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P191

Microbots for Colonic Delivery of PEITC: Using INFOGEST to Optimise Formulation and Bioaccessibility

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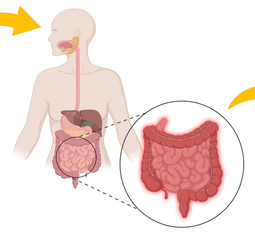
CONTEXT

Gastrointestinal diseases affect up to 40% of the global population, leading to **morbidity**, **mortality** and **burden on healthcare systems**.

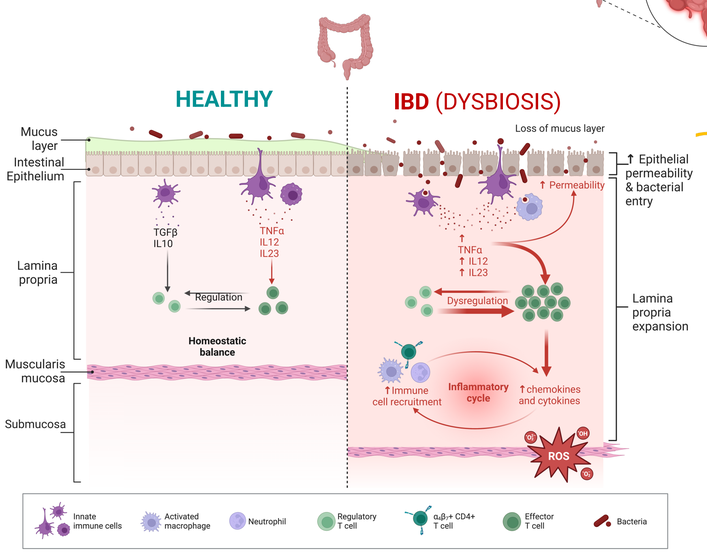


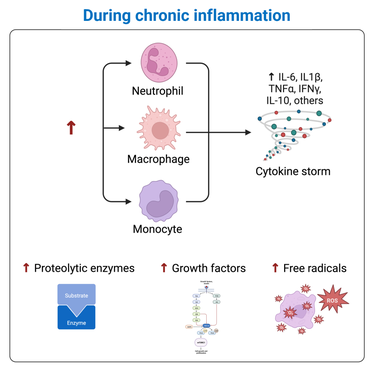
Inflammatory bowel disease (IBD)

6.8 million are affected

IBD is a chronic **intestinal inflammation**, especially in the **colon**

Crohn's Disease
IBD
Ulcerative Colitis

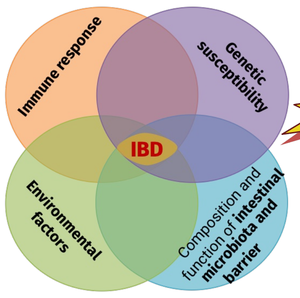




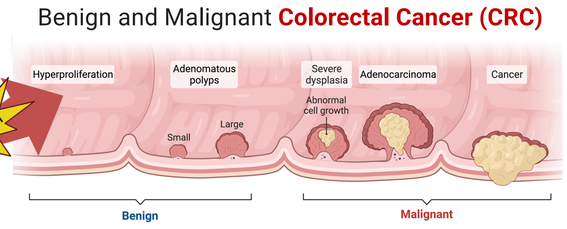
IBD an oxidative and inflammatory environment

ROS Reactive Oxigen Species

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

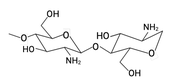
gBiOT

METHODS

WORKING HYPOTHESIS

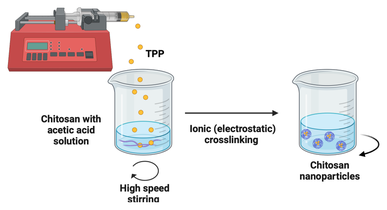
Develop a **biocompatible microbot capable of reaching the colon** by propelling itself through the surrounding gut urea, **balancing ROS levels**, and selectively **releasing anti-inflammatory compounds in the inflamed mucosa**.

How to develop a colon-targeted delivery system?

