



THURSDAY, DECEMBER 11, 2014

**MICROBIAL DYSBIOSIS – A PERSONAL CARE
PERSPECTIVE.**

BARRY MURPHY MICROBIOMICS UNILEVER



ABOUT UNILEVER

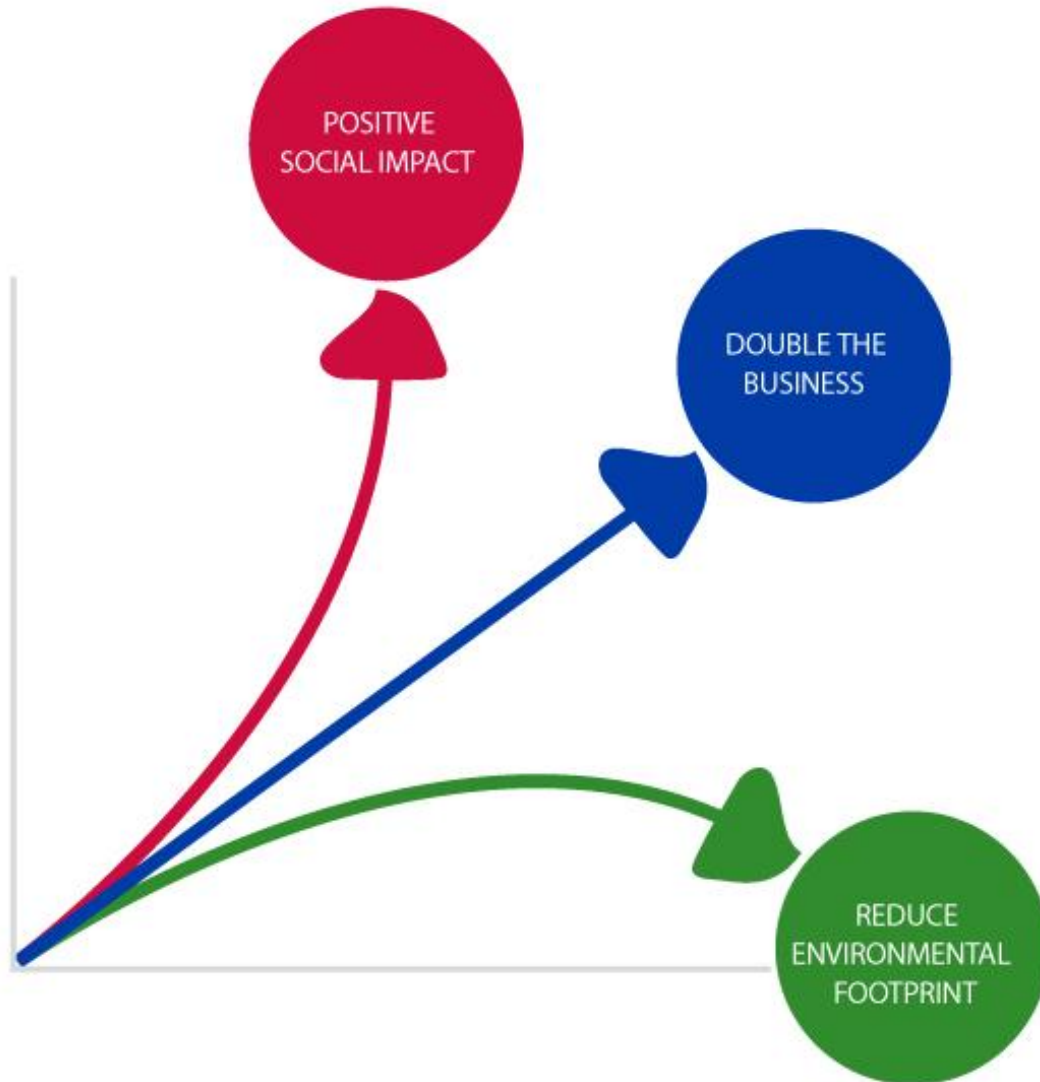


Unilever is one of the world's leading suppliers of fast-moving consumer goods.

Our products are sold in over 190 countries and used by 2 billion consumers every day.



OUR COMPASS STRATEGY



Our vision is to double the size of the business, whilst reducing our environmental footprint and increasing our positive social impact.

The Compass provides a blueprint for success by identifying what we must do to win share and grow volume in every category and country.

