



# From Knowledge to Commercialisation

## FUTURE OF THE MICROBIOME SUMMIT 2021

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# Outline

- APC Overview
- Tech transfer by numbers
- IP Licence examples
- APC spin-outs
- Concluding thoughts

# APC Microbiome Ireland

250 people

18 Senior Faculty



*Multiple **basic research** and **clinical** disciplines applied to same problem*  
**Microbiology, immunology, pharmacology, neuroscience, food science,  
nutrition, biochemistry, pharmacy, physiology,  
Gastroenterology, psychiatry, cardiology, gynaecology & obstetrics, oncology,  
pathology, gerontology, paediatrics, infectious disease**

# APC Senior Faculty



Prof Paul Ross  
APC Director  
Anti-microbials  
Food biopreservation



Dr Marcus Claesson  
Omics; Bioinformatics  
IBD



Dr Cormac Gahan  
Food pathogens  
Bile acid signalling  
Host-microbe dialogue



Prof Fergus Shanahan  
IBD & inflammatory disease  
Host-microbe signalling



Dr Gerard Clarke  
Gut-brain axis  
Pre-clinical models  
Psychobiotics



Prof Douwe van Sinderen  
Bifidobacteria & Early life  
Starter cultures & LAB  
Bacteriophages



Prof John Cryan  
Gut-brain axis  
Psychobiotics  
Pre-clinical models



Prof Paul Cotter  
Food microbiomes  
Fermented foods  
Athletes



Prof Ines Thiele  
Computational models  
Diet-health interactions



Prof Elke Arendt  
Food technology  
Plant-based diets  
Product development



Prof Catherine Stanton  
Early life microbiome  
Probiotics / prebiotics  
Food interventions



Prof Jens Walter  
Diet, fibre & microbiome  
Microbial ecology  
Human studies



Prof Noel Caplice  
Cardio-metabolic health  
In vivo porcine models  
Clinical trials



Prof Colin Hill  
Bacteriophage  
Anti-microbials  
Food biopreservation



Prof Liam O'Mahony  
Immunology & microbiome  
Allergy & Asthma  
Skin microbiome



