

*Projekt współfinansowany przez Unię Europejską w ramach Europejskiego Funduszu Społecznego*



**KAPITAŁ LUDZKI**  
NARODOWA STRATEGIA SPÓJNOŚCI

**UNIA EUROPEJSKA**  
EUROPEJSKI  
FUNDUSZ SPOŁECZNY



# Micro- and Nanosystems in Chemistry and Medical Diagnostics

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**Institute of Electron Technology**  
**Warsaw**



INNOWACYJNA  
POLSKA WSCHODNIA 

**2nd Forum Science & Technology Days Poland-East**  
**22-24.04.2009 Białystok-Białowieża,**

 **SCIENCE  
& TECHNOLOGY DAYS  
POLAND-EAST**



INNOVATIVE ECONOMY  
NATIONAL COHESION STRATEGY



**The project goal is to develop a range of biomedical devices and chemical sensors:**

- ***Lab on a chip for determination of psychotropic drugs in saliva samples***
- ***Diagnostic instruments for analysis of nanoliter volumes of body secretion for fertility and pathological states monitoring***
- ***Diagnostic instruments for fast evaluation of bovine embryos***
- ***Bio- micro-reactors for cell culture***
- ***MEMS for medical diagnostic equipment***
- ***Arrays of chemical sensors for detection of Gram-negative bacteria***



**INNOVATIVE ECONOMY**  
NATIONAL COHESION STRATEGY



## Partners of MNS DIAG :



**Institute of Electron Technology**  
**Instytut Technologii Elektronowej**



**Warsaw University of Technology**  
**Politechnika Warszawska**



**Institute of Microelectronics and Optoelectronics**  
**Instytut Mikroelektroniki i Optoelektroniki**



**Institute of Electronic Systems**  
**Instytut Systemów Elektronicznych**



**Chemical Sensors Research Group**  
**CSRG**



**Institute of Precision and Biomedical Engineering**  
**Instytut Inżynierii Precyzyjnej i Biomedycznej**



**Warsaw University of Life Sciences SGGW**  
**Szkoła Główna Gospodarstwa Wiejskiego**



**Institute of Biocybernetics and Biomedical Engineering Polish Academy of Sciences**  
**Instytut Biocybernetyki i Inżynierii Biomedycznej IBIB PAN**



**Institute of Immunology and Experimental Therapy Polish Academy of Sciences**  
**Instytut Immunologii i Terapii Doświadczalnej PAN**



**Jagiellonian University**  
**Uniwersytet Jagielloński**



**AGH University of Science and Technology**  
**Akademia Górniczo-Hutnicza w Krakowie**



**Wrocław Medical University**  
**Akademia Medyczna we Wrocławiu**



**Wrocław University of Technology**  
**Politechnika Wrocławska**



**Technical University of Lodz**  
**Politechnika Łódzka**



**Poznan University of Life Sciences**  
**Uniwersytet Przyrodniczy w Poznaniu**  
**Wydział Hodowli i Biologii Zwierząt**

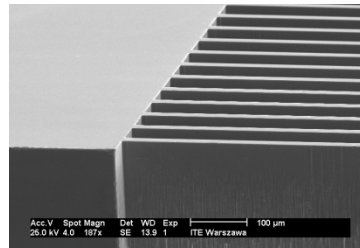


**INNOVATIVE ECONOMY**  
NATIONAL COHESION STRATEGY

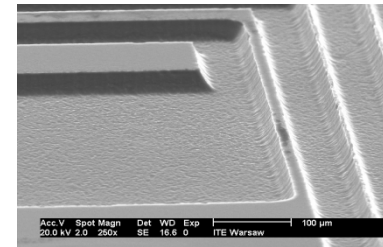




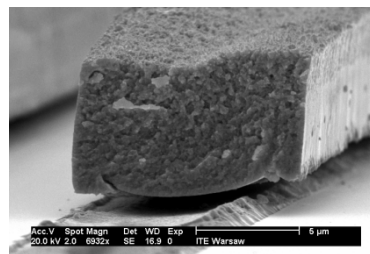
# MEMS technology – processing



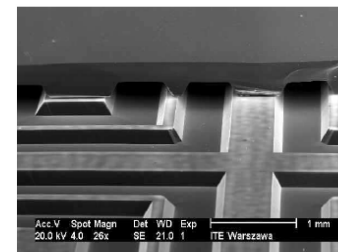
**Deep anisotropic etching of silicon**



**Patterning of polymers  
e.g. Silicone, polyimide**



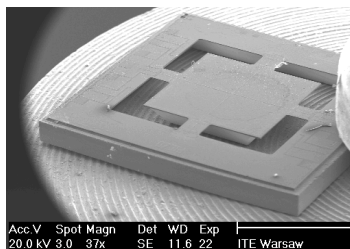
**Electroforming  
- Au, Cu, Pt, Ni**



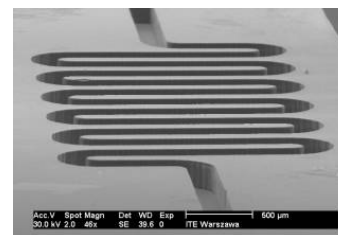
**Bonding: eutectic,  
anodic, direct, adhesive**



