

Novel Biomedical Polymers and **Devices**:

From Molecular Design to the **Clinic**

Daniel Cohn

Casali Center of Applied Chemistry, The Institute of Chemistry
The Hebrew University of Jerusalem

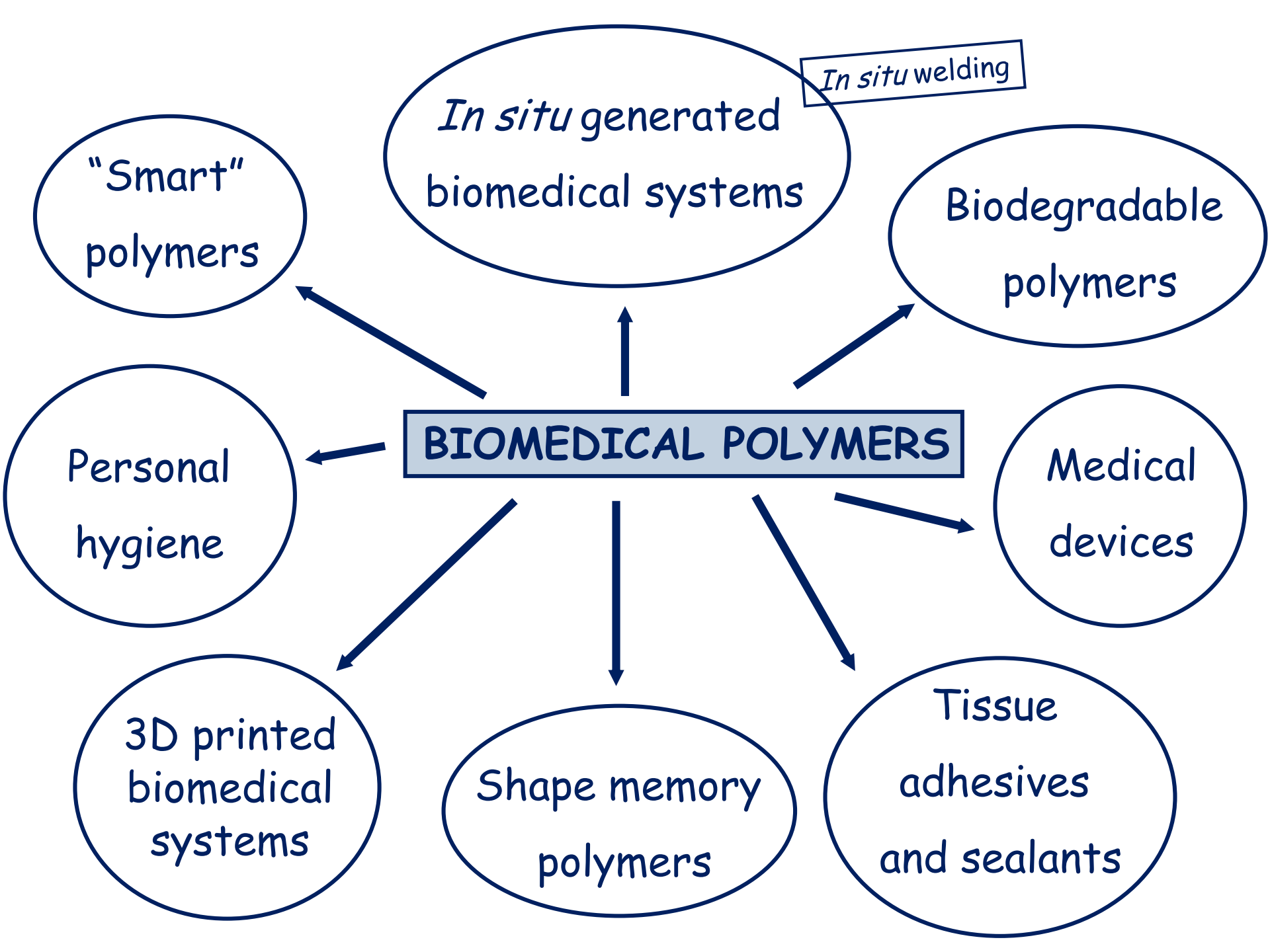
Advanced Materials for Technological Innovation

