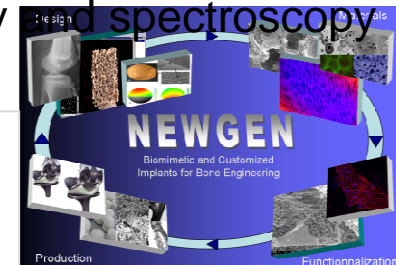


- ✓ **Complete denomination:** International Centre of Electron Microscopy for Materials Science & Faculty of Metals Engineering and Industrial Computer Science
- ✓ **Location (city, country):** Krakow, Poland
- ✓ **Director:** Prof. Dr Aleksandra Czyrska-Filemonowicz
- ✓ **Contact person in NEWGEN:** Prof. Dr Aleksandra Czyrska-Filemonowicz (czyrska@agh.edu.pl)
- ✓ **Working Group involvement:** WG2
- ✓ **Staff:** experienced scientists and researchers in advanced microscopy techniques
- ✓ **Research topics:** Metallic implants, ceramic coatings on titanium alloys, polymers scaffolds
- ✓ **Researchers expertise:** production of polymeric scaffolds and ceramic coatings; characterization by 3D tomography (FIB-SEM) and various microscopy techniques (LM, SEM, TEM, HRTEM, HRSTEM, EDS).

### AGH

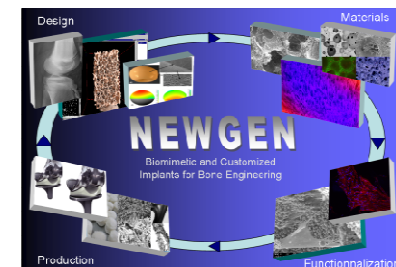
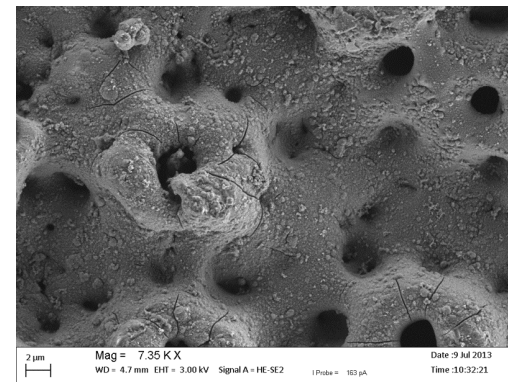
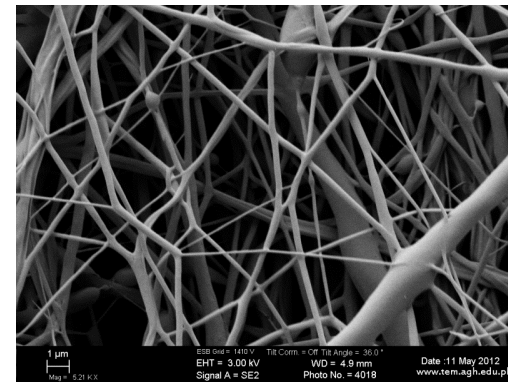
International Centre of Electron Microscopy  
for Materials Science  
al. A. Mickiewicza 30,  
30-059 Krakow, Poland



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### Production of biomaterials:

- biomaterials and nanomaterials for tissue scaffolds applications, mainly polymeric nanofibres and their composites produced by electrospinning methods
- rough and porous protective coatings deposited by micro-arc oxidation method on titanium alloys, composed of titanium dioxides and calcium phosphates



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## Characterization methods

- **FIB-SEM tomography for 3 D visualisation and metrology**

Experience in high resolution 3D imaging using FIB-SEM tomography (focused ion beam- scanning electron microscope) for electrospun nanofiber scaffolds.

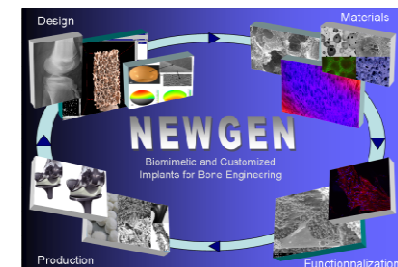
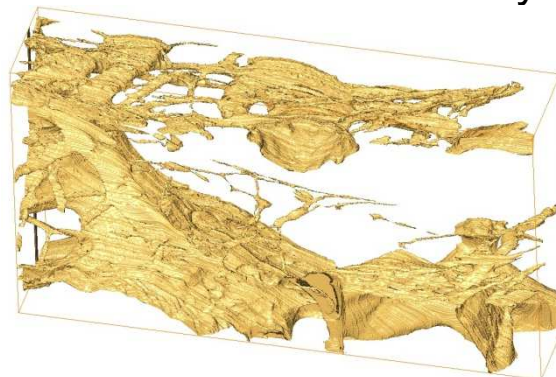
This FIB-SEM 3D tomography is used for visualization inside integration of cells and network of fibres. The technique allows to quantify spacing between fibres and analyse porosity influence on cell proliferation and integration with nanofibre scaffolds.