OUR €1 BILLION BRANDS



14 Unilever brands have a turnover of €1 billion or more

Personal Care



Foods



Refreshment



Home Care



INTEGRATED R&D



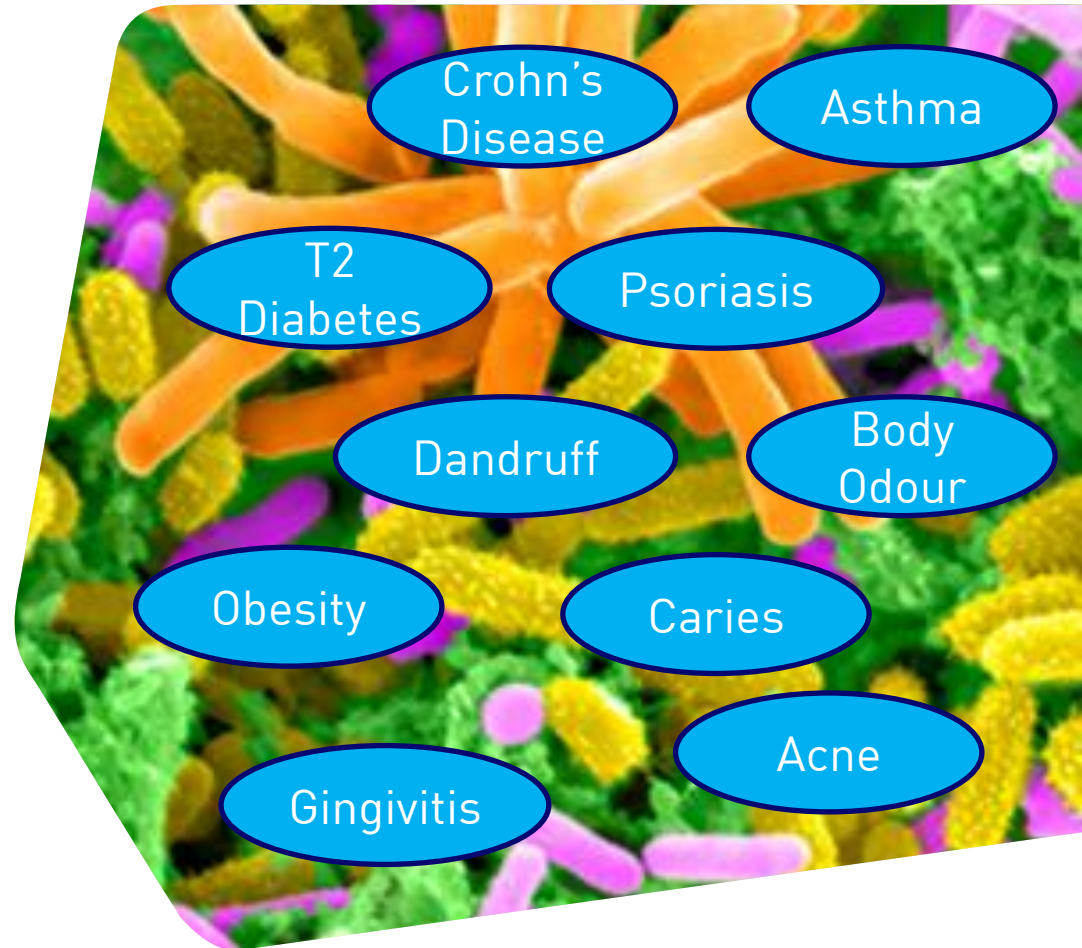
- More than 6,000 R&D professionals
- Six key R&D sites delivering groundbreaking technologies: Bangalore (India), Colworth (UK), Port Sunlight (UK) Shanghai (China), Trumbull (US), and Vlaardingen (NL)
- 92 locations around the globe with R&D teams implementing innovations in countries and factories



UNDERSTANDING MICROBIAL COMMUNITIES



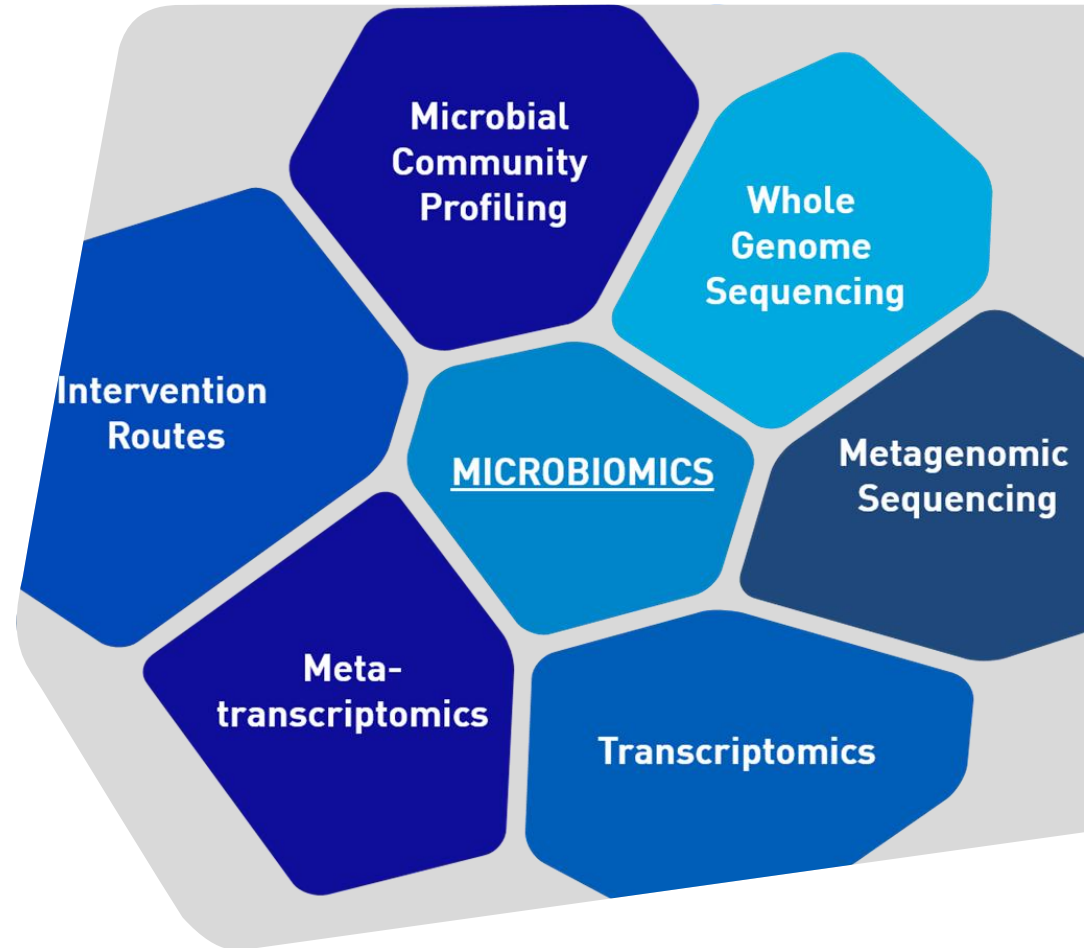
- Key to a number of Unilever categories.
- Microbial communities implicated in malodour, multiple skin conditions and caries.
- Heightened need to understand the roles of communities and of individual organisms.
- When trying to understand the community it is essential that we do not forget about the host!!!



