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CUTTING-EDGE BIOMATERIALS IN DENTISTRY: A BIOTECHNOLOGICAL PERSPECTIVE

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Abstract: Biotechnology has revolutionized dentistry with innovative biomaterials that improve treatments and patient outcomes. Key advancements include hydroxyapatite and bioactive glass, which mimic natural tooth and bone minerals, enhancing integration in bone grafts, implants, and coatings. Tissue engineering has progressed with collagen-based and polycaprolactone (PCL) scaffolds that aid dental tissue regeneration and periodontal repair. Stem cell therapy, using dental pulp and periodontal ligament stem cells, fosters new tissue growth, potentially enabling whole-tooth regeneration. Additionally, growth factors like PRP, PRF, and BMPs accelerate healing, while antimicrobial peptides, biodegradable materials, and genetically engineered proteins enhance dental care's effectiveness and longevity.

• Enhanced Integration:

Biomaterials: hydroxyapatite & bioactive glass
✓ mimic natural tooth and bone minerals
✓ promote better integration with body tissues
✓ enhancing the success of bone grafts, implants, and coatings.

• Tissue Engineering

Innovations in
✓ collagen-based
✓ polycaprolactone (PCL) scaffolds
support the regeneration of dental tissues, aiding in periodontal and dental pulp repairs.

• **Stem Cell Therapy** The use of
✓ dental pulp stem cells (DPSCs) and
✓ periodontal ligament stem cells (PDLSCs)
enables the growth of new dental tissues, with the potential for whole-tooth regeneration.