Yissum and the Faculty of Natural Sciences and Mathematics

Jerusalem, 29th March 2016



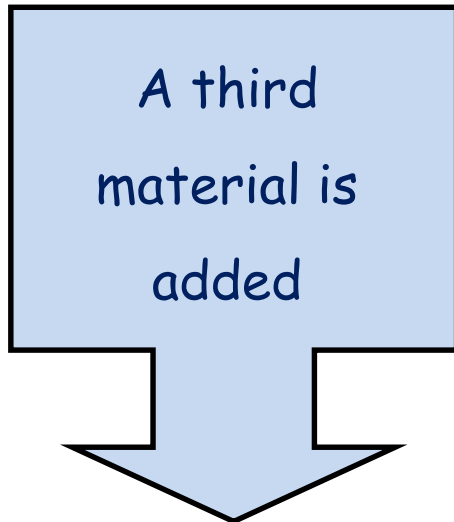
האוניברסיטה העברית בירושלים



Bonding inside the body

and building

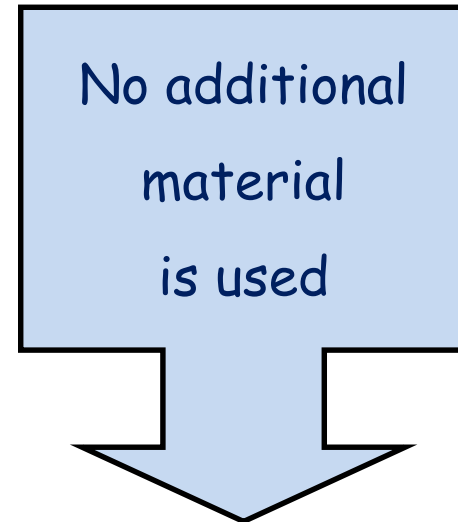
Two basic strategies



Tissue adhesive

Two tissues

In a pig model



In situ welding

Two devices

Ultra-low profile endoluminal devices

Covered stents

Designing cyanoacrylate-containing
tissue adhesives for internal clinical use



Applications for internal use

Hemostasis

Gastric Varices

Mesh hernioplasties

Lung sealing

Vascular
anastomoses

The pancreas and
jejunum