Dr Ken Nally  
Gut inflammation  
Host-microbe dialogue



Prof Subrata Ghosh  
IBD & inflammatory disease  
Host-microbe signalling



Prof Paul O'Toole  
Ageing & microbiome  
Food interventions  
Gut ecology

Highly Cited  
Researcher  
2020

Clarivate™

# APC Structure





# APC Research Pillars

## RESEARCH THEMES

ONE

Microbes  
to  
Molecules

TWO

Diet & Microbes  
at the  
Extremes of Life

THREE

Brain- Gut  
Axis

FOUR

Host-Microbe  
Dialogue

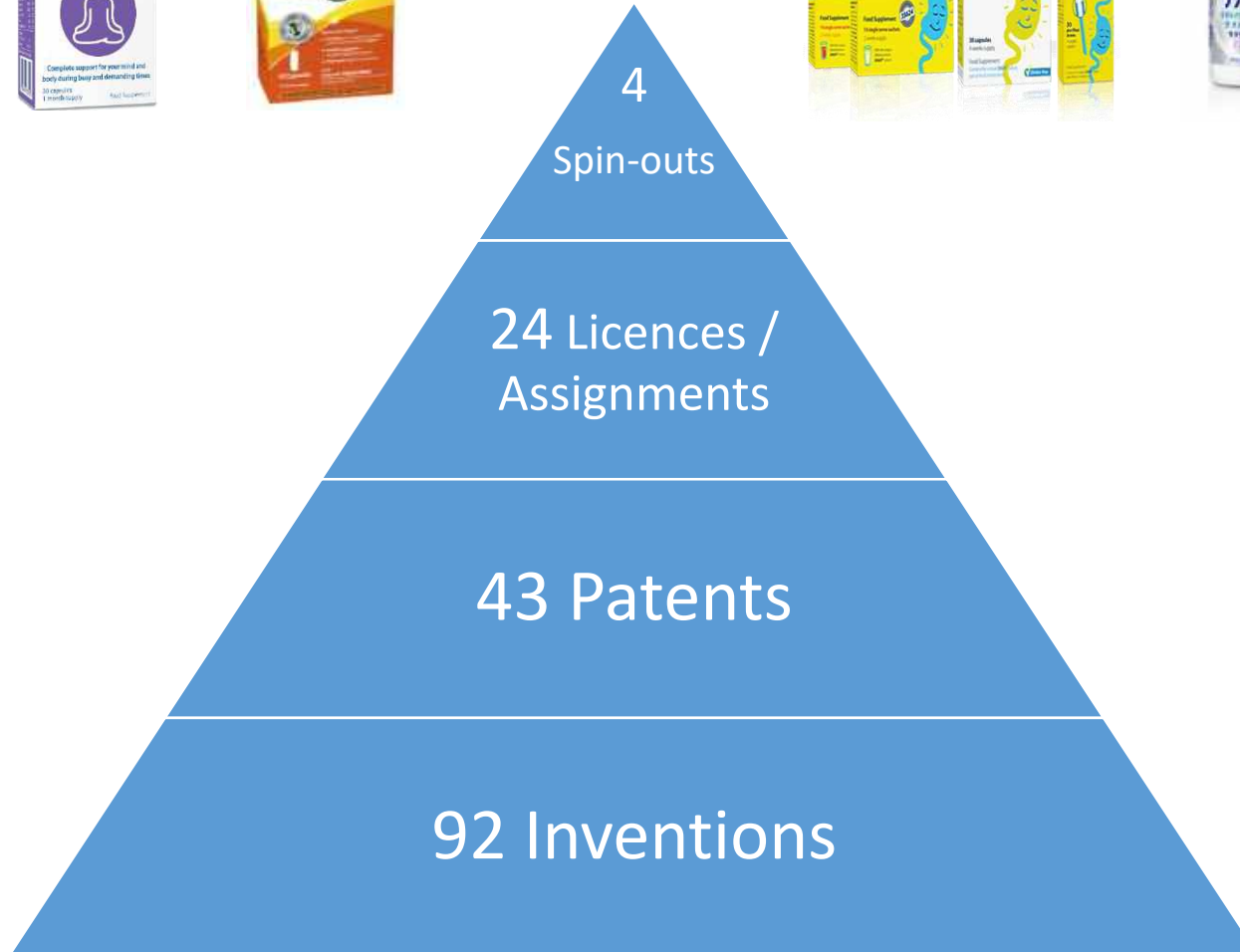
- Mine the microbiome for bioactives
- Bacteriocins and bacteriophages
- Develop prebiotics with high selectivity for bifidobacteria

- Mechanistic links between diet, microbiota and health
- Microbiome in infancy, elderly
- Microbiome signatures of health & disease

- Microbiome and stress
- Microbes, diet and cognition
- Develop psychobiotics for mood
- Microbiome in circadian rhythm & neuro disease

- Signalling bw microbes and host
- Microbiome in gut inflammation, IBD colon cancer, cardio-metabolic dis
- Skin microbiome, allergy and asthma

# Technology Transfer 2013-2020



# APC IP Examples

## CLA-producing strains for metabolic health

### Modulation of tissue fatty acid composition of a host by human gut bacteria

EP 2192909 A2 (text from WO2009043856A2)

#### ABSTRACT

The current invention provides use of a CLA-producing bacterium for the in vivo conversion in the gut of polyunsaturated fatty acids to CLA. The CLA-producing bacterium is selected from one or more of the group consisting of propionibacteria, lactobacilli, lactococci and streptococci, and bifidobacteria.

**PATENTED**

**LICENSED**

## GABA-producing strains for mood

(19) (11) EP 2 828 375 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent: 22.11.2017 Bulletin 2017/47 (51) Int CL: C12N 1/20 (2006.01) C12P 13/00 (2006.01) A61K 35/74 (2015.01) C12R 11/01 (2006.01) C12R 1/24 (2006.01)

(21) Application number: 13708357.2 (86) International application number: PCT/EP2013/051065

(22) Date of filing: 21.01.2013 (87) International publication number: WO 2013/107913 (25.07.2013 Gazette 2013/30)

(54) GABA-PRODUCING CULTURABLE BACTERIA DERIVED FROM THE HUMAN GASTROINTESTINAL TRACT

## Strain-derived peptides & bioactives

**TECHNOLOGY SUMMARY**

**EPI-RESTORE – A novel microbe-derived protein for regenerating or promoting epithelial cell growth**

**VALUE PROPOSITION**

A novel therapeutic candidate for the treatment of conditions associated with significant morbidity and unmet clinical need.