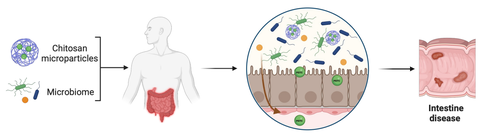


Chitosan

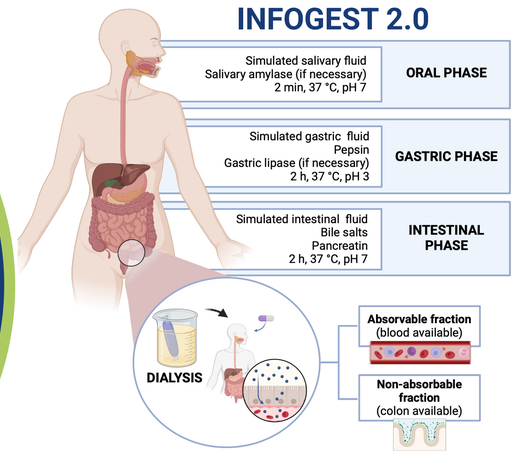
- Nontoxic, biodegradable, **biocompatible, low immunogenicity** and **bioactive polymer**
- Absorption-enhancing capability
- pH responsiveness and it is **resistant to the upper gastrointestinal tract** (GIT)
- It is mucoadhesive
- It is **metabolised by colonic microflora** to release the entrapped compounds



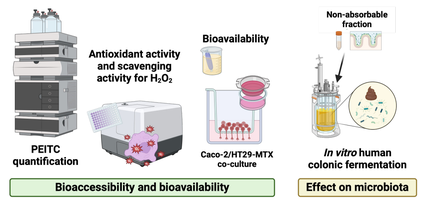
Microbiota-Activated Colon Targeted Delivery System



INFOGEST 2.0: an essential tool for optimising microbot formulations



GIT simulation will test microbots' ability to protect the PEITC in the upper GIT, reach the colon to balance the ROS level and deliver the PEITC. If the microbots cannot resist the upper gastrointestinal tract, their composition will be reformulated.



Solution

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

Anti-inflammatory · Antioxidant · Anticancer

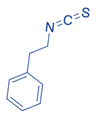
Important bioactivities to alleviate **IBD**

Stand out

CRUCIFEROUS VEGETABLES have a ↑↑ content of GLUCOSINOLATES (GLC)

Watercress (*Nasturtium officinale*)

PHENYLETHYL ISOTHIOCYANATE (PEITC)



Conversion of GLC to ITC by Plant Myrosinase

Phytochemicals: **ISOTHIOCYANATES (ITC)**

ENCAPSULATION TECH

Drug delivery strategy

- Enhances PEITC's bio-efficacy and bioavailability
- Controlled release
- Site-specific delivery (PEITC to reach colon)
- Protection of PEITC from environmental damaging
- Provides PEITC stability

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).

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**

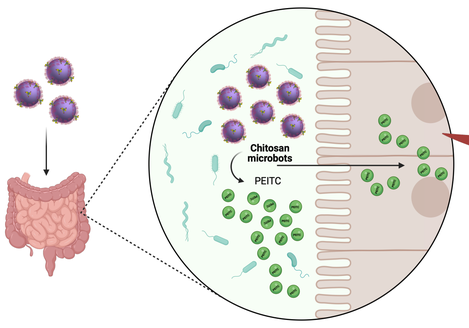
This research aims to **develop a microbot for targeted PEITC delivery to the inflamed colon**, assessing its interaction with gut microbiota and the efficacy of antioxidant and anti-inflammatory properties.

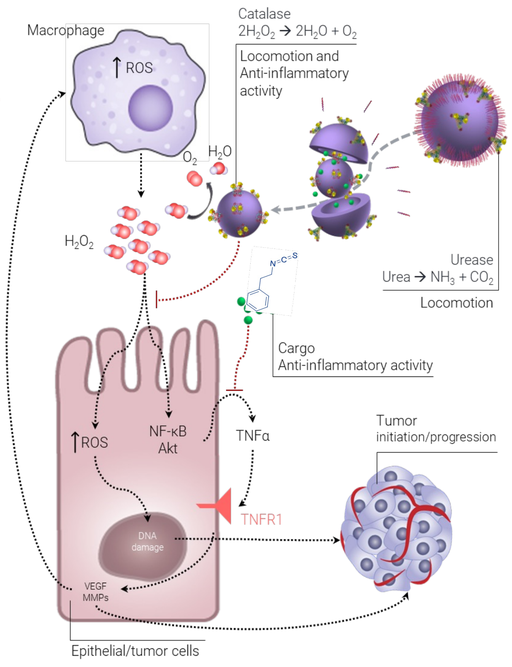
EXPECTED RESULTS

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

Develop a **microbot** precisely and efficiently oriented to the **colon**. This microbot would chemically and catalytically modify the inflammatory state for **IBD prophylaxis or treatment** and, consequently, **cancer prevention.**

Colon-targeted delivery system





Microbots developed for oral administration could help **prevent and control gastrointestinal diseases, including IBD**, reduce cancer risk, and improve the patient's quality of life.

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