Liquid Embolic System

Intestinal leaks

Adjunct for dural mater repair

Moving along the procedure

Disadvantages



Deployment

The viscosity is far too low

Polymerization

The rate of polymerization is too fast
The polymerization exotherm is very high

Performance

The adhesive strength is often too high
The adhesive is extremely stiff

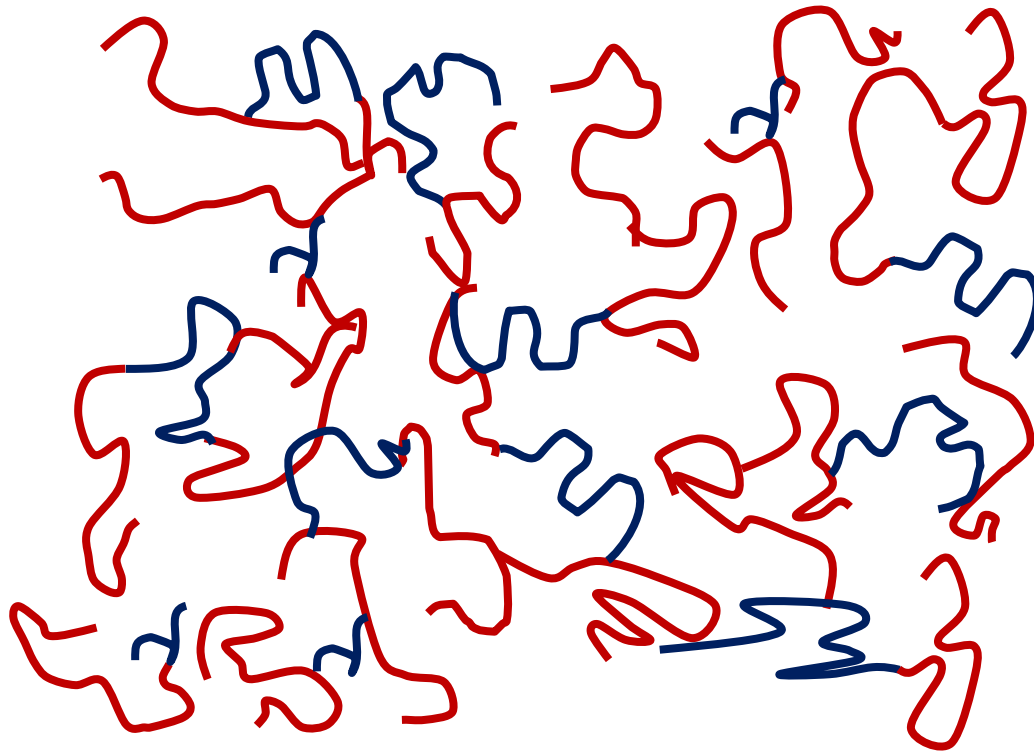
Degradation

The rate of degradation is extremely slow
Is considered to be somewhat toxic

Our working concept

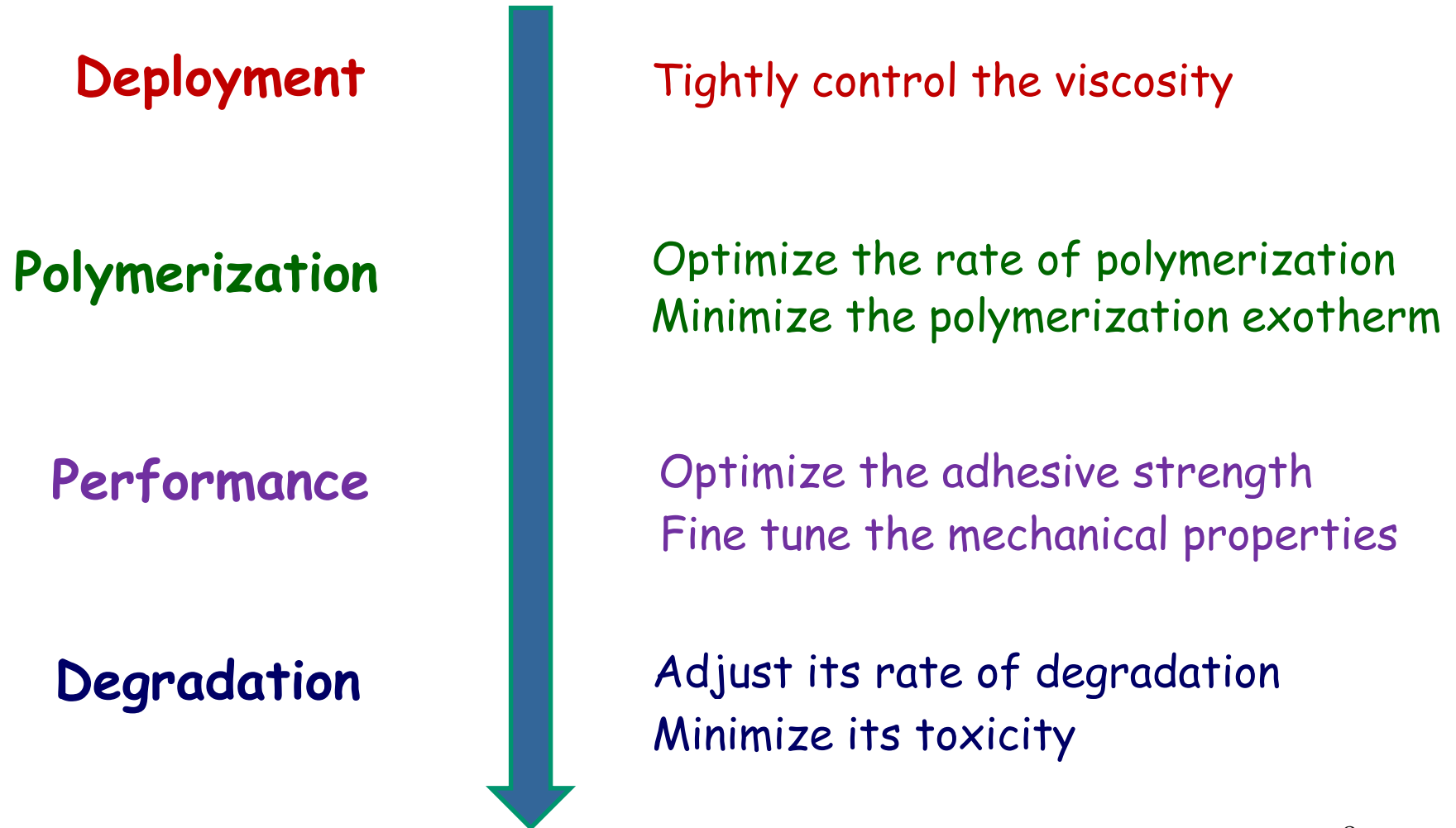
In situ copolymerization of CA with
a multifunctional biodegradable cross-linkable comonomer

