Current progress and perspectives on biomaterials with surgical applications

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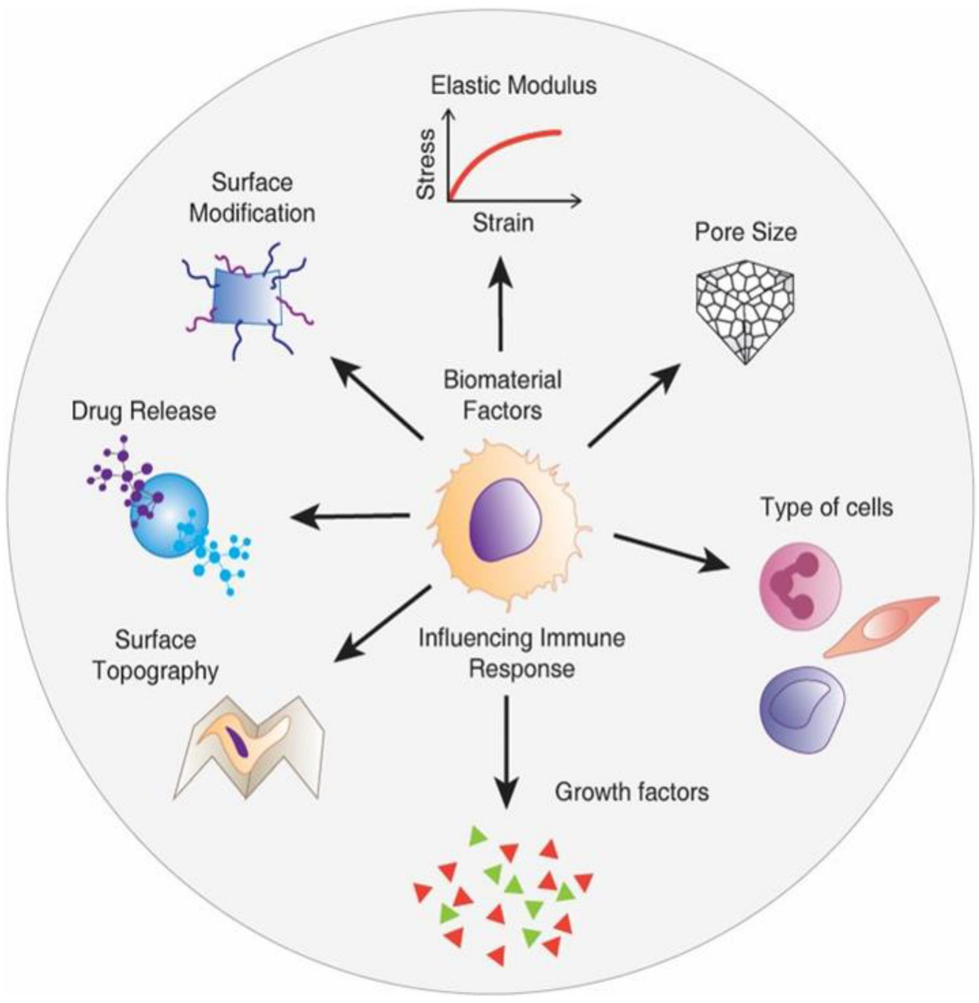
- Recent advances in the development of biomaterials have given new options in surgery.
- The new generation of medical devices controls chemical breakdown and resorption, prevents post-operative adhesion and stimulates regeneration of tissues. Polymeric biomaterials include a diverse array of medical devices, including non-degradable biomaterials (silicone, polypropylene, expanded poly-tetra-fluoro-ethylene) or biodegradable polymers, including implants and three-dimensional scaffolds for tissue engineering, which require particular physicochemical and biological properties. This paper provides a review of biomaterial-based treatment and prevention methods with surgical applications and discusses the perspective in the development of innovative biomaterials.

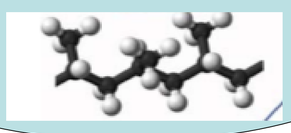
❑ Requirements of biomaterials
- ➢biocompatible
- ➢biodegradable
- ➢ inert or specifically interactive
- ➢mechanically stable
- ➢chemically stable
- ➢processable
- ➢nonthrombogenic
- ➢sterilizable



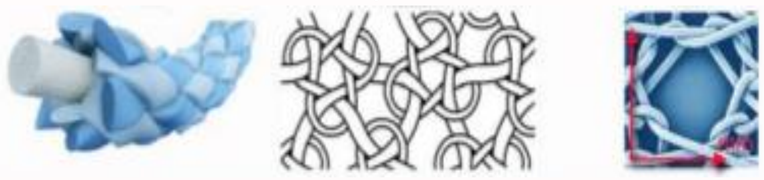
❑ Polymeric Biomaterials
- recent development -
- ➢Fibrin-based material
- ➢Gelatin-based material
- ➢Hyaluronic acid- based material
- ➢Chitosan-based material
- ➢PEG-based material
- ➢Poly(α-hydroxyacid)s-based material
- ➢others

