Bioactive and Biocompatible Copolymers for Use in Medical Implants

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The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a new class of biomaterials with improved properties for biomedical applications.

Overview

Many human diseases and conditions can be treated by implanting devices within the body. However, these devices may be rejected by the body's immune system or "fouled" by the accumulation of bacteria, cells and proteins. Moreover, few materials exist that can be used in blood-contacting devices or applications.

Polyurethane copolymers have been widely used for biomedical applications, including implantable devices, because they have excellent mechanical properties and biocompatibility. However, the use of polyurethanes in blood-contacting applications has been limited due to polyurethane's poor hemocompatibility. Additionally, unmodified polyurethanes are inherently passive and lack the bioactivity needed to interact with and regulate the biological environment.

Glycosaminoglycans, such as hyaluronic acid, are polysaccharides that are found in all mammals. Hyaluronic acid is bioactive and plays a key role in embryonic development, extracellular matrix homeostasis, wound healing and tissue regeneration. Hyaluronic acid also is non-immunogenic and non-thrombogenic, making it suitable for intravascular use.

The Invention

UW-Madison researchers have combined polyurethane with naturally-occurring glycosaminoglycans, such as hyaluronic acid and dermatan sulfate, to create a new class of biomaterials with improved properties. The resulting copolymers combine the elasticity and mechanical strength of polyurethane with the biological properties of glycosaminoglycans. They have excellent hemocompatibility and biocompatibility for use in medical implant devices.

In addition, selecting the appropriate glycosaminoglycan allows the biological properties of the copolymer to be tailored to elicit specific physiological responses. For instance, the polyurethane-dermatan sulfate copolymer formulation is non-biofouling, while one version of the polyurethane-hyaluronic acid copolymer permits the growth of endothelial cells only.

Applications

- Wound healing
- Vascular grafts
- Scaffolds for tissue engineering
- Coatings for implantable devices, catheters and blood-contacting devices
- Hemodialysis tubing
- Drug delivery

Key Benefits

- Combining a biocompatible urethane with a bioactive polysaccharide results in a copolymer with improved properties for biomedical applications.
- Biological and physical properties of the polyurethane-glycosaminoglycan copolymers can be tailored by adjusting the properties of the glycosaminoglycan.
- In contrast to surface-modified polymers, some formulations of these copolymers can be degraded by enzymes, making them particularly desirable for applications related to wound healing, drug delivery and tissue engineering.

Additional Information

For More Information About the Inventors

- Kristyn Masters
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Tech Fields

- Medical Devices : Other medical devices

For current licensing status, please contact Jeanine Burmania at jeanine@warf.org or 608-960-9846