



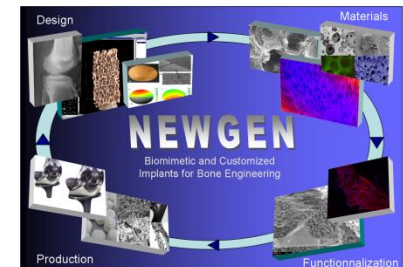
- **Complete denomination:** Biomaterials and Cosmetics Department
- **Location (city, country):** Torun, Poland
- **Head of Department:** Alina Sionkowska
- **Contact person in NEWGEN:** Alina Sionkowska
- **Working Group involvment:** WP1 and WP2
- **Staff:** 8 staff (1 Prof., 3 researchers)
- **Research topics:** Modification of polymer properties, miscibility and physico – chemical properties of polymer blends containing biopolymers i.e. collagen, chitosan, silk, elastin, keratin, cellulose, physico – chemical properties of polymer composites, biopolymeric films and sponges for biomedical applications, polymeric biomaterials.
- **Researchers expertises:** Preparation and characterization of materials containing biopolymers: polymer blends, composites, biomaterials  
Physico –chemical properties: thermal properties, viscosity, rheological properties, photodegradation of materials, mechanical properties.

**Nicolaus Copernicus University**

Faculty of Chemistry

Gagarin 7

87-100 Torun - POLAND

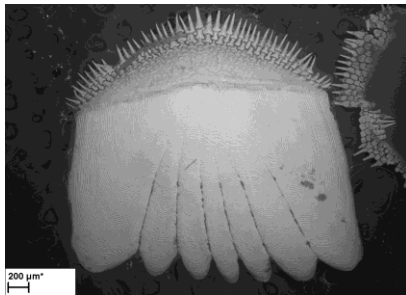


**COST Action MP1301**



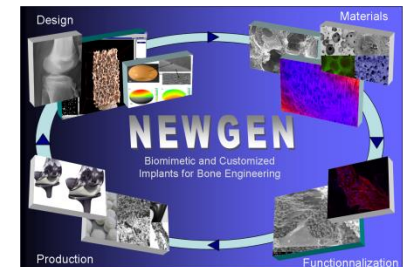
## Raw materials synthesis

Extraction of collagen from several sources,



The natural source of collagen:

- Tendons
- Skin (fish and mammals)
- Fish scales
- Other marine sources

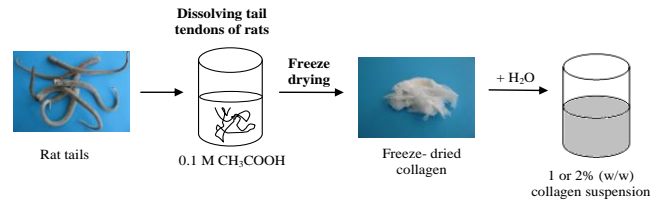




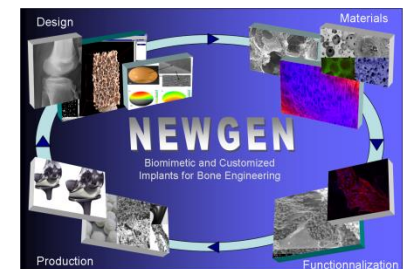
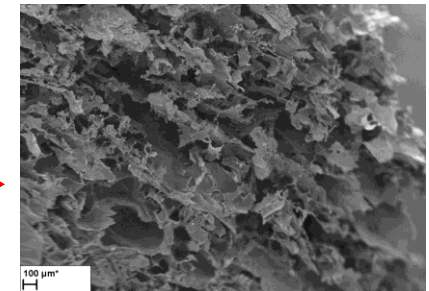
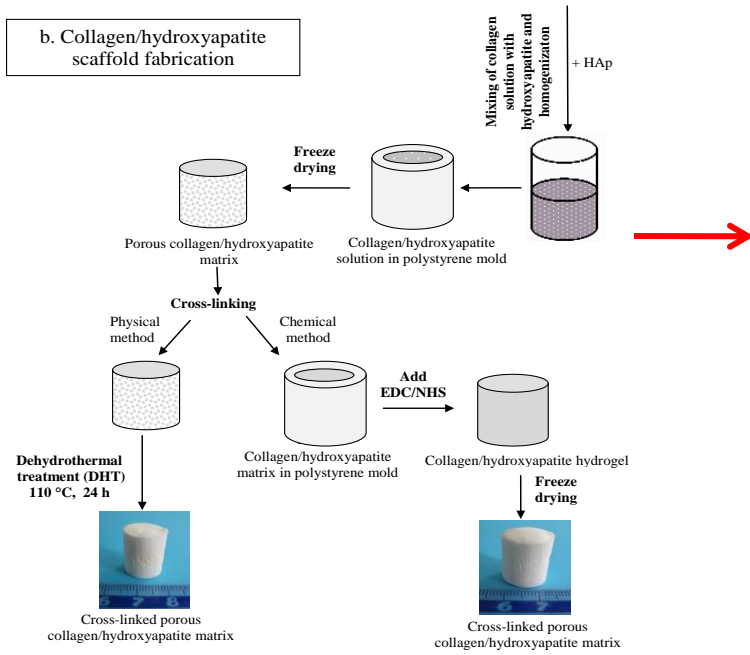
# Raw materials synthesis

## Scaffolds

### a. Collagen Processing

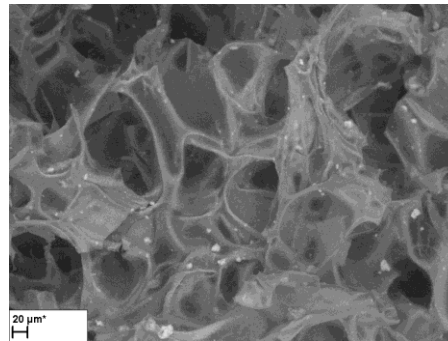


### b. Collagen/hydroxyapatite scaffold fabrication

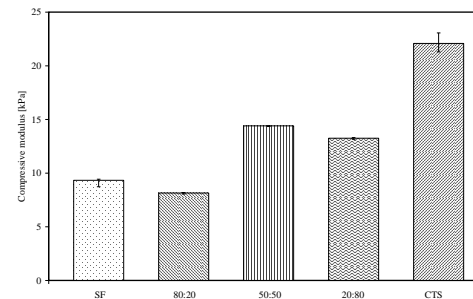


# Raw materials synthesis

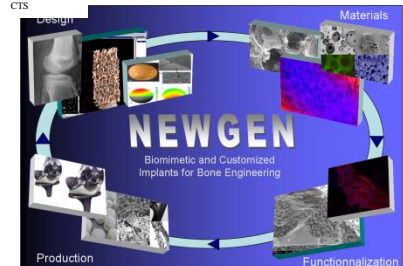
- ✓ polymer blends
  - biopolymer/synthetic polymer blends
  - blends of two biopolymers
- ✓ composites
  - polymer/biopolymer with hydroxyapatite
  - biopolymer with montmorillonite



