"Być Małym czy nie być Małym, oto jest pytanie."

Wielki-Mały nicień
Caenorhabditis elegans

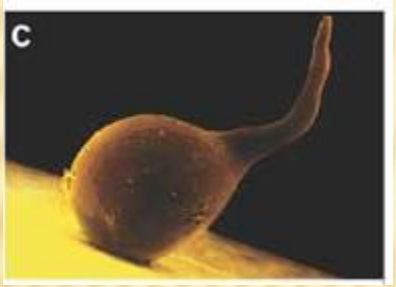
✓ wolno żyjące:

Węgorek octowy (*Turbatrix aceti)*

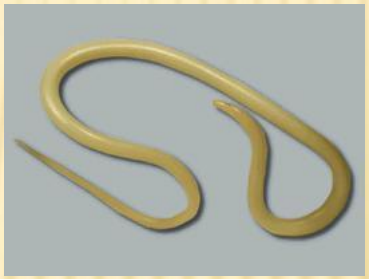
Caenorhabditis elegans

✓ pasożyty roślin i zwierząt

Guzak arachidowy
Meloidogyne arenaria



Glista ludzka
Ascaris lumbricoides

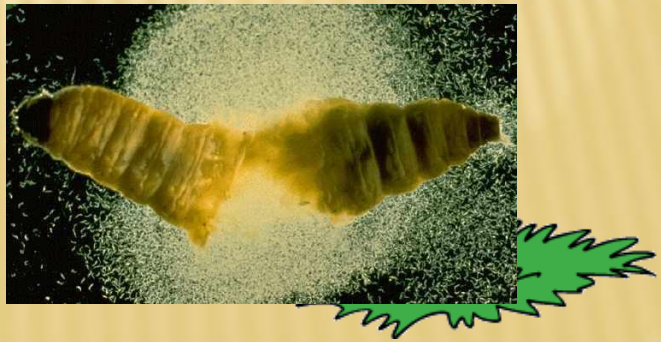


Tęgoryjec psi
Ancylostoma caninum

✓nicienie drapieżne

Steinernema feltiae

Heterorhabditis megidis



Główne wydarzenia w badaniach nad Caenorhabditis elegans

1900 – Organizm, znany jako Caenorhabditis elegans zidentyfikowany przez Maupas'a

1948 – Caenorhabditis zaproponowany jako obiekt badań genetycznych (Dougherty i Calhoun).

1963 – Październik – Brenner otrzymuje próbkę C.elegans od Dugherty'a

1964 – Czerwiec – Brenner pisze list do Perutz'a z propozycją zmiany kierunku badań.

1966 – Brenner kontynuuje poszukiwania innych organizmów do projektu.

Późne lata 60te – Badania genetyczne nad C.elegans rozpoczynają się w Laboratory of Molecular Biology (LMB). Czynniki mutagenne są użyte na robaku w badaniach genetycznych.

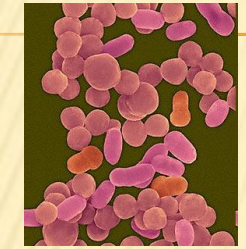
1974 – Neurobiologiczne badania nad C.elegans rozpoczynają się w LMB. Długość sekwencji zostaje określona przez Benner'a i Sulston'a.

1983 – Brenner publikuje wyniki badań genetycznych nad C.elegans. Po-empbionalny rozwój opublikowany.

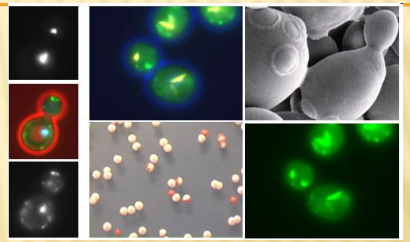
Połowa lat 80tych – Opublikowane w „The Mind of Worm" kompletnego rodowodu komórek embrionalnych

1998 – Mapowanie kodu genetycznego C.elegans (The Human Genome Project) oficjalnie rozpoczęte. C.elegans dodane do „organizmów modelowych".