❖ MESHES
Strategies of mesh functioning

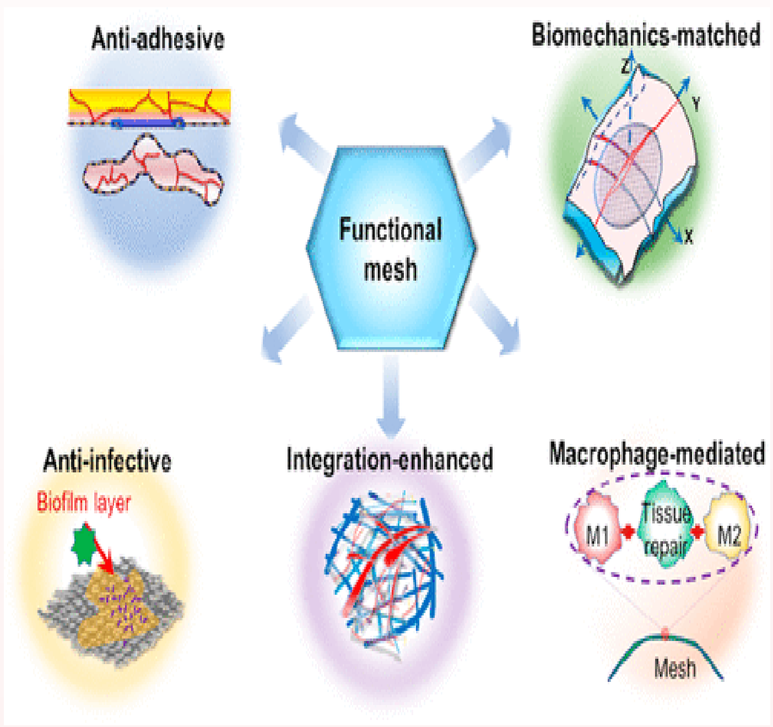
Material



Structural conformation



fiber *textile pattern* *pore size*

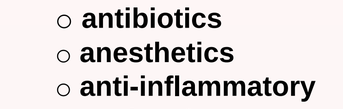


❖ SUTURES

Antimicrobial sutures
- **Antimicrobial agents**
  - **antibiotics**
  - **antiseptics**

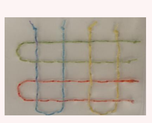
- **Silver nanoparticles** (loaded or coated)

Drug-eluting sutures
- **Multi-drug combination** (synergic and/or additive effects)



  - **antibiotics**
  - **anesthetics**
  - **anti-inflammatory**
  - **analgesics**

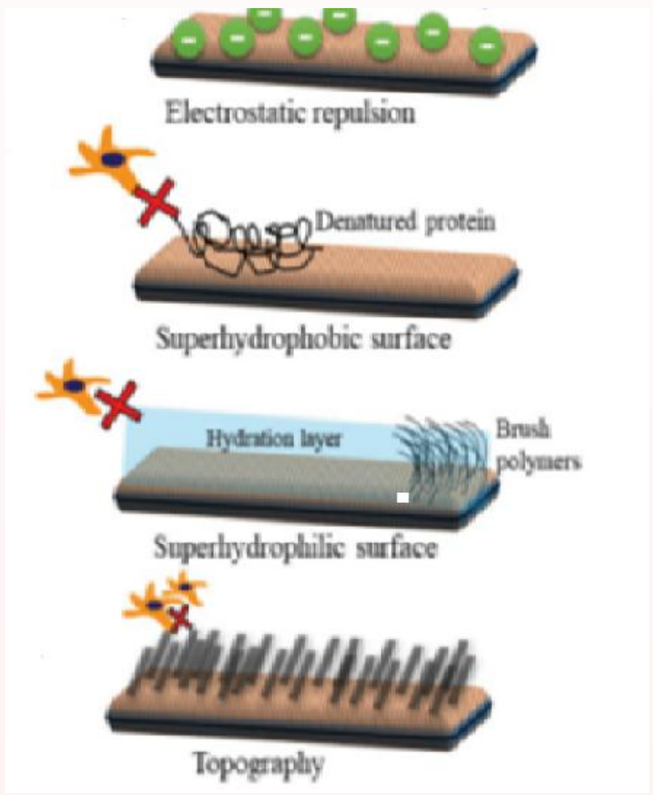
Smart sutures
- **Shape memory and elastic sutures**
- **Electronic sutures** (integretion of sensors)



❖ BIOMATERIALS TO PREVENT POST-OPERATIVE ADHESION

Strategies of Anti-Adhesion

❑Types of adhesion barriers
- **Physical Barriers**
  - hydrogels
  - films
  - sponge
  - solution
  - powder
  - spray
- **Chemical Barriers**
  - anti-inflammatory agents
  - fibrinolytic agents
  - anticoagulants



Conclusions

- ❑ Biomaterials include a wide range of natural and synthetic polymers with high strength, flexibility, durability, and favorable safety profile
- ❑ Natural polymers are hydrophilic, biocompatible, biodegradable, hemostatic and with high bioadhesive properties.
- ❑ Based on the combination of new generation technologies and cell-based therapies, the biocompatible and bioactive properties of some of these medical products can lead to progress in repairing injured or harmed tissues and in tissue regeneration.

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