MICROBIOMICS IN UNILEVER



- A move away from the traditional culture based methods.
- Evolved from 454 to Illumina sequencing.
- Efficient sampling methods for a number of category interests.
- Bioinformatic pipelines in place to process data for taxonomic classification
- While a shift to microbiomics over plates has its advantages there are disadvantages also.



IMPORTANCE OF MICROBIAL COMMUNITIES

- **Deodorants** –Major routes to malodour are VFA's, Odorous steroids and Thioalcohols.
- All are produced by the microbial breakdown of non odorous precursors found in human sweat.
- *Staphylococcus* and *Corynebacterium* implicated in axillary malodour.
- Host genetics important – ABCC11 protein necessary for transport of AA linked thioalcohol precursors.



IMPORTANCE OF MICROBIAL COMMUNITIES



- **Oral Care** - *Streptococcus mutans* strongly linked to caries formation.
- Importance of biofilms in oral care – plaque.
- Production of acids and endotoxins in anaerobic conditions leads to numerous conditions
- *Porphyromonas gingivalis* known to be a “key stone” species in periodontitis.

The Signal logo, featuring the word 'Signal' in a bold, dark blue, italicized sans-serif font. A red and white brushstroke graphic is positioned above the 'i' in 'Signal'.

The REGENERATE ENAMEL SCIENCE logo, with 'REGENERATE' in a large, bold, blue sans-serif font and 'ENAMEL SCIENCE' in a smaller, blue sans-serif font below it.

The Closeup logo, featuring the word 'Closeup' in a bold, blue, italicized sans-serif font with a white outline and a slight shadow effect.