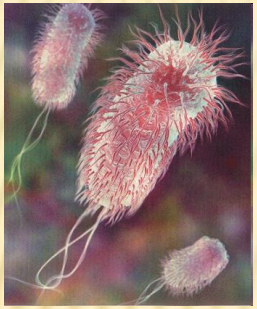
Historia sekwencjonowania



1995: Haemophilus influenzae



1996: Saccharomyces cerevisiae

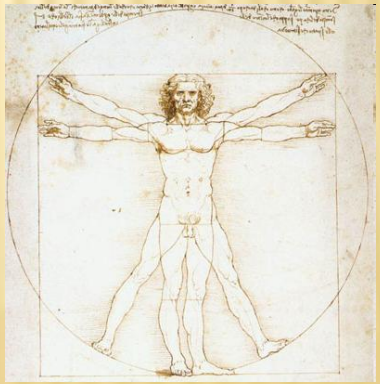


1997: Escherichia coli

1998: Caenorhabditis elegans

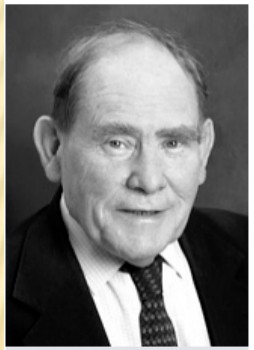
2000: Drosophilia melanogaster

2003: Homo sapiens



The Nobel Prize in Physiology or Medicine 2002

"for their discoveries concerning 'genetic regulation of organ development and programmed cell death'"



Sydney Brenner

1/3 of the prize

United Kingdom

The Molecular Sciences Institute
Berkeley, CA, USA

b. 1927
(in Union of South Africa)

H. Robert Horvitz

1/3 of the prize

USA

Massachusetts Institute of Technology (MIT)
Cambridge, MA, USA

b. 1947

John E. Sulston

1/3 of the prize

United Kingdom

The Wellcome Trust Sanger Institute
Cambridge, United Kingdom

b. 1942

The Nobel Prize in Physiology or Medicine 2006

"for their discovery of RNA interference - gene silencing by double-stranded RNA"