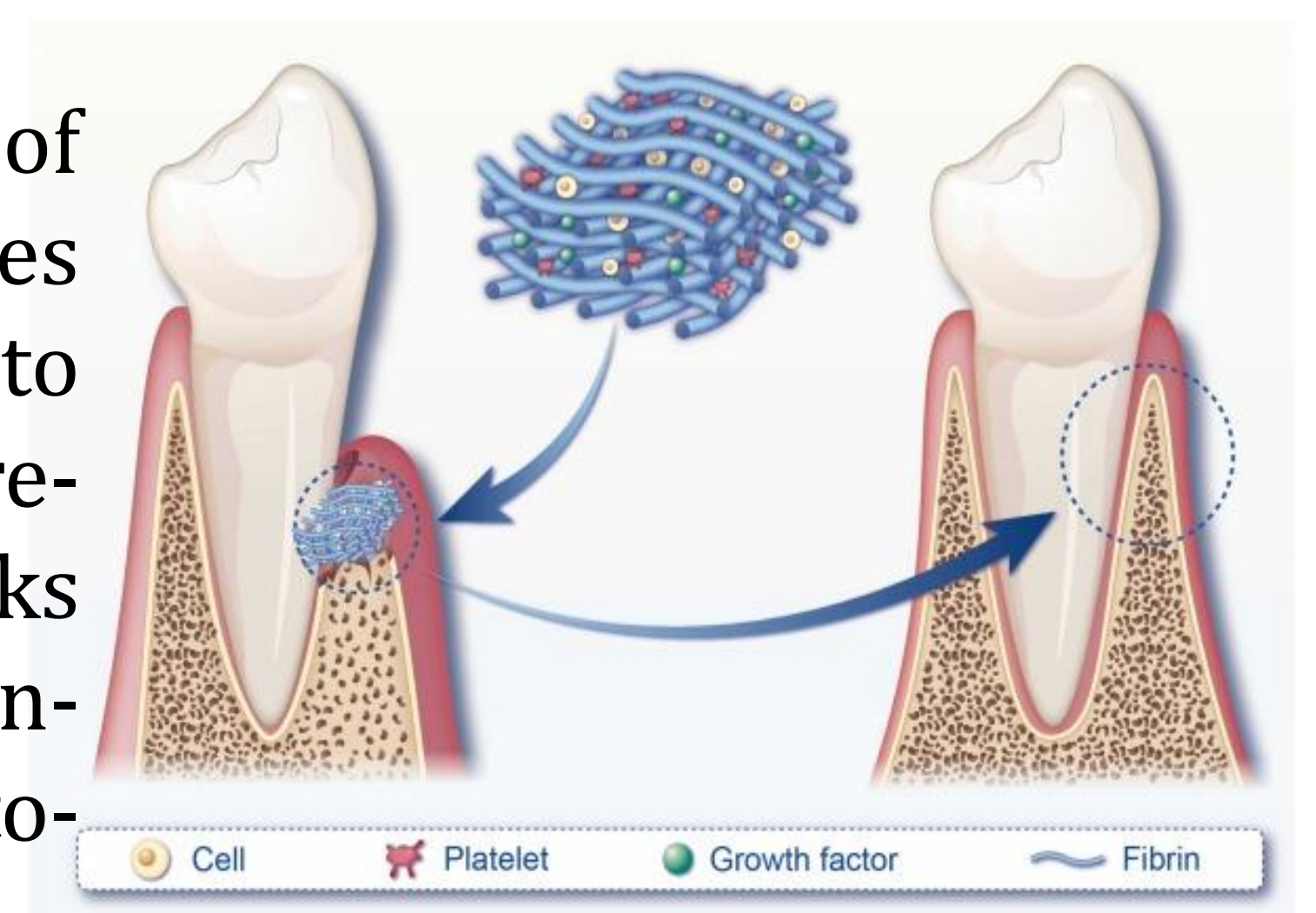
• Accelerated Healing

✓ growth factors and
✓ biologics such as PRP, PRF, BMPs are incorporated into treatments to speed up healing and promote bone growth.



