Discussion Group for ISAPP – Environmental Probiotics

Wed June 3rd, 2020

Goals:

•Identifying the scope and importance of using beneficial microbes for environmental/ecosystem purposes.

•Categorize which products/applications should be included in the probiotic/prebiotic definition and which should not.

		Speaker
10.00am	Introductions – The panel of experts	Gregor Reid, Lawson Health Research Institute, Canada
10.10am	Examples of what's out there – from yoga mat sprays to coated toilet paper	Gregor Reid
10.20am	Biodegradation and bioremediation in waste-water treatment systems	Greg Gloor, Western University, Canada
10.30am	Biodegradation of drugs	Jeanne Kagle, Mansfield University, PA, USA
10.40am	Waste-water and aquaculture	Rao Changanti, University of Michigan, USA
10.50am	Plant and crop production	Akos Kovacs, Denmark
11.00am	Plant health to improve milk productivity in cows	John Al-Alawneh, University of Queensland, Australia
11.10am	Honey bees as recipients and deliverers of probiotics (Elina Nino was supposed to present, but Brendan filled in at last minute)	Brendan Daisley, Western University, Canada
11.20am	Open discussion on categorizing which products/applications are probiotic/prebiotic and which are not	Gregor Reid - mediator
Noon	Adjourn	

Key Points from the Presentations and Discussion

1. This virtual session was attended by 55 people including several ISAPP Board members, students and fellows, industry scientists and experts.
2. The **outstanding presentations** illustrated the breadth of applications across the environment for probiotics, prebiotics and beneficial microbes. These included degradation of highly toxic compounds and drugs in waste-water treatment facilities; applications to salmon, trout and shellfish farming and beekeeping; probiotics for plant hosts (improving growth, yield, health) and their subsequent benefits to livestock (improving health, milk production, less mastitis) and humans.

3. **Website examples** of some uncommon products (e.g.odor reducers, sanitizers, mattresses, etc) labeled as 'probiotic' or 'prebiotic' were selected at random (see table below) to illustrate the current marketplace (mis)use of these terms. It was proposed that these products do not meet the published definitions and should use other terminology, for example as below. In many of the examples provided, even if evidence was available to prove some type of benefit from such products, it is clear that not all conceivable microbe-induced benefits should be considered to be probiotic benefits. Companies need to refrain from using the terms probiotic and prebiotic when they do not meet the relevant criteria.
4. The session raised **critical points about the breadth of the probiotic and prebiotic definitions.**
   Probiotic: "Live microorganisms that, when administered in adequate amounts, confer a health benefit on the host".
   Prebiotic: "A substrate that is selectively utilized by host microorganisms conferring a health benefit"
   - **The 'host'** has to be a living organism. It cannot be dirt or nutrients in soil, nor a commensal such as *Rhizobium* that provides a benefit to plant growth. But, potentially a host could be a microbe, such as one administered to the soil that is then shown to confer a benefit to the plant.
   - There seems to be consensus that further discussion on what constitutes a **'host'** is warranted, given the range of products now claiming to be probiotic or prebiotic. This could clarify issues such as phage, other microbes, unicellular v multicellular, direct v indirect effects.
   - The **word host** in the context of the Hill et al 2014 paper was understood to mean a live organism. It was not limited to humans, but includes also companion and agricultural animals, fish, plants, insects, etc.
   - If we consider a host being another microbe, how does that fit the definition? It can't simply be mutualism. What is meant by a 'health' benefit? The World Health Organization definition of health is "a state of complete physical**,** mental**,** and social well-being**,** and not merely the absence of disease or infirmity"**.** This implies that **hosts** need to have a 'brain' to be mentally well. If we ignore the 'mind' part and just state free from disease, would that work?
   - The issue of whether the effect needs to be **direct or can be indirect** was raised and not fully resolved during the meeting. Does the probiotic effect need to be direct or can indirect effects qualify? Although there are many beneficial effects of microbes (making fermented foods, producing antibiotics, processing waste water, etc), our current understanding is that a probiotic must exert a benefit on the host directly. However, clarification of this point may be needed. The issue was raised that removing a toxin or drug from waste-water is a primary intent and a benefit to humans who subsequently drink the water, but the primary benefit is to degrading a

toxin not to contributing to human health, thus the application to the waste-water treatment would not represent a probiotic.

- In a **waste-water treatment system**, could a probiotic be applied to propagate the 'beneficial strains'? Not unless there was correlation with a specific benefit to the host which downstream might be fish, frogs, or animals and human consuming the water. But this needs more thought. It is important to remember intent, reasonable interpretation and avoidance of incorrect extrapolation of the definitions.
- In the case of using **a probiotic to cover plants or soil** and the strain ends up helping the plant grow via the roots, is improving yield a health benefit? If the 'healthier plant' then has better nutrition for the cow which then produces more milk and the cow has less mastitis, is this a secondary probiotic benefit? Is this a benefit due to a post-biotic? Of note, a consensus statement and definition of 'postbiotic' is pending publication.
- If the 'probiotic' is improving yield, would it not simply be called a fertilizer?

Product	Does it meet the definition?	What should it be designated?
SCD Probiotic home and garden and other household cleaners: microbial consortia	No	Microbial cleaner?
Betterair probiotic purifier: unknown content?	No	Spore-forming bacterial cleaner?
PureBiotics: spore-forming bacteria	No	Spore-forming bacterial cleaner?
Z-Probiotic: mixture of organisms for cleaning	No	Microbial cleaner?
ProBac cleaner	No	Spore-forming bacterial cleaner?
Luma probiotic cotton mattress	No	?
Aveeno Moisturizer	No	Moisturizer with colloidal oatmeal
Andrex prebiotic toilet paper: almond oil, butter, argan oil	No	Lotion-coated toilet paper
Beneo inulin cleaner for farmers	Yes Prebiotic	
Chrisal's mist	No	?
Yogibiotix yoga mat cleaner	No	No longer on market?
Natren's Jourdan Probiotic aftershave	No	Fake news?

In summary, thanks to all who presented and took part in the discussion. I trust this properly represents the session and provides an insight into points raised by participants. There are clearly issues that need to be further resolved and potentially presented as a paper or some other printed document, at least urging companies to use alternatives to probiotic and prebiotic until they sufficiently prove their product fits the definition. That remains for the future.

Gregor Reid, 4th June, 2020