Photo: L. Cicero

Andrew Z. Fire

1/2 of the prize

USA

Stanford University School of Medicine
Stanford, CA, USA

b. 1959

Photo: J. Mottern

Craig C. Mello

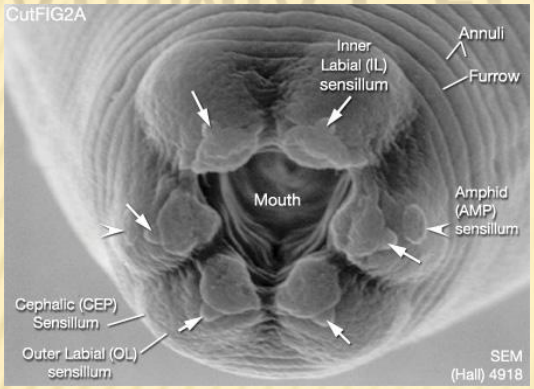
1/2 of the prize

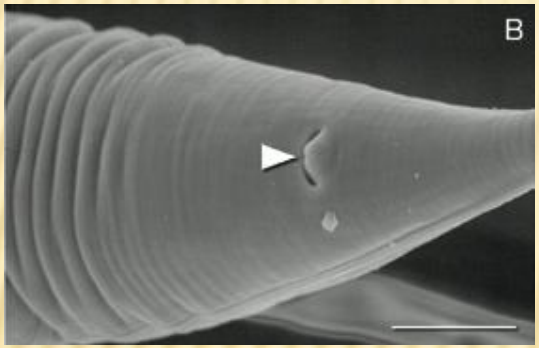
USA

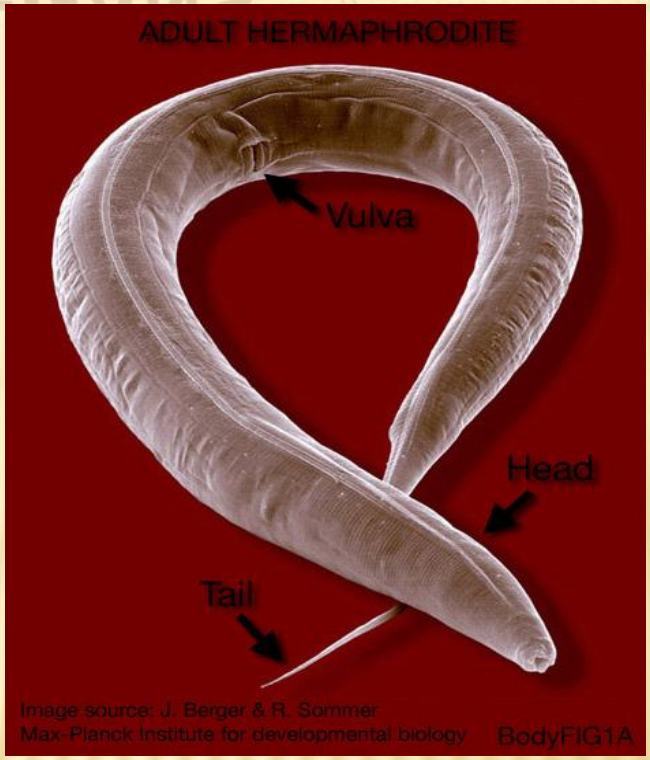
University of Massachusetts Medical School
Worcester, MA, USA

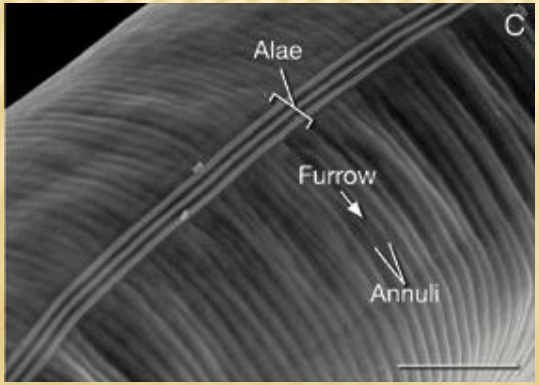
b. 1960

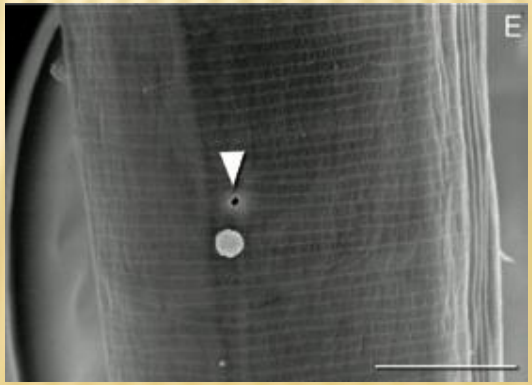
ANATOMIA *C.ELEGANS* HTTP://WWW.WORMATLAS.ORG/