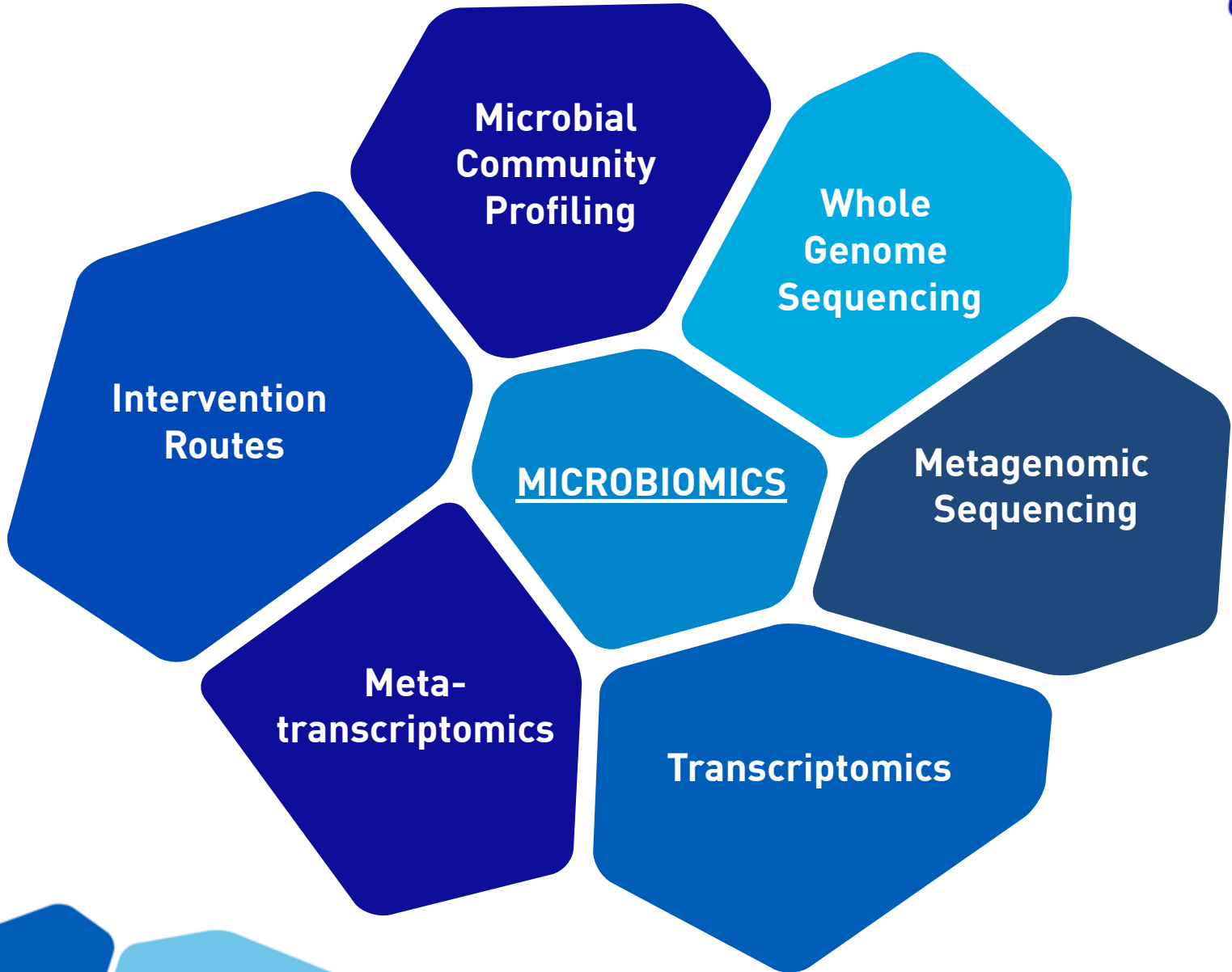
IMPORTANCE OF MICROBIAL COMMUNITIES



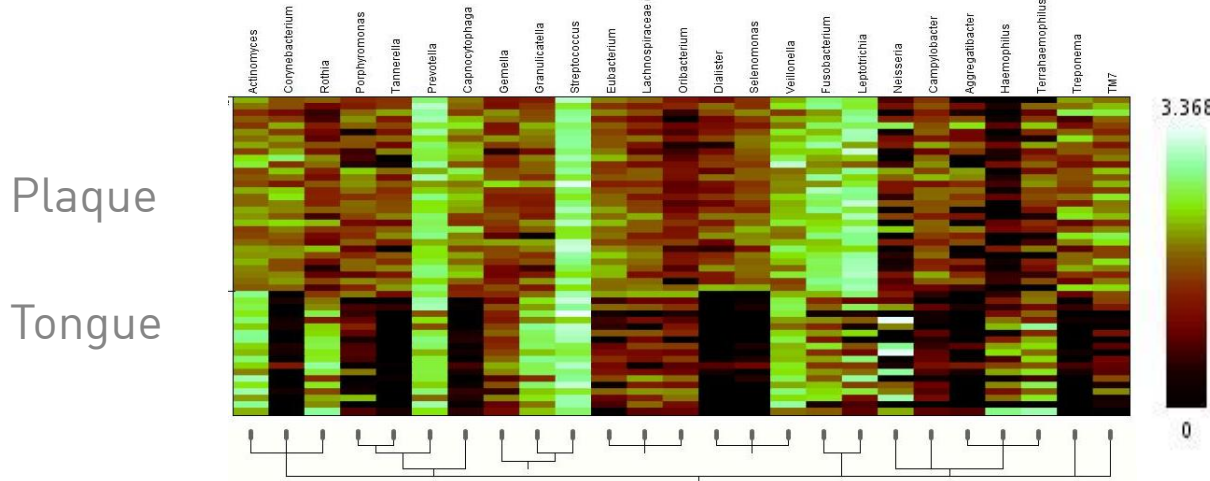
- **Scalp Care** – *Malassezia* and *Staphylococcus* spp. implicated in dandruff.
- Outgrowth of particular species associated with dandruff but incomplete understanding.
- Host genetics are possibly important.
- Transcriptomics have been used to elucidate the mode of action of a number of actives.