**THE TECHNOLOGY** (GRAPHIC)

Ground-breaking research in the APC Microbiome Institute has led to the discovery of a peptide secreted by *Bifidobacterium breve* that has a significant proliferative effect on epithelial cells. The technology holds potential for the treatment of diseases or conditions characterised by damaged epithelium including

## Bacteriophage

**TECHNOLOGY SUMMARY**

**CF Phage – therapeutic to treat lung infections of Cystic Fibrosis patients**

**VALUE PROPOSITION**

A phage cocktail preparation containing phages NH-4 and MR299-2 is effective in clearing (killing) *Pseudomonas* in acute infections in murine lungs and in *Pseudomonas* biofilms on human cell-lines. The phage cocktail has broad range activity against *Pseudomonas* isolated from Cystic Fibrosis (CF) patients and represents a promising phage therapy to treat *Pseudomonas* lung infections in CF patients. Phage therapy is particularly beneficial over antibiotic therapy because *Pseudomonas* biofilms show high-level antibiotic resistance.

**THE TECHNOLOGY**

Researchers from the Alimentary Pharmabiotic Centre (APC) have shown that certain virulent phages, isolated from environmental samples, have the potential to kill a number of *P. aeruginosa* strains isolated from CF patients. A phage cocktail preparation consisting of phages NH-4 (a myovirus) and Q299-2 (a podovirus) have been shown to be effective in killing and

Wells in the top rows show control biofilm cultures without phage added and bottom rows with phage added. (A) time 0 h and (B) time 24 h.



# Development of a microbial artificial consortium to restore the gut microbiota of elderly

## 1. DEVELOPMENT OF THE ARTIFICIAL CONSORTIUM MCC100

### Microbiome Culture Collection

729 isolates of 90 species



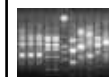
Literature review



### Selection of 70 species

Based on prevalence in the gut microbiota

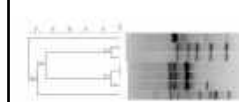
RAPD-PCR



### Genetic dereplication of selected bacterial isolates

193 isolates -> 130 different strains

Selection based on abundance and genetic variability



**MCC100**

Genomes sequencing



Antimicrobial profiling



7 antibiotics

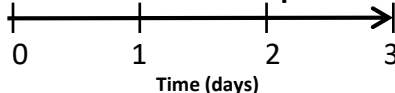
## 2. ESTABLISHMENT OF AN *IN VITRO* HUMAN COLON MODEL

Culture time: 3 days in continuous flow

No batch culture period before continuous culture is necessary

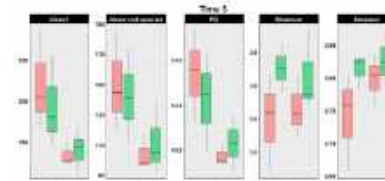
Optimization of the composition keeps more taxa after 3 days of culture