CA

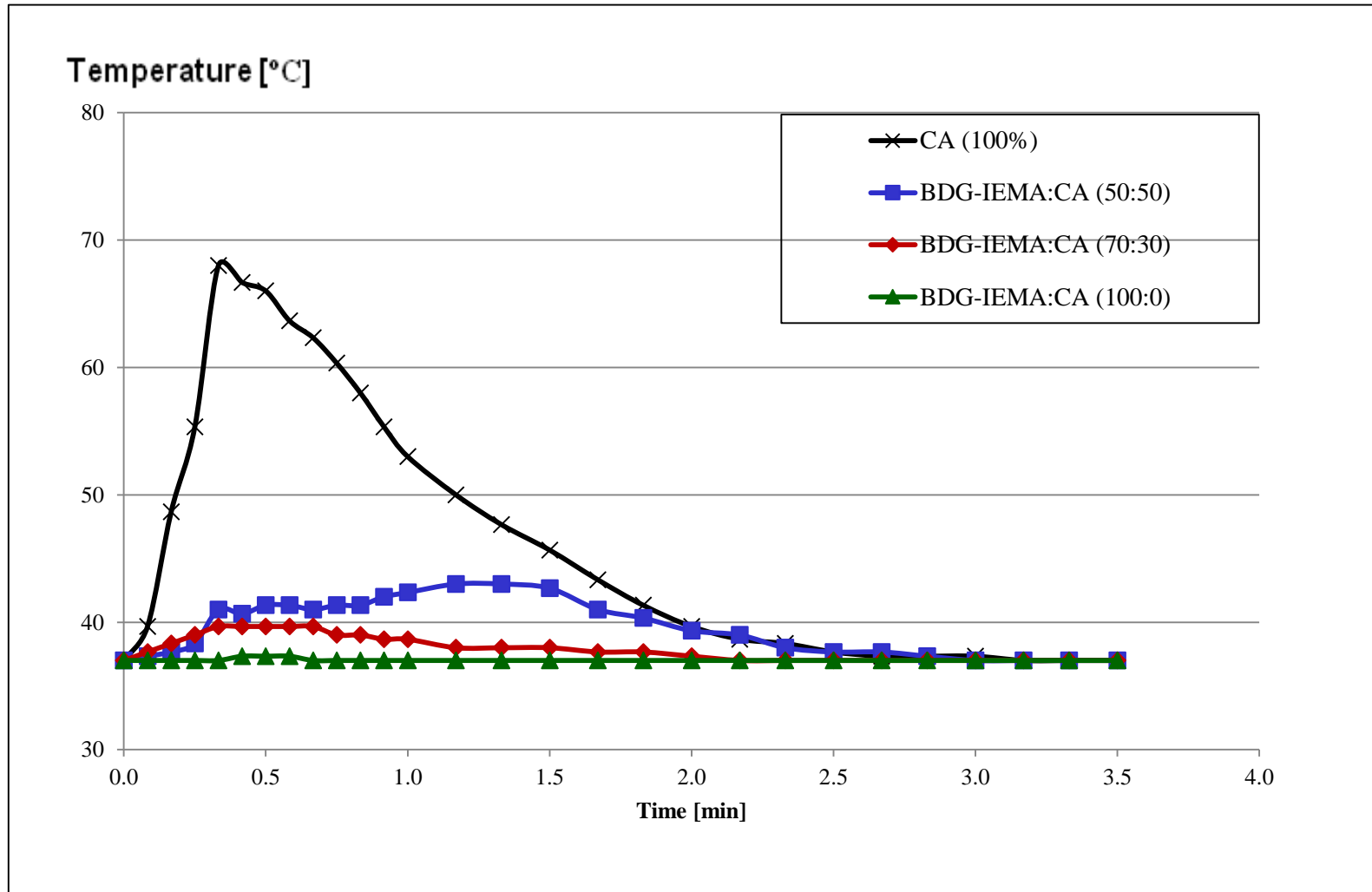


BDG

Moving along the procedure



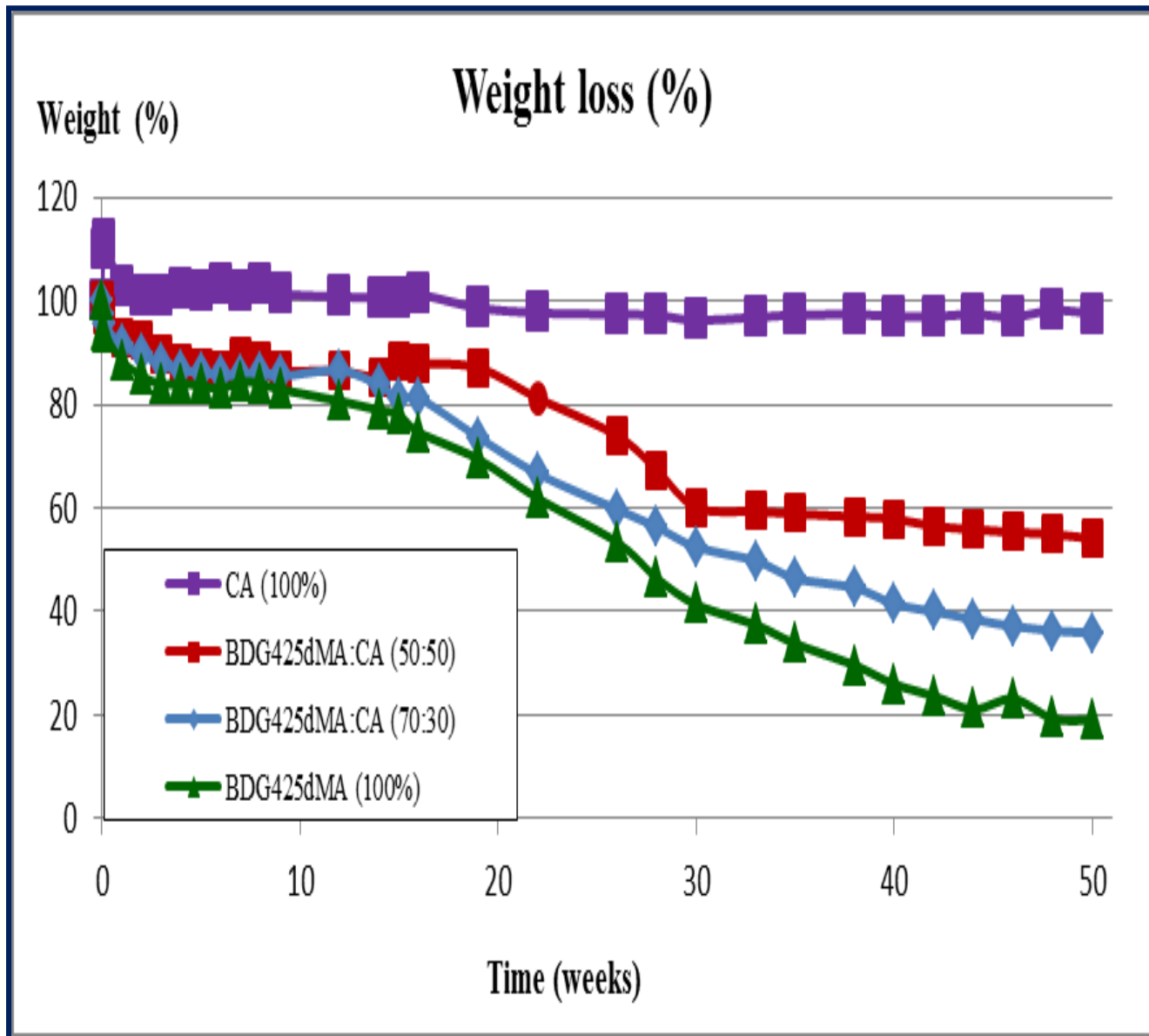
Polymerization exotherm



Polymerization at 37°C

Cyanoacrylate Adhesive

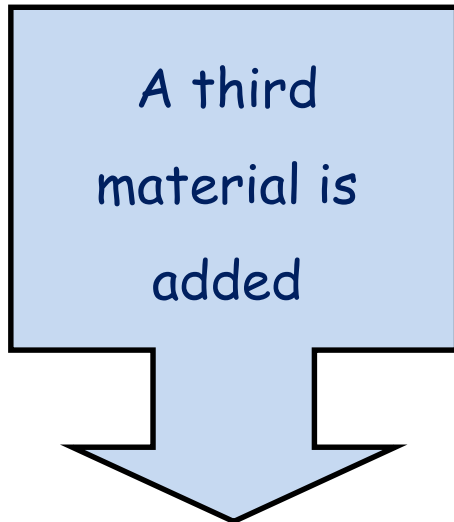