SEM of sponge made of chitosan, silk fibroin and nano-hydroxyapatite

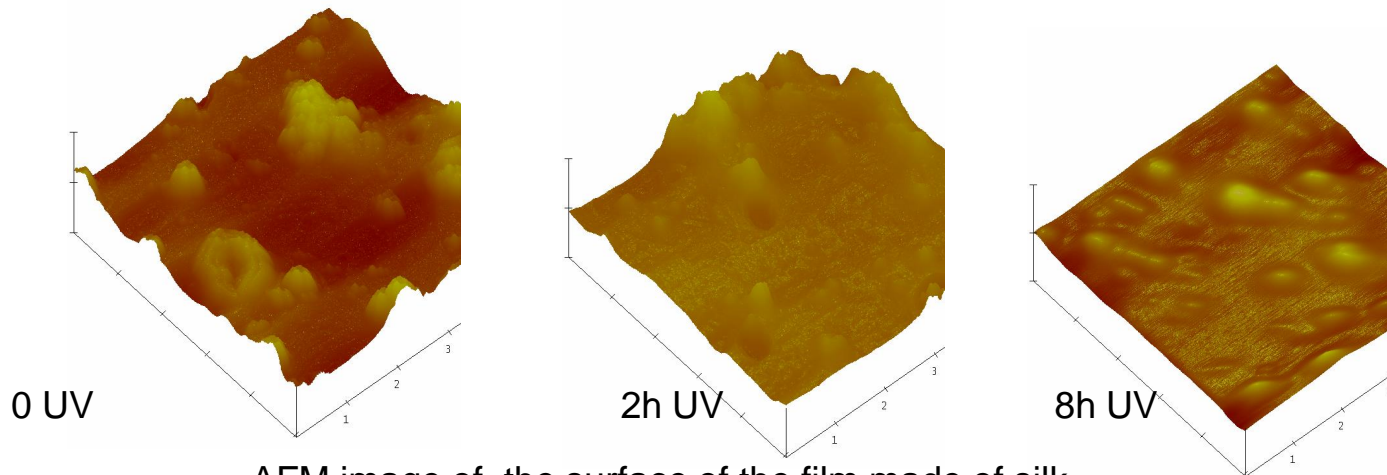


Compressive modulus of silk fibroin/chitosan blends



### Photodegradation of materials

The effects of artificial solar radiation from an Accelerated Weathering Chamber (Weatherometer) and/or UV-irradiation on the properties of biopolymeric materials.



AFM image of the surface of the film made of silk fibroin before and after 2 and 8 hours of irradiation



### *Specialized techniques available in our lab :*

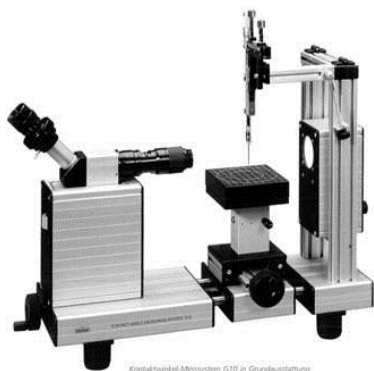
- ✓ a tensile tests Zwick&Roell 0.5,
- ✓ the quartz Ubbelohde capillary viscometer and Ubbelohde capillary viscometers,
- ✓ a mercury lamp Philips TUV – 300 which emits light mainly 254 nm,
- ✓ the Accelerated Weathering Chamber's (Weatherometer) Suntest which produces artificial sunlight (Xenon lamp, 300–800 nm)
- ✓ Genesis II FTIR spectrophotometer Mattson (USA) equipped in ATR device (MIRacle™ PIKE Technologies) with zinc selenide (ZnSe) crystal,
- ✓ the DSA10 goniometer of Krüss GmbH (Germany), equipped with software for the drop shape analysis,
- ✓ a rotary viscometer Bohlin Visco 88 with concentric cylinder at different temperatures (25-40°C) and shear rates (20-1230s<sup>-1</sup>),
- ✓ differential scanning calorimeter Netzsch 204 F1 Phoenix
- ✓ a Shimadzu spectrophotometer (Model UV-1601PC)





### Wetting:

contact angles, surface free energy ( $\gamma_s$ ) and its polar ( $\gamma_s^d$ ) and dispersive ( $\gamma_s^p$ ) components



DSA10 goniometer

### Thermal properties:

Temperature range: -180°C to 700°C

Wide range of heating rates: 0.001 K/min to 200 K/min

Fast cooling: max. 200 K/min

Very short time constant with T-sensor

Extremely high sensitivity with  $\mu$ -sensor

Intracooler for the extended range: -85°C to 600°C

Automatically controlled liquid nitrogen cooling: -180°C to 700°C

TM-DSC: programming and evaluation of temperature modulated

DSC tests with unique FRC correction



DSC 204 F1 Phoenix - Netzsch

### Mechanical properties

Zwick&Roell testing machine

