



# RCSI

## PanaColl: A collagen-based scaffold for the delivery of antibiotics and enhancement of tissue regeneration

### Introduction

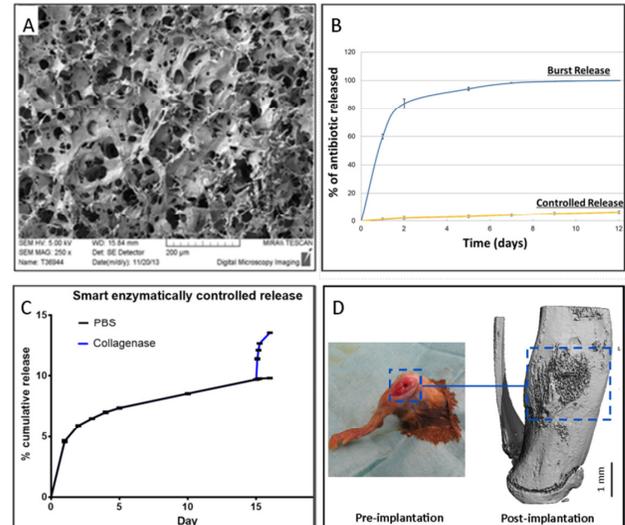
Osteomyelitis (OM) is an infection of bone caused by bacteria such as *Staphylococcus Aureus* (*S. Aureus*). The current gold standard treatment for chronic OM is debridement of the infected bone followed by administration of intravenous antibiotics for a minimum period of 6 weeks. However, the avascularised pathology of OM often leads to insufficient antibiotic doses at the site of infection, and, furthermore, this treatment doesn't contain a component to promote the regeneration of the damaged bone. Therefore, there currently is an unmet clinical need for a novel therapy that combines a local delivery of antibiotic and a biomaterial or scaffold that promotes regeneration of bone.

### PanaColl

Panacea Collagen (or "PanaColl") scaffolds are 3D porous scaffolds composed of collagen and hydroxyapatite (the two main components of native bone tissue), see Fig. 1A, and can be loaded with antibiotics such as vancomycin, gentamicin and teicoplanin which are effective against bacteria including *S. Aureus*. The PanaColl scaffold is a dual-layered product with a dual release antibiotic profile. A "burst release" layer releases an antibiotic rapidly (85% cumulative release after 2 days) and a "controlled release" layer releases an antibiotic at a much slower rate ( $\approx 0.6\%$  release per day), see Fig. 1B. Furthermore, the controlled release layer is responsive to enzymatic activity. That is, in situations of high enzymatic activity, such as microbial infections, the release rate of the antibiotic from the scaffold is increased, see Fig. 1C. The efficacy of the PanaColl scaffold has recently been demonstrated in a murine model of OM, where PanaColl scaffolds implanted following debridement of infected bone were found to treat the infection and regenerate the damaged bone, see Fig. 1D.

### Clinical applications

PanaColl scaffolds can be utilised to treat hard tissue infections such as OM or can be easily modified with other compounds to treat different conditions including septic arthritis, cystic lesions and wound infections.



**Fig. 1.** A) Scanning electron microscopy image of a porous PanaColl scaffold. B) Dual release profile of the antibiotic-loaded scaffold. C) The release rate of the antibiotic spikes when collagenase is added at day 15. D) Image of infected bone pre-implantation (left) and CT scan demonstrating bone regeneration post-implantation with scaffold (right).

### Advantages

PanaColl is an "off the shelf" product which can: (a) reduce the overuse of antibiotics and antibiotic resistance, (b) reduce the reoccurrence of infection, (c) deliver high local doses and sustained release of antibiotics without systemic toxicity, (d) aid in tissue regeneration and (e) shorten hospital in-patient treatment times.

PanaColl features	Benefits
Controlled delivery of <u>different</u> antibiotics.	Burst release to kill initial infection & controlled release to prevent reoccurrence.
PanaColl scaffolds for <u>different</u> applications	Functionalised collagen scaffolds containing antibiotics for hard or soft tissue infections.
Hydroxyapatite	Promotes bone formation.
High porosity (>98%)	Facilitates cell migration, nutrient exchange & waste removal.
High pore interconnectivity	Prevents avascular necrosis & enhances cell mobility.
Mechanical strength	Facilitates handling & ease of use.