Degradation



Bonding inside the body

and building

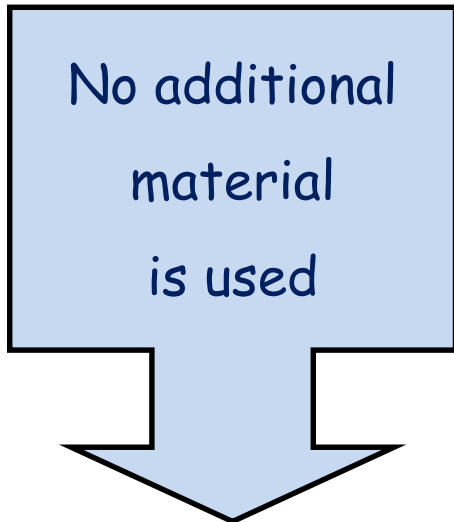
Two basic strategies



Tissue adhesive

Two tissues

In a pig model



In situ welding

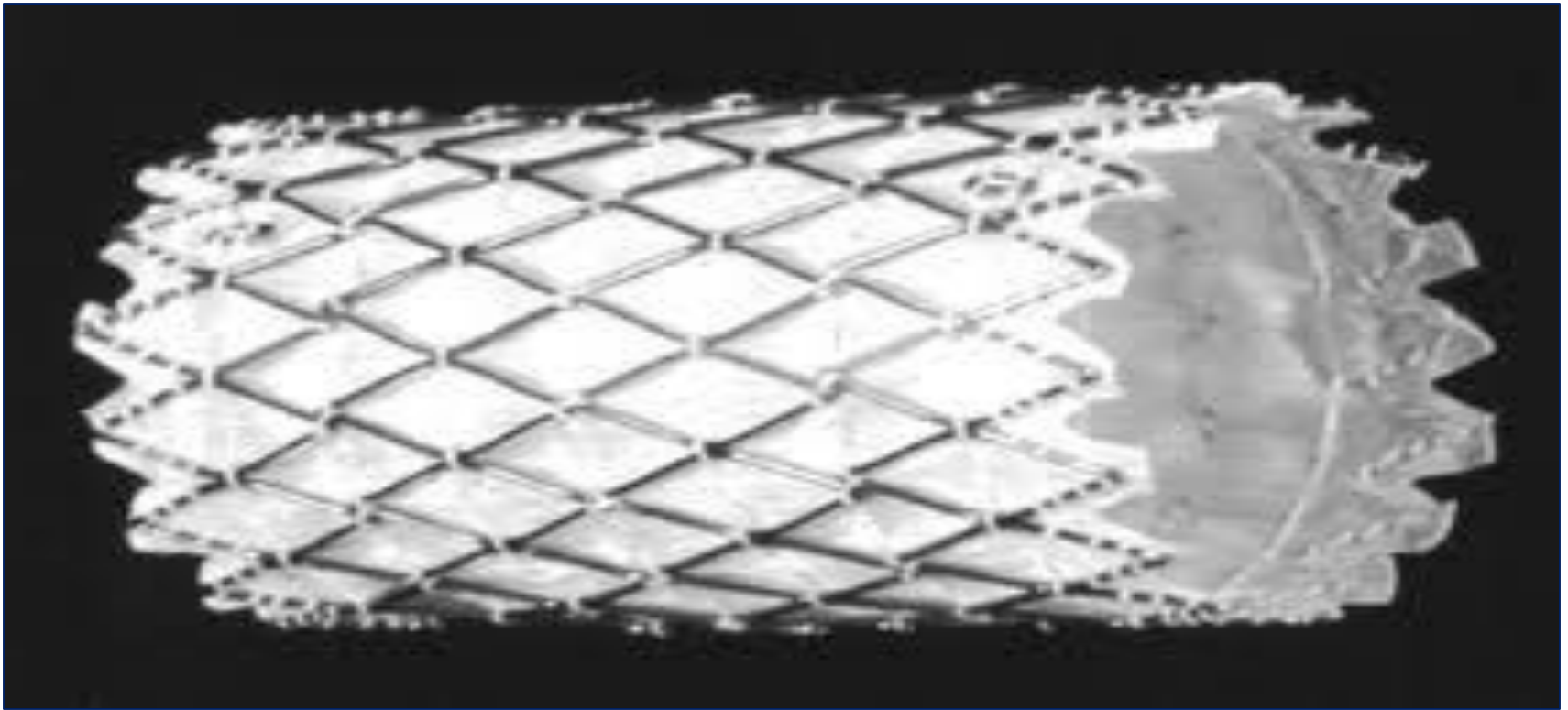
Two devices

Ultra-low profile endoluminal devices

Covered stents

But common **Complex anatomies**





Typically, the "graft component"
constitutes at least 60% of total profile

"Sequentiability"

In situ weldability

In situ welding

Two or more components are welded together
at the site of performance of the device

- ✓ Weldable at a physiologically acceptable conditions
 - ✓ Strong and reliable
 - ✓ Fast