These imaging techniques therefore provide unprecedented **nanoscale** imaging resolution using combined scanning electron and ion beam microscopies.

This 3D tomography can be also used as a complementary method to X-ray micro computed tomography (mCT) at submicron level.

- **Quantitative electron microscopy**

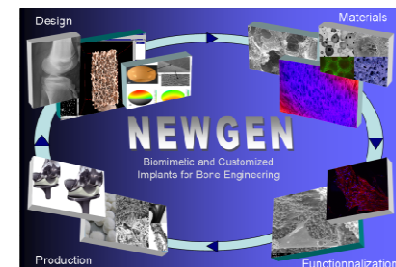
Experience in quantitative characterization of macro-, micro- and nanostructure and chemical composition of materials using advanced electron microscopy and spectroscopy down to atomic level as well as surface analyses (AFM).



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We have possibilities of quantitative characterization of materials micro- and nanostructure by analytical electron microscopy methods, also at the atomic level (70 pm resolution) using the following techniques:

- Diffraction : Selected area electron diffraction (SAED); Convergent beam electron diffraction (CBED); Micro- and nanodiffraction ( $\mu$ D, NBD), Precession electron diffraction (PED);
- Phases identification in multiphase and multilayered materials with the aid of electron diffraction and spectroscopy methods supported by specialized software
- High resolution transmission- and scanning transmission electron microscopy (HRSEM, HRTEM, HRSTEM)

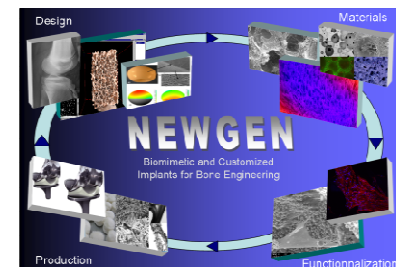
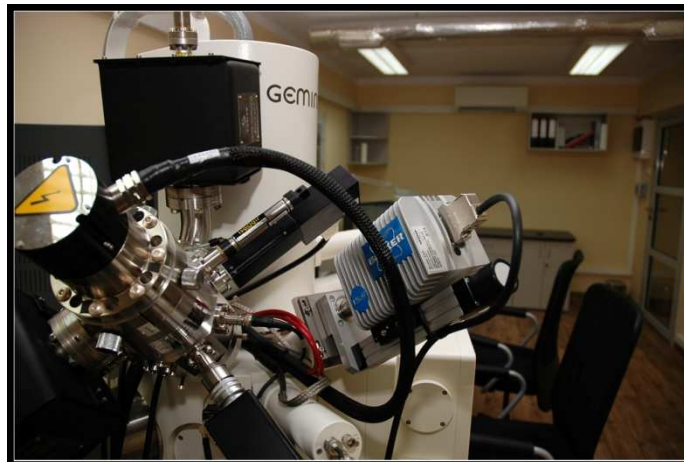


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Chemical analyses (qualitative and quantitative) by spectroscopy methods:

- Energy dispersive X-ray spectroscopy (EDS) with a possibility of collecting elemental distribution maps at the atomic level
- Electron energy loss spectroscopy (EELS)
- Elemental distribution maps by energy filtered transmission electron microscopy (EFTEM)

Investigation of the electric and magnetic fields with the aid of electron holography;  
Lorentz microscopy



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### 4 Transmission electron microscopes (TEMs):

#### Titan3 G2 60-300 (FEI)

Probe Cs corrected S(TEM) with a ChemiSTEM system for analytical resolution (70pm) electron microscopy

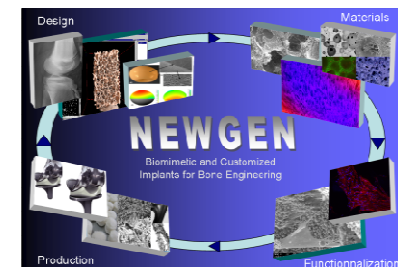
#### Tecnai G2 20 TWIN (FEI)

- STEM-HAADF detector
- EDX microanalysis system TIA
- Precession electron diffraction DigiStar and ASTAR system for automatic analysis of grain orientations and phase mapping in nano-areas (NanoMEGAS)

#### JEM-2010ARP (JEOL)

- STEM-ASID attachment
- EDX microanalysis system INCA
- CCD camera Orius SC1000

#### JEM-200CX (JEOL)



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## FACILITIES



### 2 Scanning electron microscopes (SEMs):

#### Merlin Gemini II (ZEISS)

high resolution electron microscope equipped with:

- FEG electron gun
- EDX detector with Quantax 800 (Bruker) microanalysis system
- EBSD detector with Quantax CrystAlign 400 (Bruker)

microanalysis system

#### NEON CrossBeam 40EsB (ZEISS)

electron microscope equipped with:

- FIB column
- FEG electron gun
- SEM column with SE, EsB and BSE detectors
- EDX detector with Quantax 400 (Bruker) microanalysis system

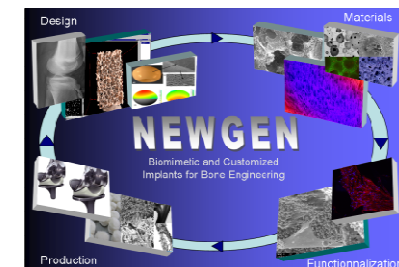


### Atomic force microscope Dimension 3100 SPM

### Light microscopes (LM):

Axio Imager M1m (ZEISS)

Stereo Discovery (ZEISS)



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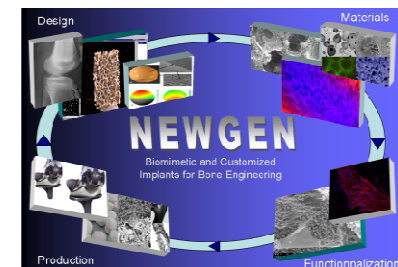
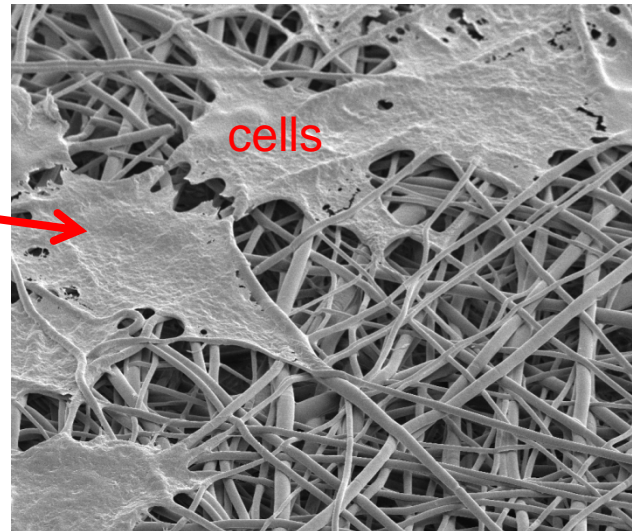
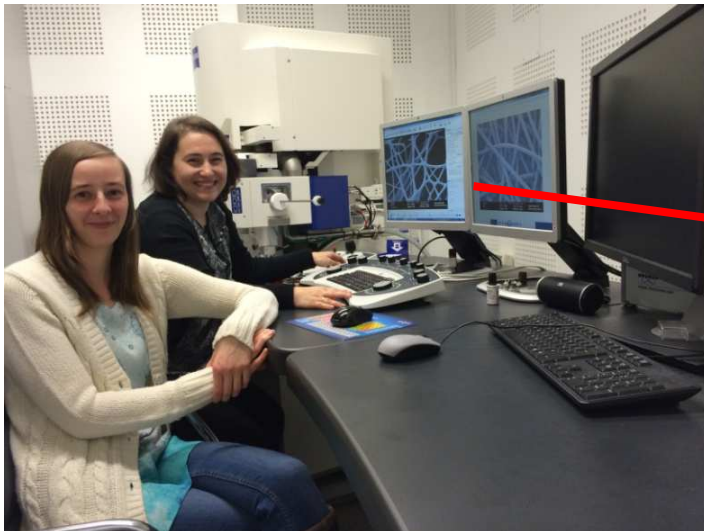
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## FACILITIES



Our newly opened **in vitro cell laboratory** provides facilities for basic biocompatibility investigations with cell lines. It is equipped with :

CO<sub>2</sub> incubator, laminar flow chamber, liquid nitrogen dewars, fridge/freezer(-20°C), sterilizer, benchtop centrifuge, inverted microscope with fluorescence, micro plate reader.



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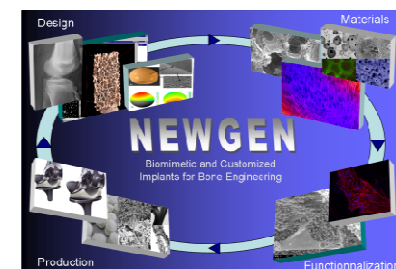
## Team members



The International Centre of Electron Microscopy for Materials Science team



<http://www.tem.agh.edu.pl/main/>



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