Continuous flow at pH 6.8

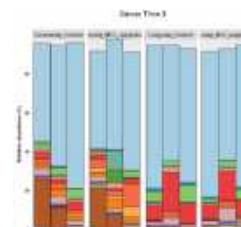


## 3. EFFECT OF SUPPLEMENTING FRAIL AND HEALTHY ELDERLY MICROBIOTA TYPES WITH THE MCC100

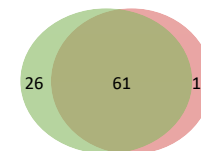
Alpha diversity increase



Modulation of taxa abundance



Maintenance of a greater number of unique taxa



# Artugen Therapeutics



Prof Colin Hill

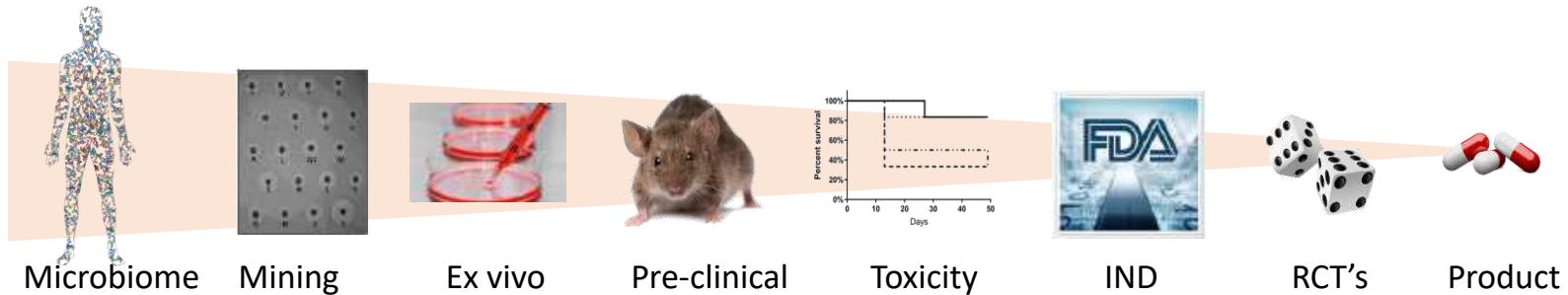


Prof Paul Ross



Ronald Farquhar, CEO

- Established 2015
- Financed by Morningside Ventures
- Developing LBPs for infectious, inflammatory & oncologic disease
- Discovery team based at APC Microbiome Ireland
- Development team based in Concord, MA



ART24 – a live biotherapeutic with potent activity against different *Clostridium difficile* strains

**March 12, 2020**

Artugen Therapeutics Announces First Patient Dosed with ART24, Artugen's first clinical product candidate for prevention of recurrence of *Clostridium difficile* infection