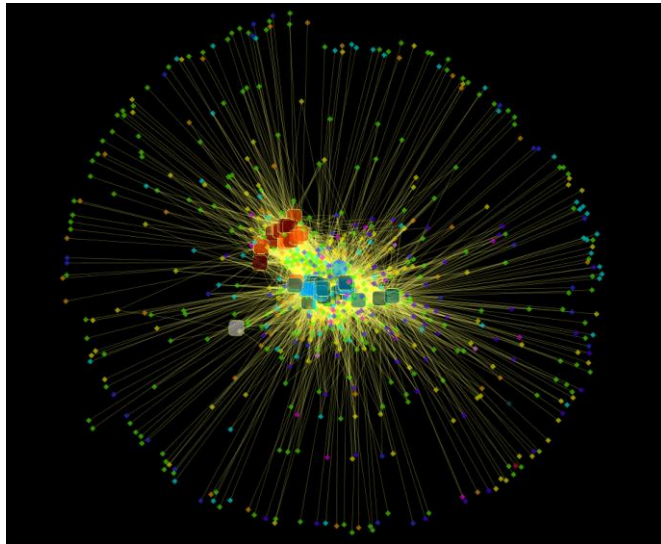
MICROBIOMICS



VISUALISING MICROBIAL COMMUNITIES

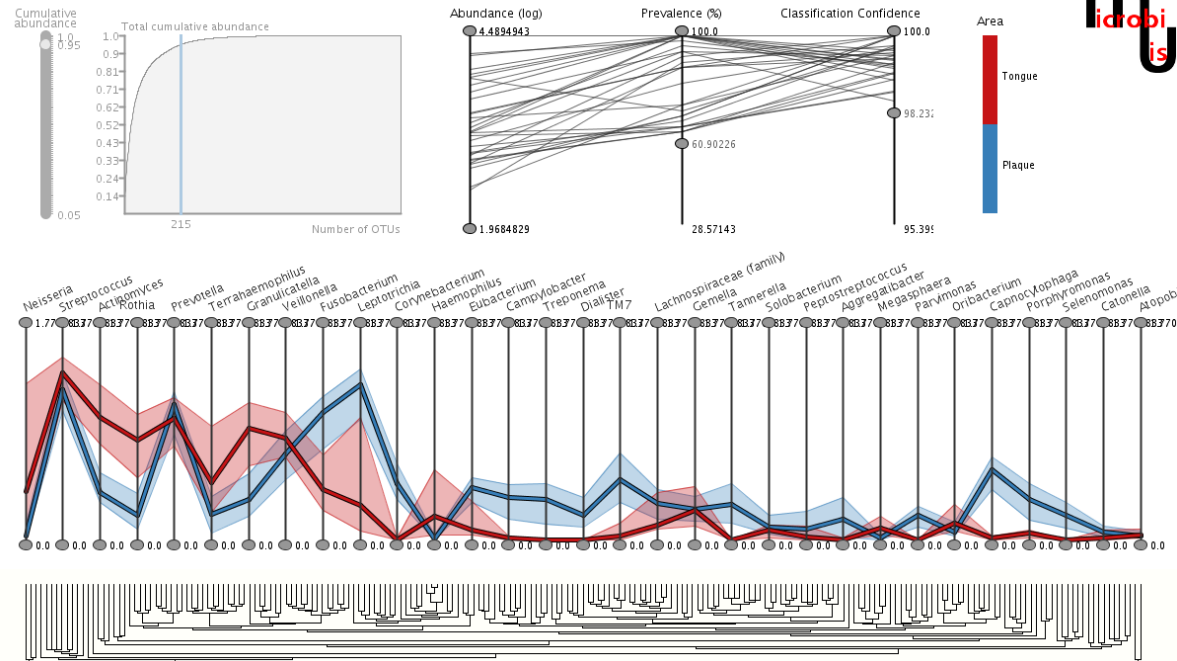


Heatmapper
Microbiviz
Cytoscape



Orange/red – tongue
Blue – plaque

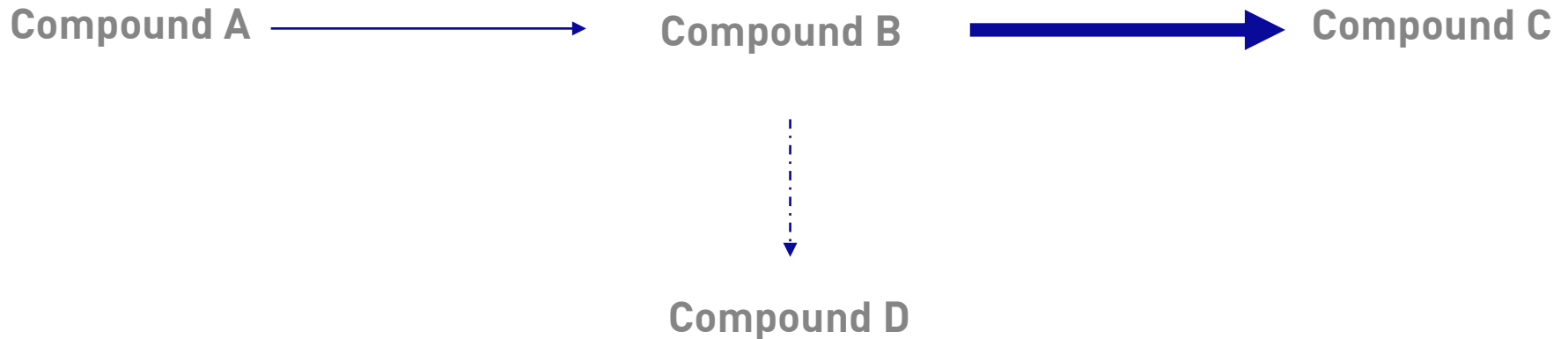
Screenshot from MicrobiVis 2.0 – 21 Nov 2014 15:15 – Visualization author: Sara Johansson Fernstad



