PORTO CANCER MEETING

gBIOT - Nutraceutical biopolymeric-biocatalytic microbot against gut inflammatory disorders

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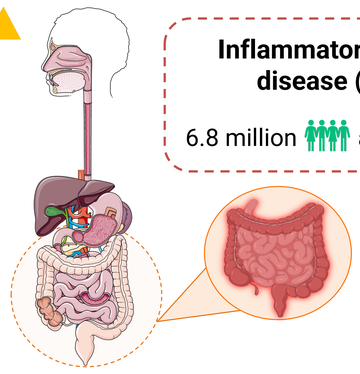
CONTEXT

Gastrointestinal diseases have increased in **incidence** and **prevalence** over the past decade, affecting up to 40% of people worldwide.

Morbidity

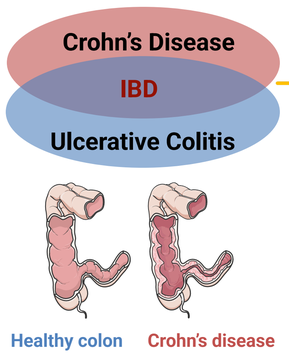
Burden to the healthcare system



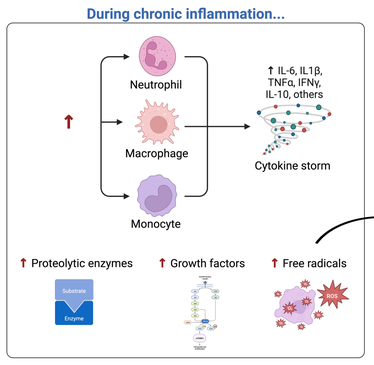
Inflammatory bowel disease (IBD)

6.8 million are affected

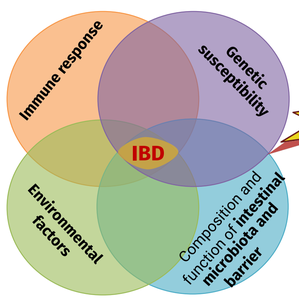
IBD is characterised by chronic **intestinal inflammation**, especially in the **colon**



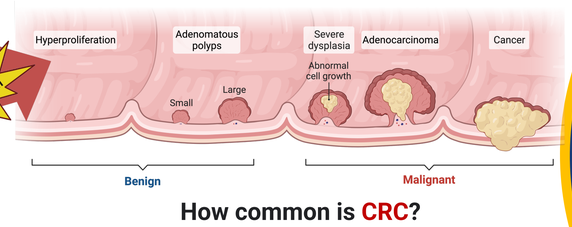
Healthy colon — Crohn's disease



What is the aetiology of IBD?



Benign and Malignant **Colorectal Cancer (CRC)**

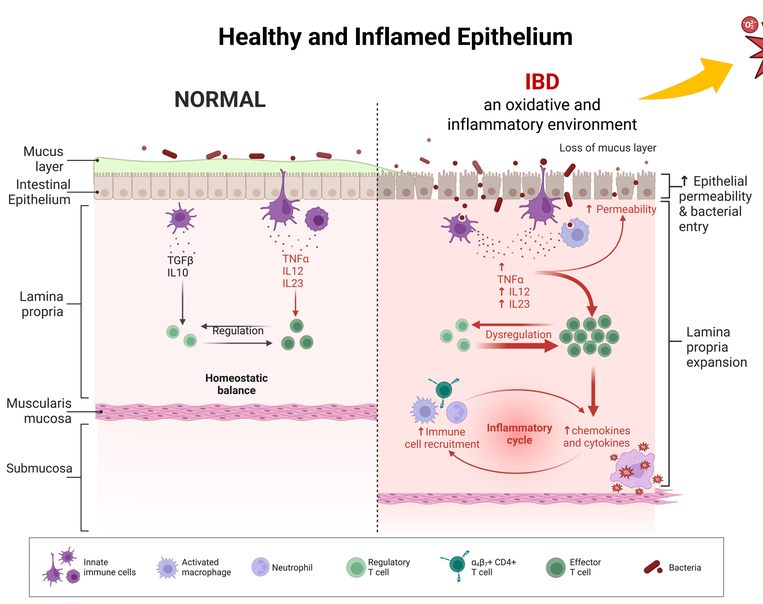


How common is CRC?