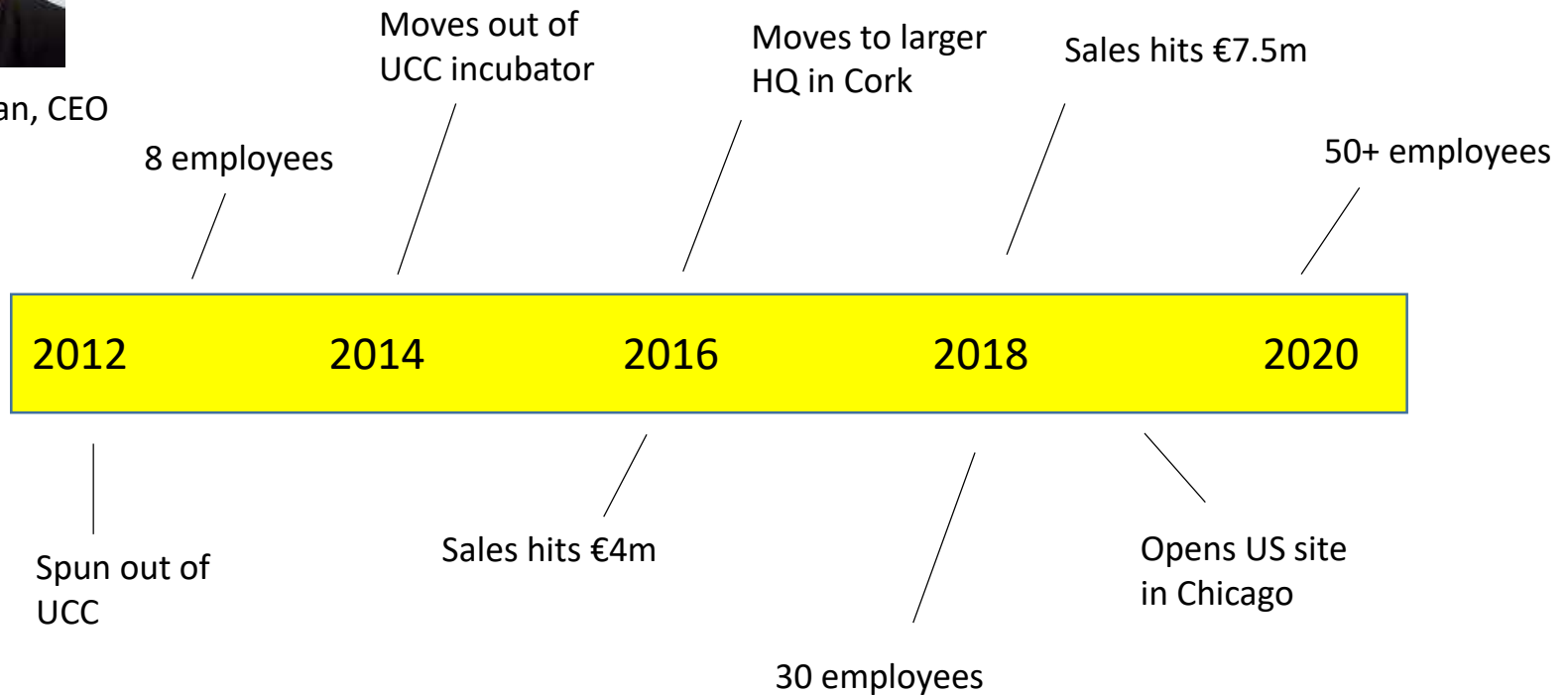
# Atlantia Clinical Trials



To commercialise the APC Human Studies Platform



Andrea Doolan, CEO



Atlantia performs clinical studies to ICH-GCP standards for the functional foods, beverages, ingredients, supplements, pre- and probiotics, microbiome-based and bacteriophage therapeutics sectors.

# Tucana Health (4D Pharma Cork)

**Tucana Health** established 2015

To commercialise IP relating to microbiome signatures for the diagnosis and treatment of diseases



Fergus Shanahan




Paul O'Toole

## 4D pharma buys Tucana to add diagnostic capabilities to microbiome R&D toolkit

by Nick Paul Taylor | Feb 11, 2016 9:01am



4D pharma (LON:D0DD) has struck a deal to buy Tucana Health. The takeover, which is costing €3.1 million (\$4.5 million) upfront with more tied to milestones, is intended to boost 4D pharma's ability to identify patients who may benefit from live biotherapeutics, starting with a treatment for irritable bowel syndrome (IBS). 



Initial focus on the diagnosis and patient stratification for IBS. Longer term the company will focus on building a diagnostic platform across multiple disease areas mirroring the programmes developed by MicroRx, 4D pharma's therapeutic platform.



CEO  
Dr Marcus Claesson



CTO  
Prof Paul Cotter



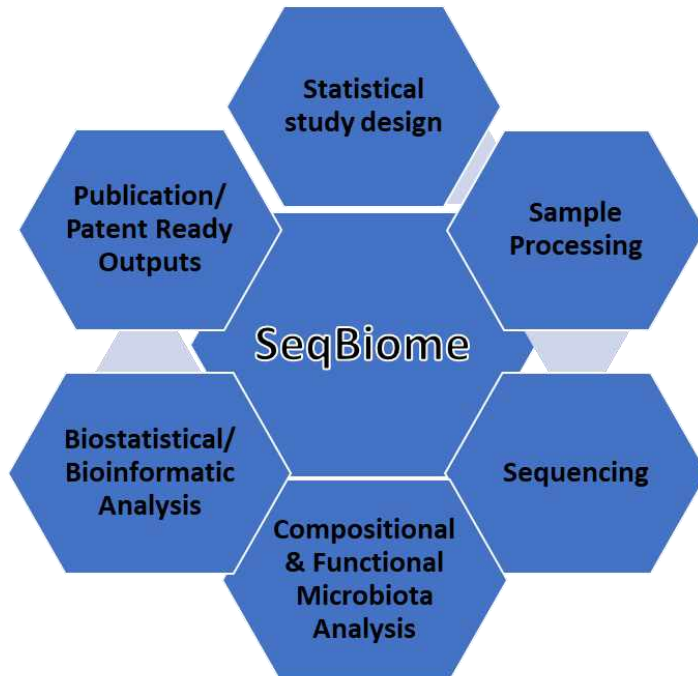
CCO  
Brad Wrigley

SeqBiome

Providing high-quality interactive  
sequencing & microbiome analysis

## Why SeqBiome?

- ✓ Globally recognised know-how
- ✓ State-of-the-art sequencing & analysis pipelines
- ✓ Wide range of sample environments