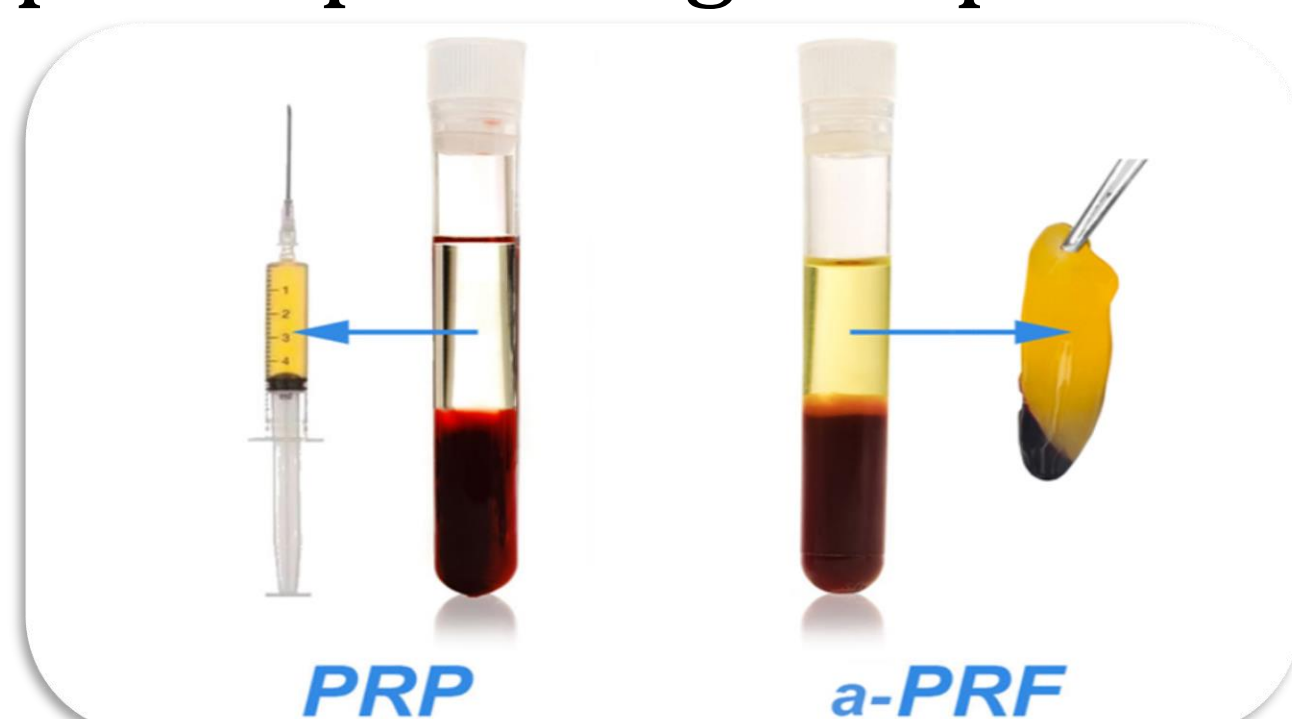
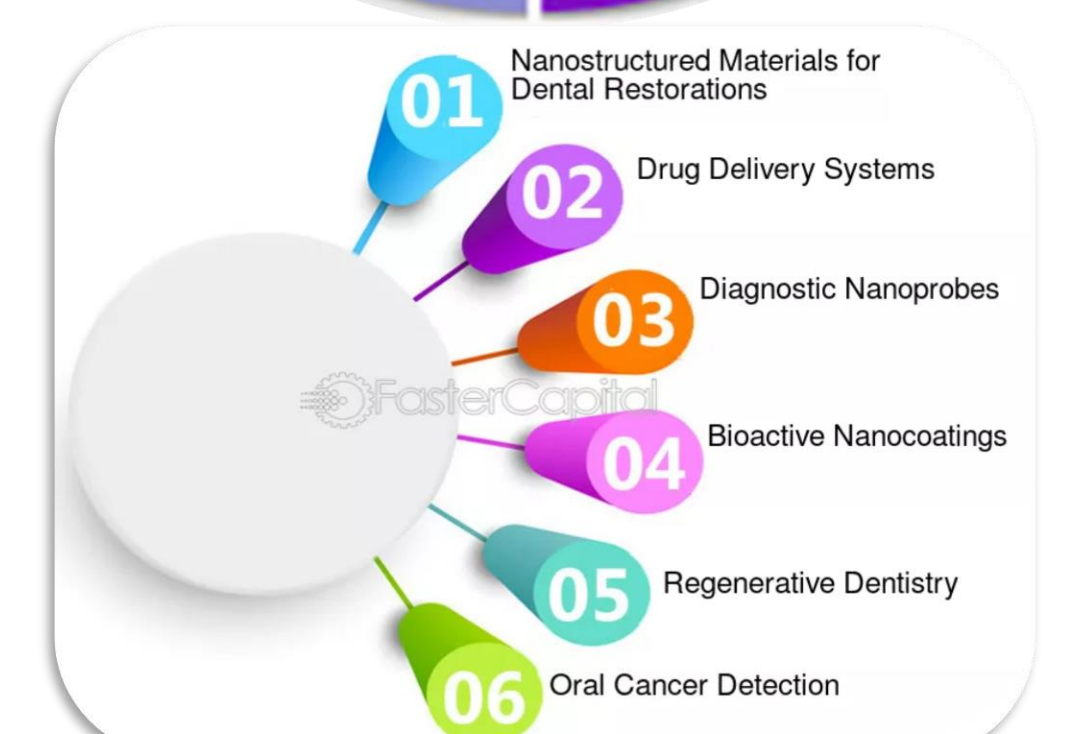
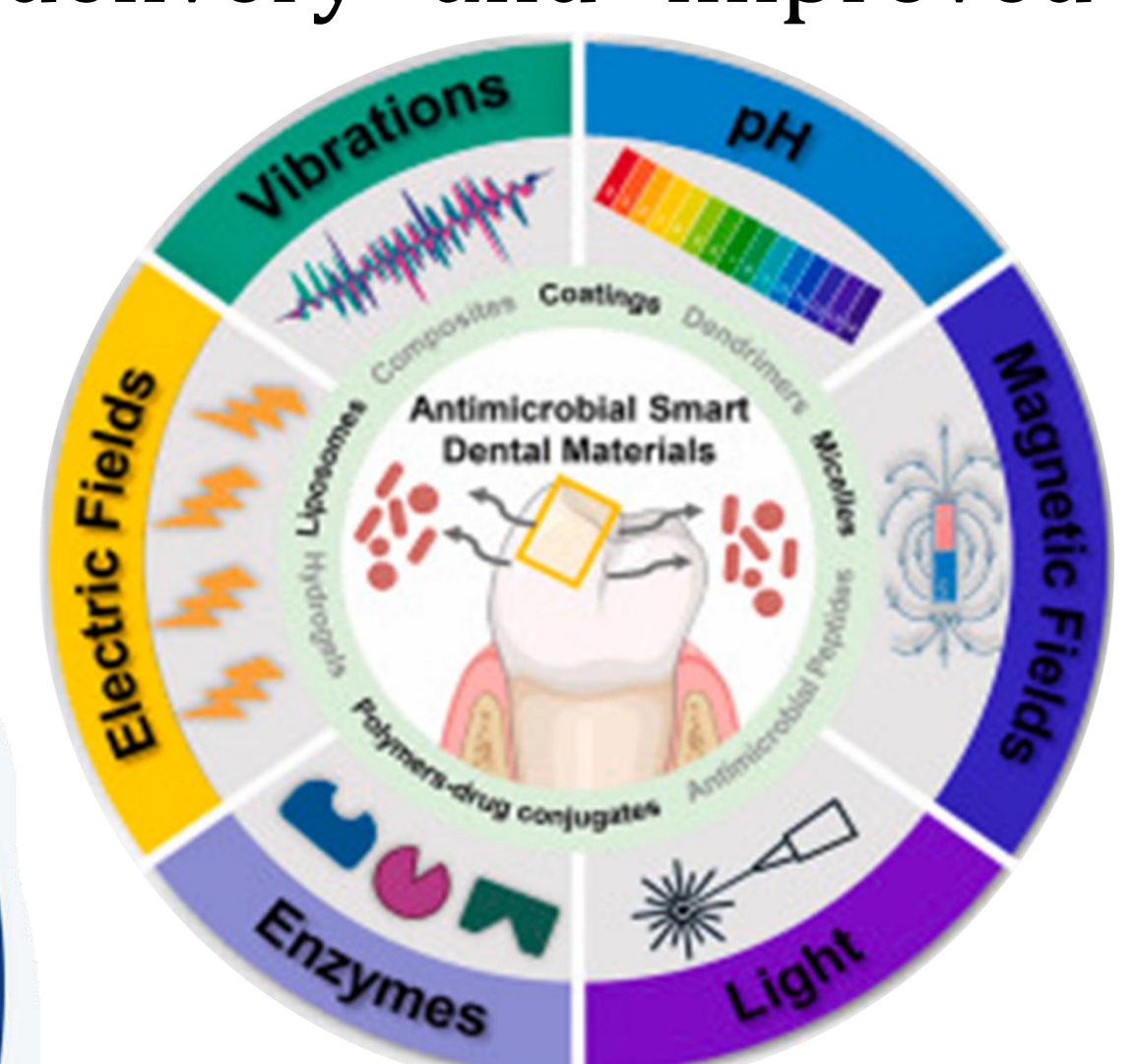
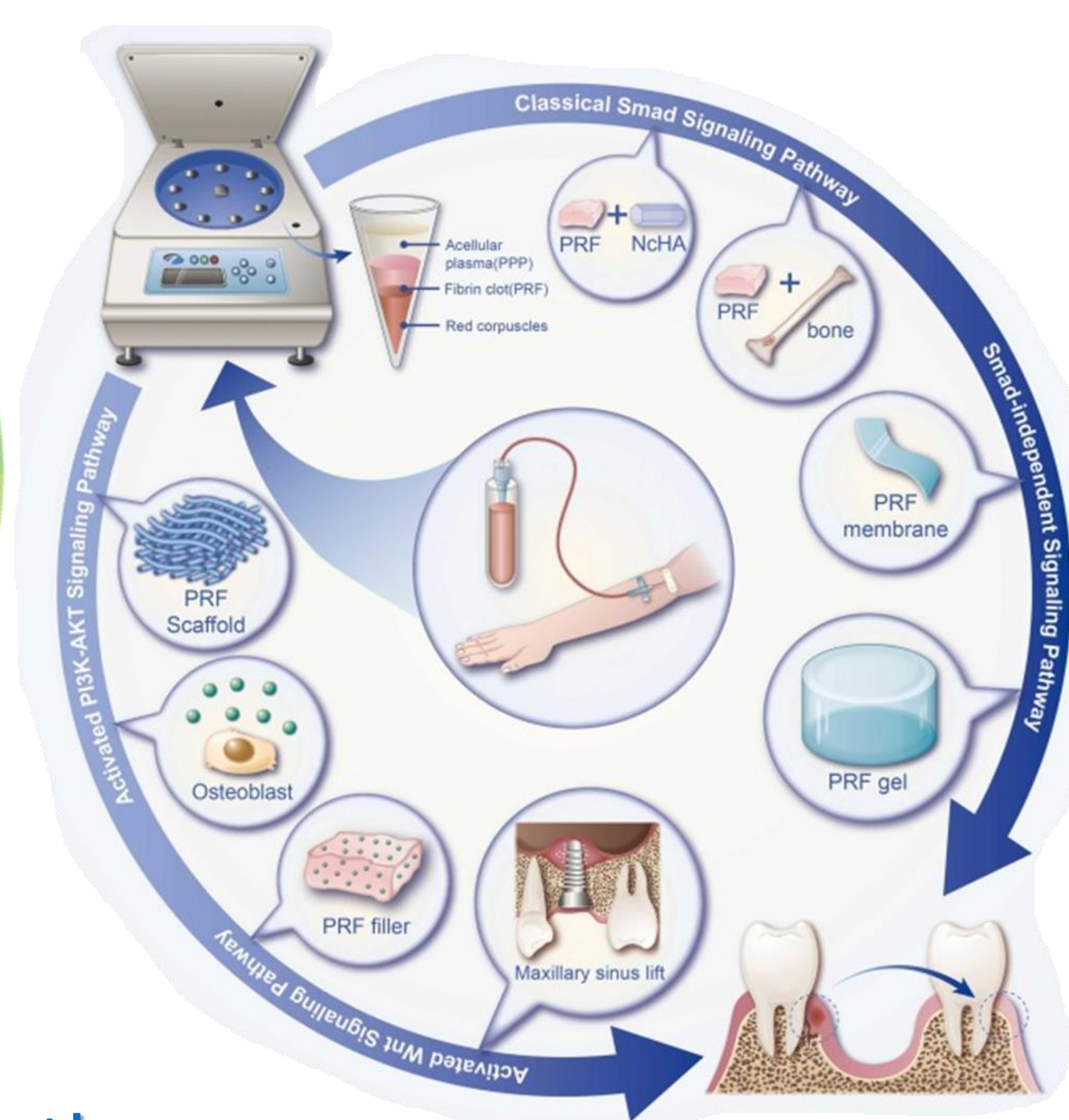
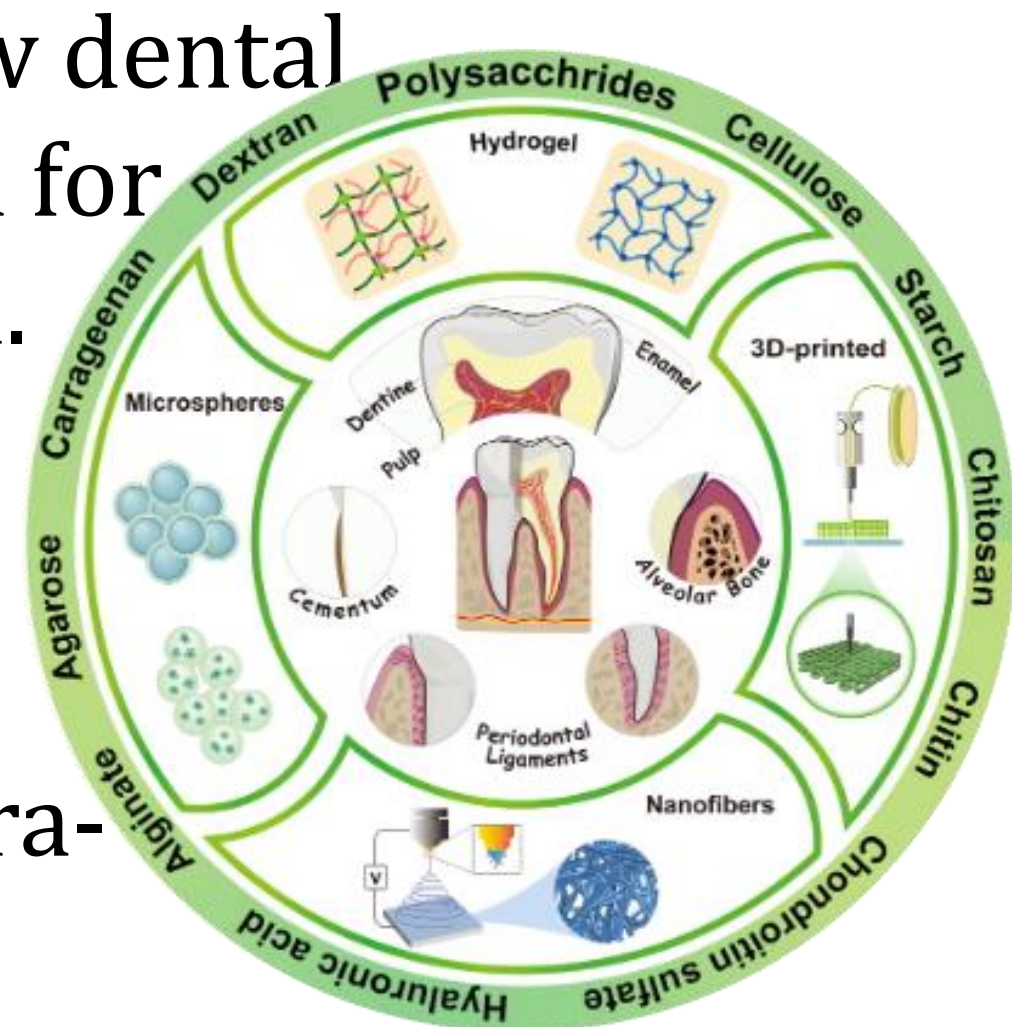
• Infection Control

The integration of antimicrobial peptides and proteins into dental materials reduces infection risks and enhances the longevity of dental restorations.



• Biodegradable Materials

The development of biodegradable and smart materials like chitosan and responsive polymers allows for controlled drug delivery and improved wound healing.



• Tissue Regeneration

Genetically engineered proteins, such as recombinant human collagen and amelogenin, are making significant progress in tissue regeneration and enamel repair.

Conclusions: The advancements in biotechnology are revolutionizing dentistry by introducing biomaterials that significantly improve dental treatments and patient outcomes. Biotechnology is providing more effective, biocompatible, and patient-specific dental treatment options, significantly enhancing the quality of dental care.