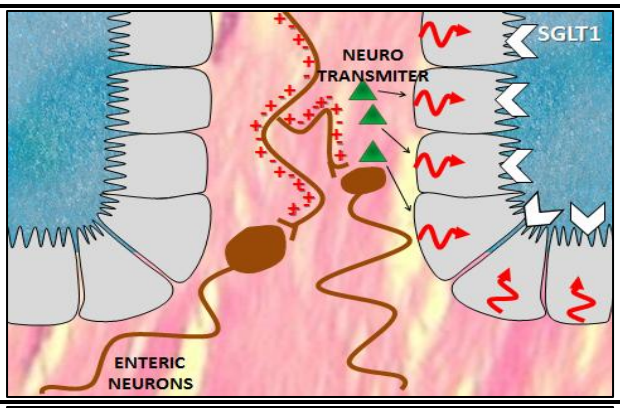
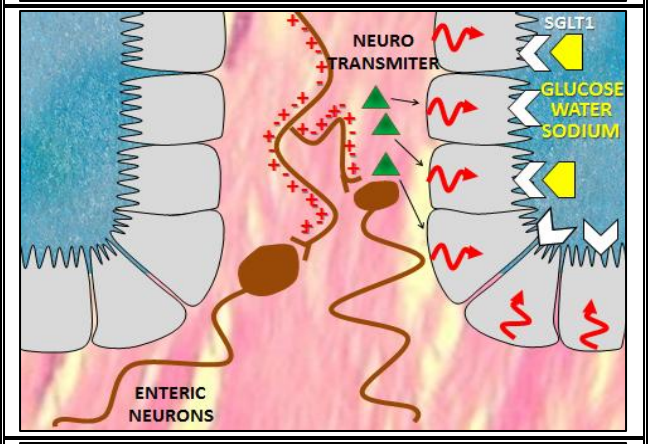
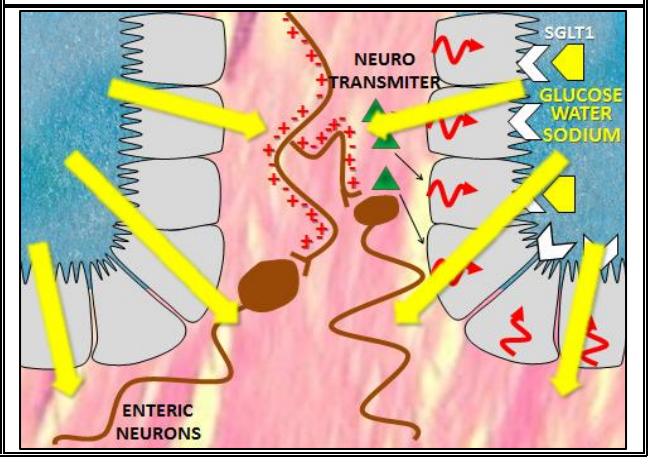
Mode of action

Moran et al, 2010 using pigs as a model recently discovered that there is a strong interaction between SUCRAM® / Molasweet and EEC. This complex interaction can be demonstrated in a series of annotated slides as follows:

1. Enteroendocrine cells (EEC's) are in the outer layers of the epithelium of the lower GIT and only 1% of outer layer cells.	
2. One dimeric taste receptor, T1R2+T1R3 is connected to the outside of the EEC's.	
3. Small quantities of SUCRAM® flows in the lower GIT and due to the high affinity of EEC's for SUCRAM®, it finds its way to the EEC and taste receptor compound and attach to the receptors.	

4. This result into a downstream signal that stimulates the EEC's to secrete, among others, GLP-2 hormone into the GIT wall.	
5. Inside the GIT wall is the network of enteric neurons to which GLP-2 receptors are attaching to.	
6. The GLP-2 hormone moves from the EEC and attach onto the GLP-2 receptor.	
7. This creates an impulse that is transferred via the neuron the rest of the enteric neuron system.	

8. The focus moves now to the area at the lower end of the enteric neuron.	
9. The impulse reaches the other enteric neurons.	
10. The neurons then secrete a neuro transmitter into the internal compartment of the GIT wall.	
11. These neuro transmitters send an impulse to all the other enterocyte cells (which make up the largest number of mucosa cells).	

12. Sodium/Glucose co-Transporter (SGLT1), a protein that is responsible for absorption of glucose, is attached to the enterocyte cells.	
13. The neuro transmitter impulse then stimulates the number and activity of SGLT1 to increase the absorption of Glucose from the digesta into the enterocyte cells.	
14. Water and Sodium are also absorbed together with glucose by SGLT1. This absorption is in the ratio of 1 glucose, 1 sodium and 250 water.	

In discussion

It is clear the SUCRAM® / Molasweet stimulate the absorption of glucose, sodium and water in the lower GIT. This increase in absorption leads firstly to an increase in energy uptake (in the form of glucose) derived from the feed and secondly, as SUCRAM® / Molasweet is evoking GLP-2 release, this gut hormone also has an effect on the villi health in the GIT(Taylor-Edwards et al, 2011). It is important to note that due to the high affinity of EEC's for SUCRAM®/Molasweet, one needs only a small amount to have the required effect. Furthermore, SUCRAM® / Molasweet will also play a great roll in rehydration of animals due to the effect it have on water absorption.

Conclusion

Therefore could therefore be concluded that SUCRAM® / Molasweet does not only have an effect on the taste and smell of animal feed, but also have in functional effect in the GIT by stimulating the absorption of glucose, sodium and water.

Reference

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