FLUX BALANCE ANALYSIS

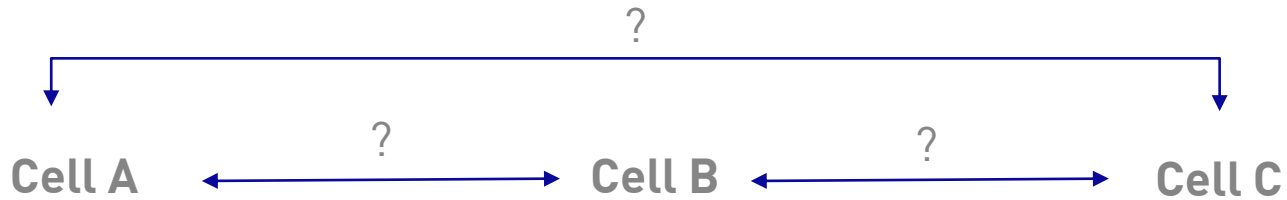


Relatively simple analysis when kinetic data is available

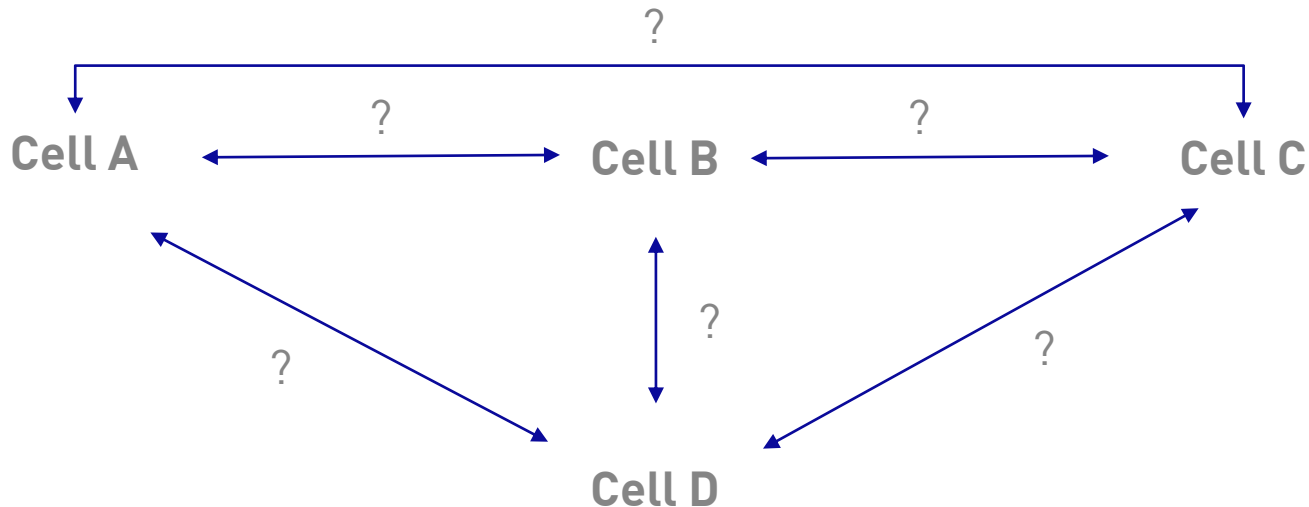


Essential in biotechnology in order to improve metabolite production

FLUX BALANCE ANALYSIS



Much more complicated when whole cells are used in this context

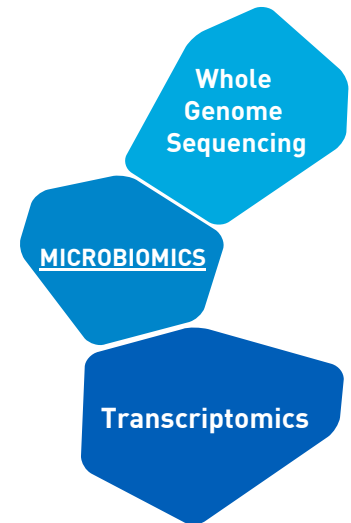
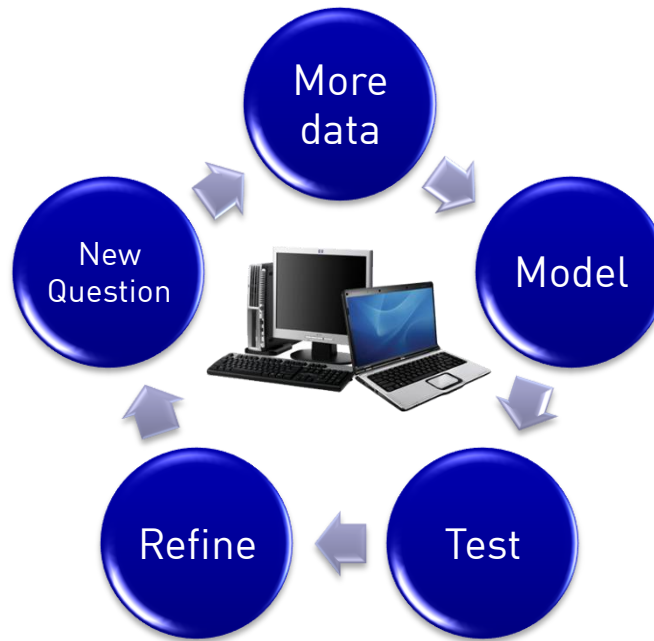


How can we model these relationships? How much data do we need?

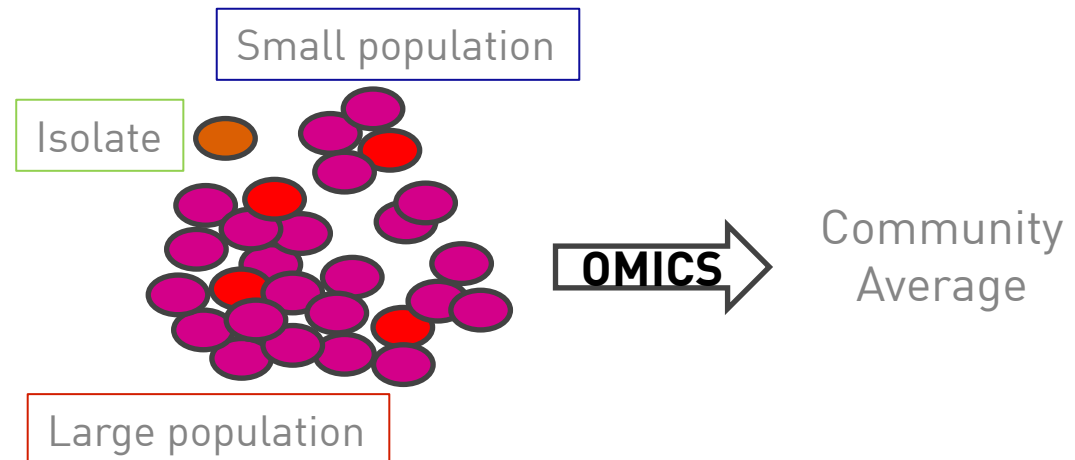
FLUX BALANCE ANALYSIS IN “PURE” CULTURE



- Using RNA seq data to determine expression profiles in response to actives.
- Possible to use data to develop *in silico* constraint based models for further analysis.