Thermoplastic polymers displaying
fine tuned low softening temperatures

The concept



Sequential deployment

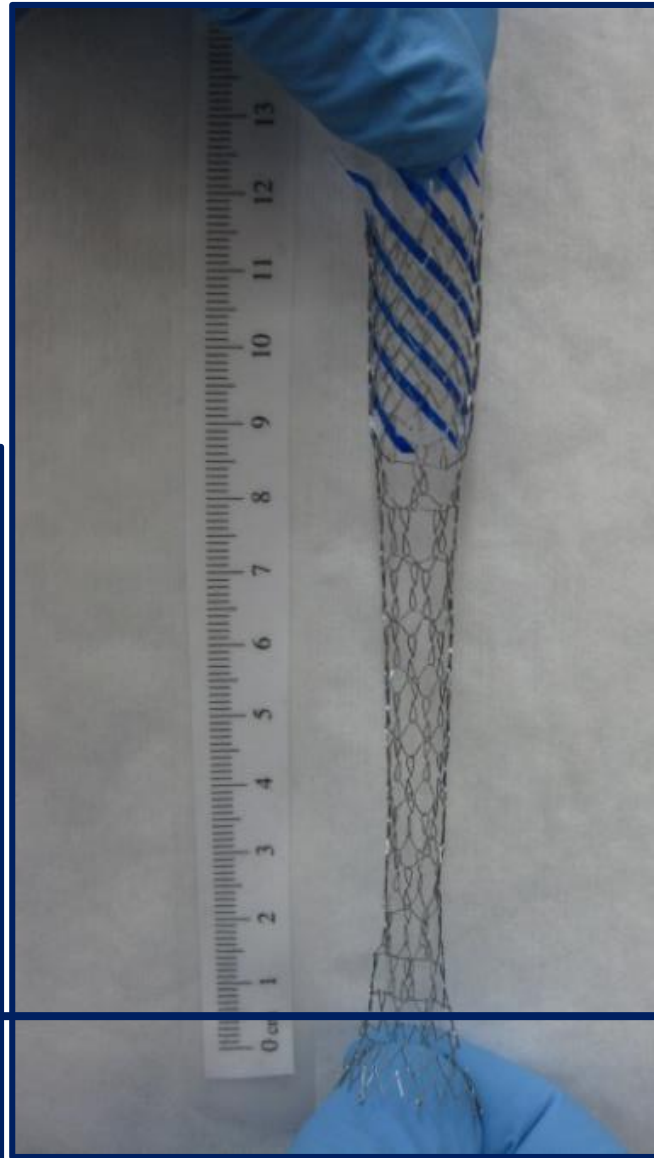
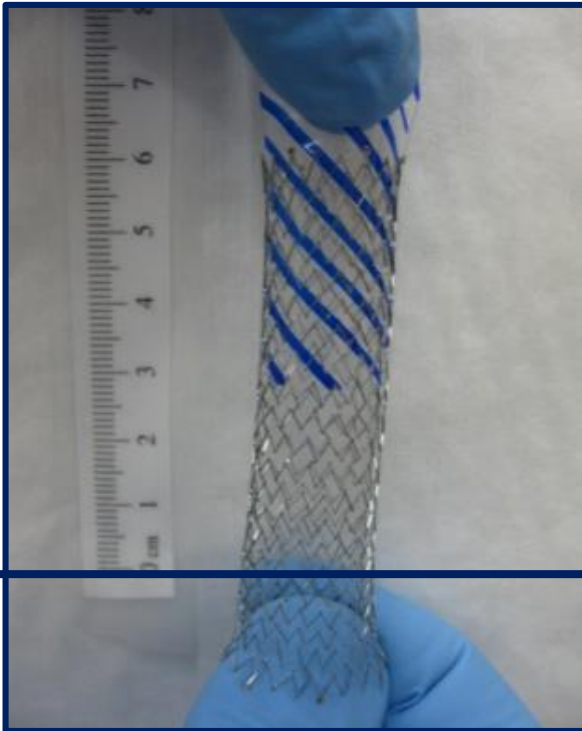
Coated stent



Welding a patch to a coated stent



Strength of the welded connection



Strength of the welded connection



THANKS FOR YOUR KIND ATTENTION!!



That's all Folks!!