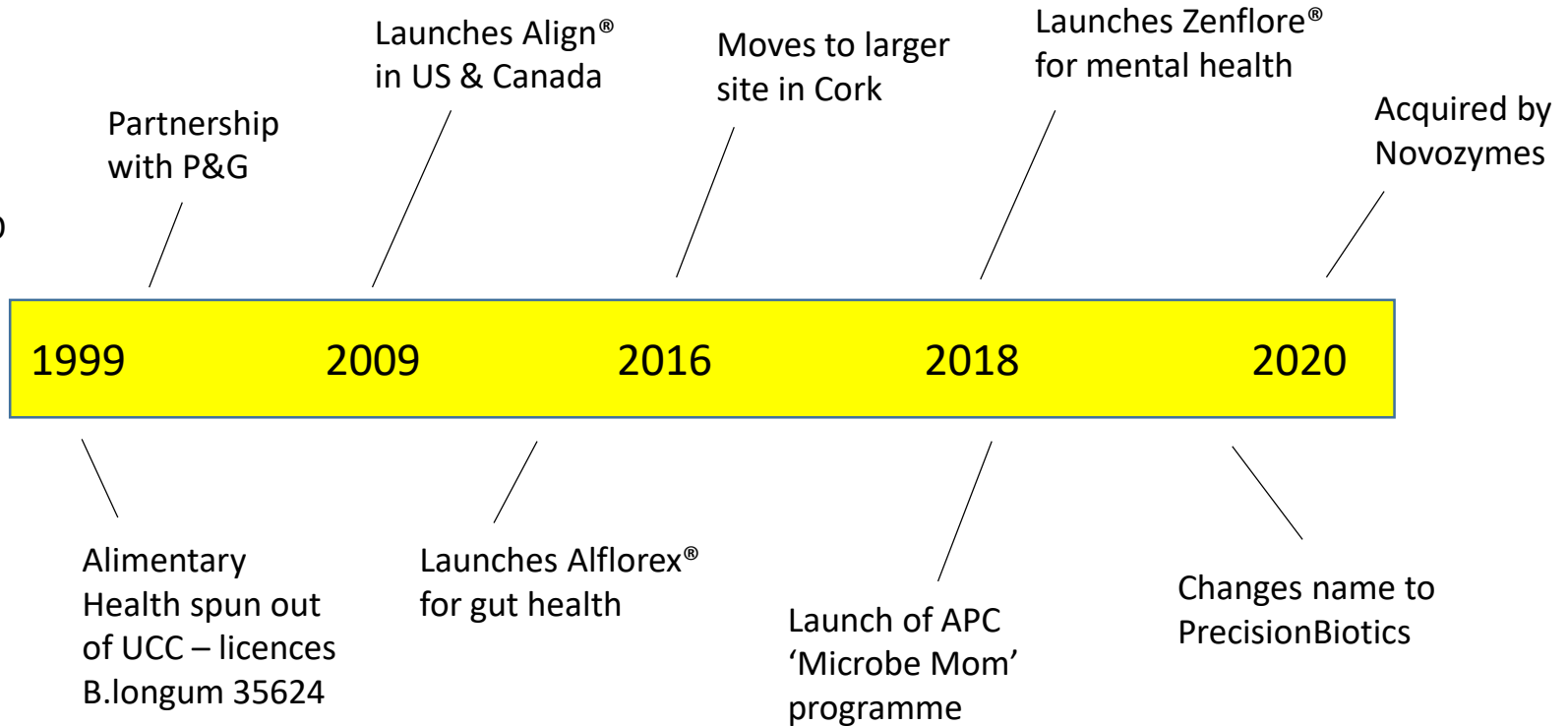




# PrecisionBiotics



Barry Kiely, CEO



## Novozymes acquires PrecisionBiotics Group to advance its business within human health

The acquisition of PrecisionBiotics Group will advance Novozymes' activities in the area of biological solutions for human oral and gut health - one of the growth pillars in the strategy Better business with biology.



# Concluding thoughts..

- Possible for academics to have high-quality research outputs AND work with industry! (AND protect IP)
- Industry collaboration increases research commercialisation
- Rate-limiting step for spin-out generation is often the availability of commercial leads
- Successful spin-outs can be based on “soft” IP
- Timing is everything!
- Regulatory aspects should inform the research plan
- Large companies increasingly partnering with biotech / start-ups – implications for academic-industry partnership?

# **APC is Open for Business!**

**Collaboration & Licensing Opportunities**

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## **APC Microbiome Ireland-Atlantia Clinical Trials Industry Webinar**

**Title: Food and Ingredient Development Opportunities for Microbiome Modulation**

**Main Speaker: Jens Walter, APC Microbiome Ireland, University College Cork**

**Time: Friday Mar 26, 2021 1:00 PM - 2:00 PM GMT**

**To register please go to <https://attendee.gotowebinar.com/register>**