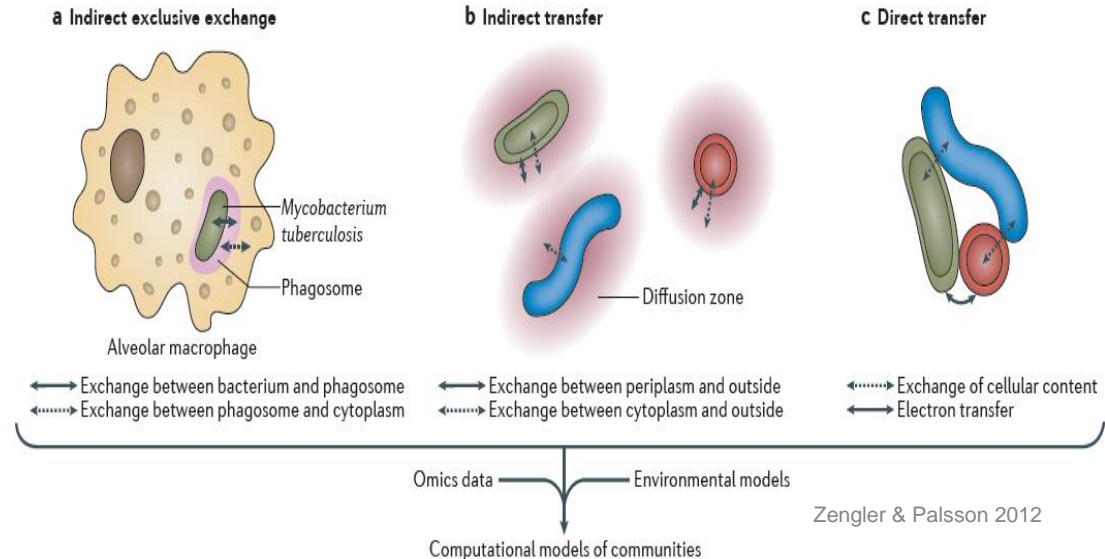
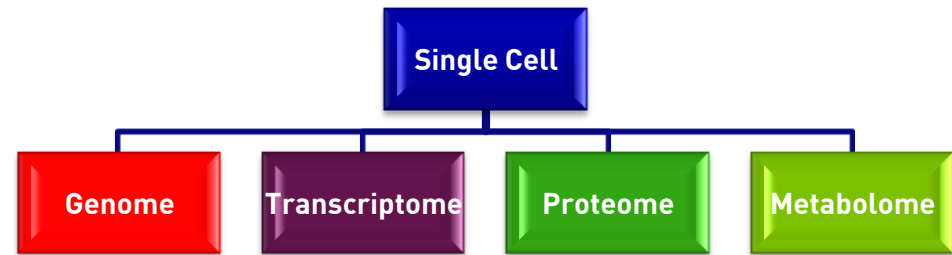


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- Numerous assumptions being made including that the population is homogenous.
 - Also does not represent the true state of the organism *in vivo* with regard to community interactions.



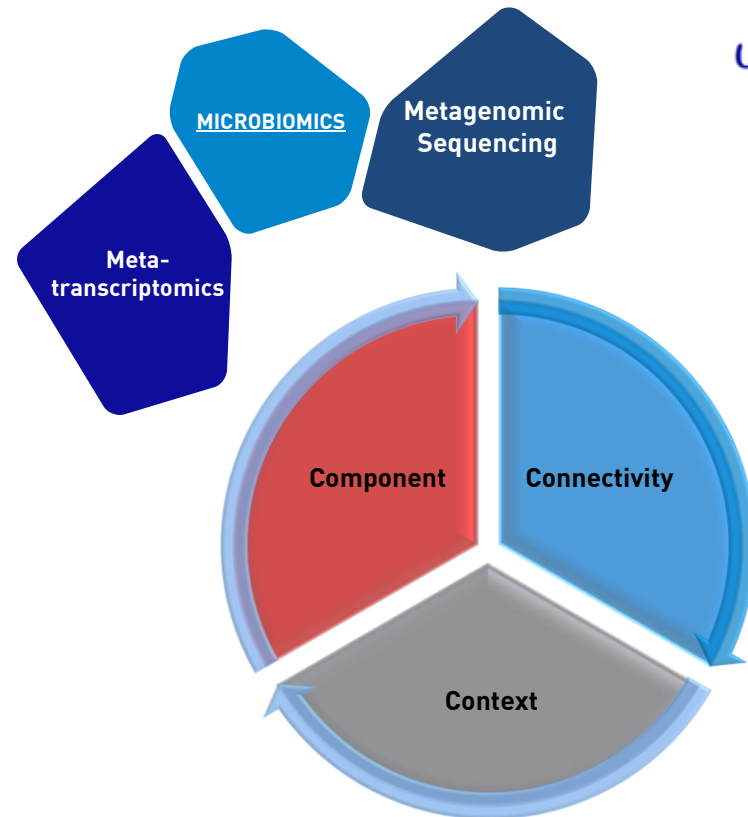
SYSTEMS BIOLOGY: BOTTOM UP APPROACHES

- Cultivation approaches will result in dominant/less fastidious taxa being analysed. Must go beyond barcode analysis.
- Does not take into account interactions between community members (+ve/-ve/neutral) and host/environment.
- Genome Scale Metabolic Reconstruction
- Will this form of analysis even be needed in the future. What is there v's what are they doing?