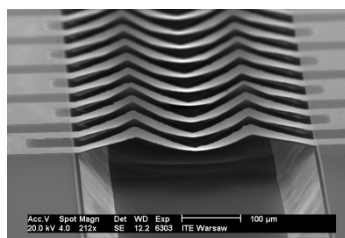
# MEMS structures



**piezoresistive silicon  
transducer**



**microfluidic  
channel**



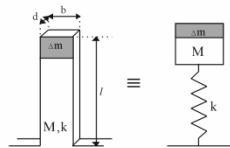
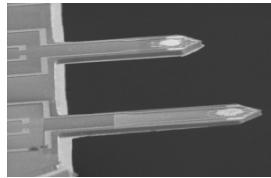
**Si chip with metallic  
resistors over the groove**



**flexible metal paths  
embedded in polymer**

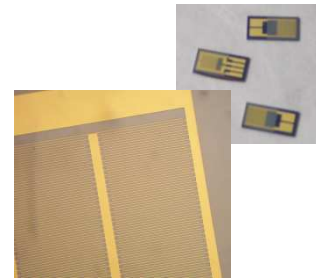


# MEMS devices

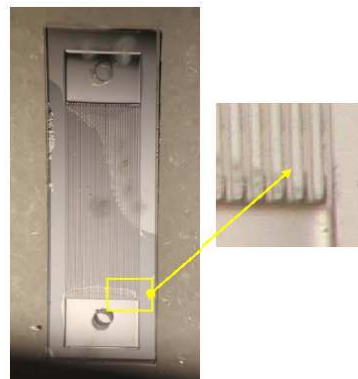


$$k = \frac{E \cdot b \cdot d^3}{l^3} \quad \Delta f_0 = \frac{1}{2\pi} \left( \sqrt{\frac{k}{M + \Delta m}} - \sqrt{\frac{k}{M}} \right)$$

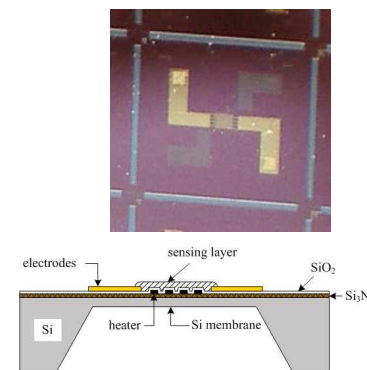
**nanobalance based on Si cantilevers manufactured in cooperation ITE – PWr**



**dew point detectors manufactured in cooperation ISE - ITE**



**silicon microreactors manufactured in cooperation IBIB - ITE**



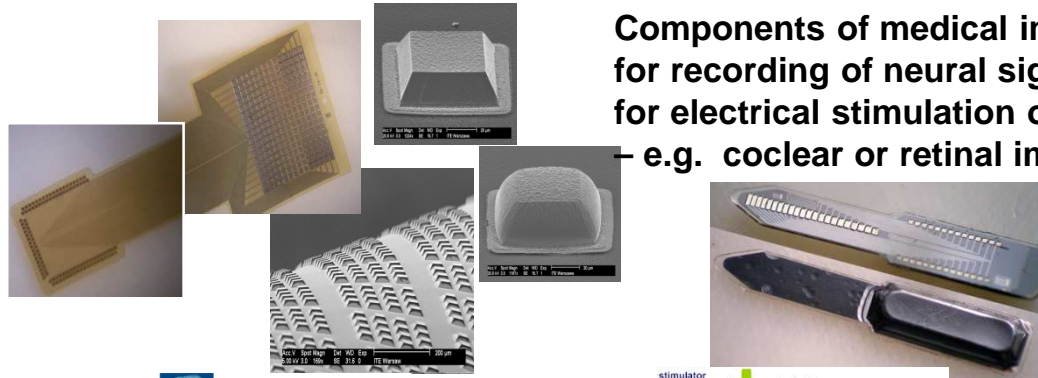
**gas sensor manufactured in cooperation ITE - AGH**



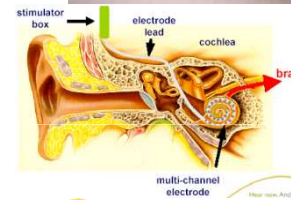
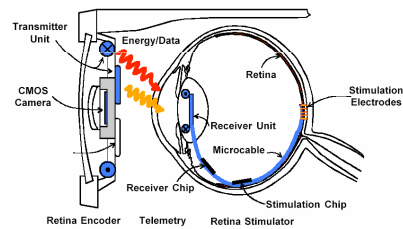
# MEMS applications



Components of medical implants  
for recording of neural signals or  
for electrical stimulation of nerves  
– e.g. coclear or retinal implants



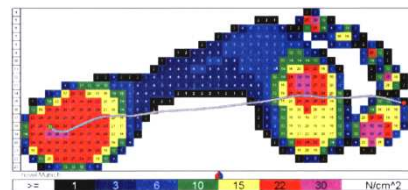
IIP Technologies



Cochlear™

*Sensors for medical products – e.g. for ambulatory measurement of human body.*

Diagnosis of posture defects on basis of the measurement of the foot pressure on floor.



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**UNIA EUROPEJSKA**  
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Porównanie objętości sprawozdań finansowych  
z wykonania projektów badawczych

**Thank You**



**POIG 1 kwartał**  
**356 249,04 zł**



**6 Program Ramowy**  
**1 rok, 72 991,14 EUR**  
**wraz z raportem audytu**