CRC is the **3rd most common cancer type** worldwide & the **2nd most deadly cancer**

Data source: Globocan 2020

Healthy and Inflamed Epithelium



→ Most efficient mechanisms to combat the colonization of pathogenic microorganisms

→ Generate mutations at the DNA level
→ Produce inflammatory disorders

Solution

Phytochemicals: a current strategy to prevent and treat chronic diseases, including cancer

Anti-inflammatory — Antioxidant — Anticancer

Important bioactivities to alleviate **IBD**

TREATMENT:

GOAL → **Achieve Remission** → Improve symptoms; Control inflammation; Prevent carcinogenesis → **BETTER QUALITY *of* LIFE**

Effective plans focus on **OVERALL HEALTH** while minimizing **SIDE EFFECTS *and* DISCOMFORT**

gBiOT aims to develop an intelligent system efficiently oriented to the colon, loaded with natural bioactive compounds, and capable of reducing microenvironmental oxidative stress in gastrointestinal diseases.

METHODS

ENCAPSULATION TECH

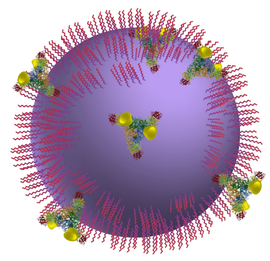
Drug delivery strategy

- → Controlled release
- → Protection of active components from damaging environmental conditions
- → Avoiding localized retention
- → Reducing the effective dose and toxicity of active components

MICROBOTS

Devices expected to do specific tasks at the atomic, molecular, and cellular levels:

Move, feel/manipulate their environment, and display intelligent behaviour (perceiving the environment, processing such perceptions, and responding to maximize an expected result).



How does the microbot move?

By anchoring enzymes in micro/nanostructures, biocatalysis can produce a propulsive force that generates self-propelled micro/nanoparticles. In this regard, the enzyme urease is a successful example that allows for enhanced Brownian motion of micro/nanoparticles in the presence of urea as a biofuel.

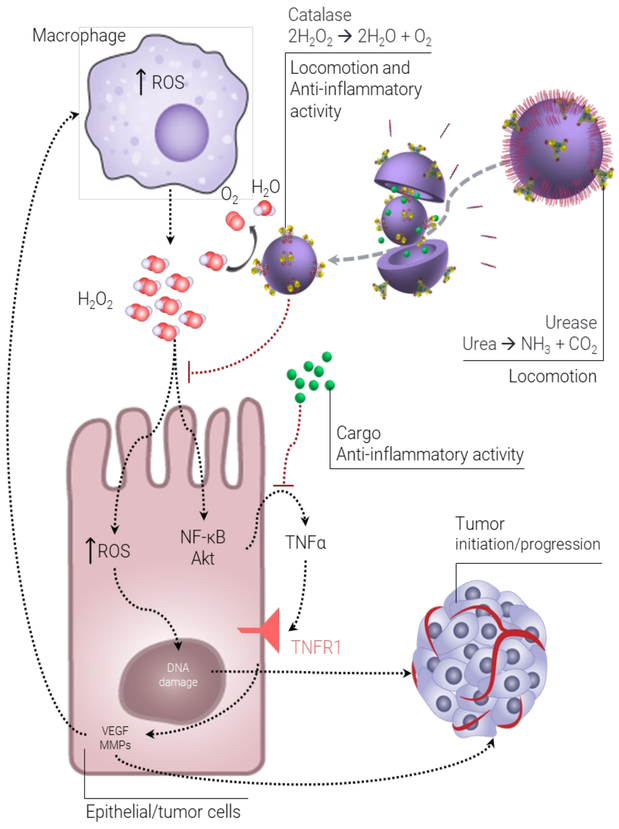
WORKING HYPOTHESIS

"It is technically feasible to develop a biocompatible microbot capable of reaching the colon by propelling itself through the surrounding gut urea, balance ROS levels and release anti-inflammatory compounds selectively in the inflamed mucosa"

EXPECTED RESULTS

gBiOT will develop a target-efficient biocatalytic and biocompatible polymeric microbot capable of detecting and transforming the environment and delivering bioactive compounds.

- ✓ Develop a "rocket" **modular microbot** specifically and efficiently oriented to the **colon**, modifying the inflammatory state chemically and catalytically.
- ✓ **Load** the microbot with **natural bioactive compounds**.
- ✓ **Validate** the prototype ***in vitro*** and ***in vivo*** for the target functionalities: bacterial enzyme-activated sensitivity, anti-inflammatory properties, and anticancer activity.
- ✓ Explore the **creation** of a **nutraceutical ingredient**: direct encapsulation of natural extracts in the microbot.



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ACKNOWLEDGEMENTS

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