SYSTEMS BIOLOGY: TOP DOWN APPROACHES

- Can target whole community but lack of resolution.
- May allow the study of community interactions without knowing key members.
- Requires the integration of multiple datasets across species.
- Genomics leading the way but other techniques need to evolve further.
- Better datasets and databases are needed, Kyrpides et al., 2014.



Excellent

- Genomics
- Transcriptomics
- Epigenomics



Developing

- Metabolomics
- Lipidomics

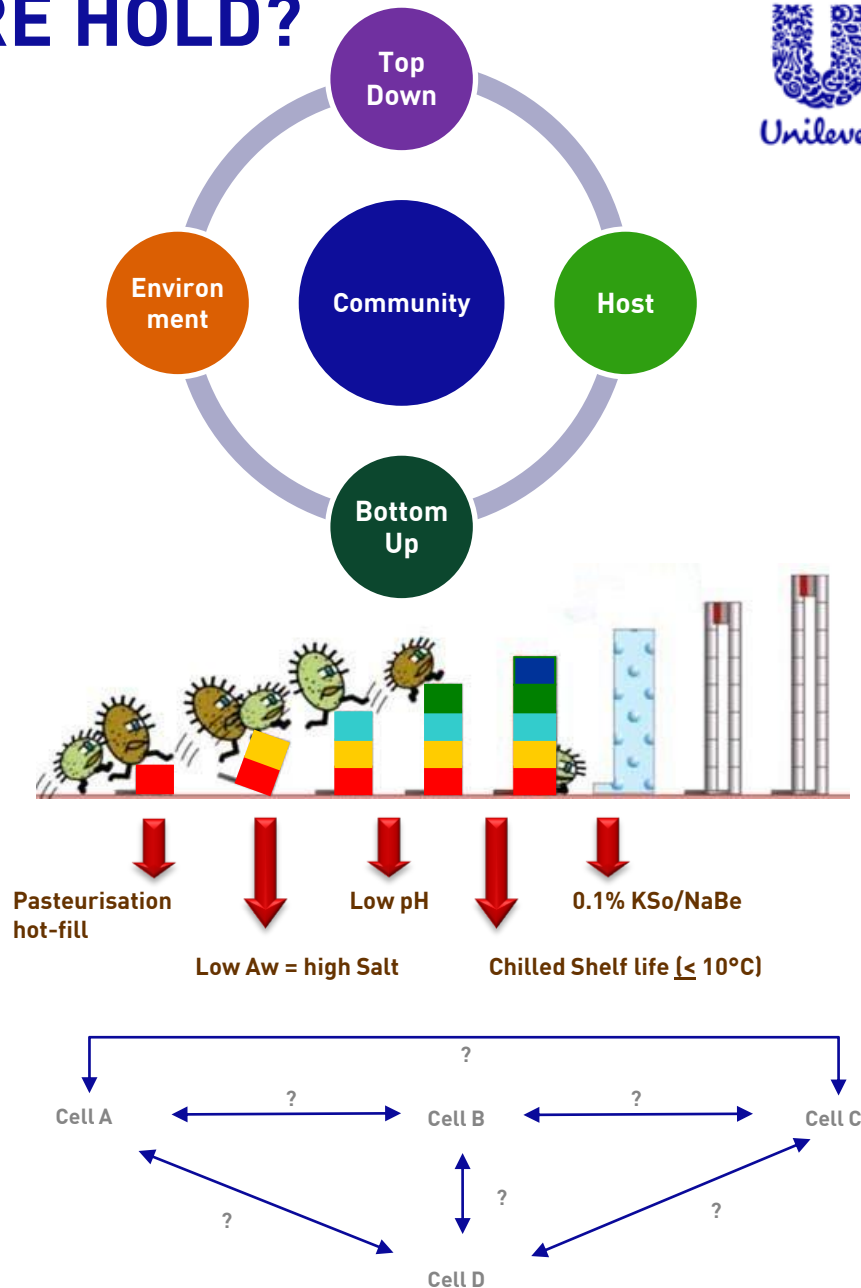


Basic

- Proteomics

WHAT WILL THE FUTURE HOLD?

- Multi-integration strategies (Weight)
- Predictive modelling can be used to evaluate intervention routes, quicker/cheaper/safer.
- Can predictive models be used to determine the effect of broad spectrum antimicrobials / hurdles.
- Community model where affect of removing a particular species is revealed. How will the remaining members adapt to fill the niche?



ACKNOWLEDGEMENTS

Port Sunlight

Sally Grimshaw

Suzi Adams

Joanne Hunt

Jane Shaw

Dave Arnold

Sara Johansson Fernstad

Noel Ruddock

Mark Harker

Svetlana Riazanskaia

Janette Jones

Clive Harding

Shanghai

Wentao Peng

Tiger Huang

Elaine Xu

Mike Hoptroff

University of Glasgow

Umer Ijaz

Colworth

Adrian Smith

Jenny Pople

Rebecca Ginger

University of Warwick

Chris Quince



UNIVERSITY OF
LIVERPOOL

University of Liverpool

Neil Hall

John Kenny

Christiane Hertz-Fowler



University
of Glasgow