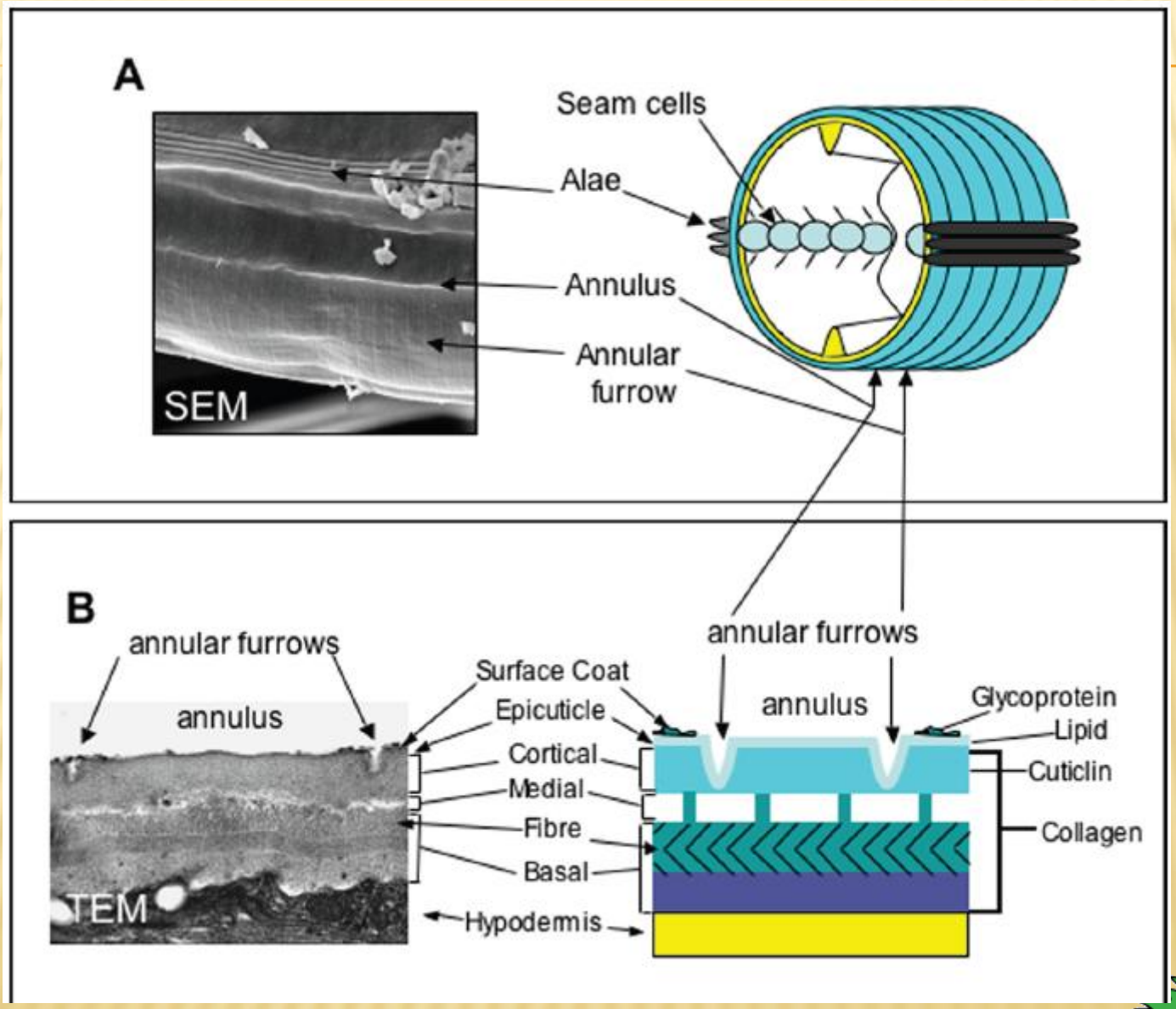




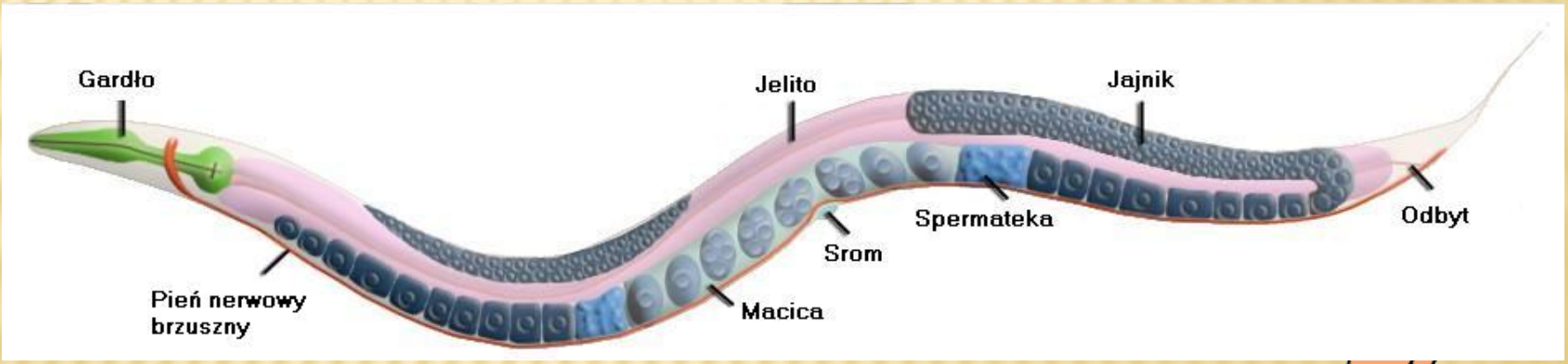


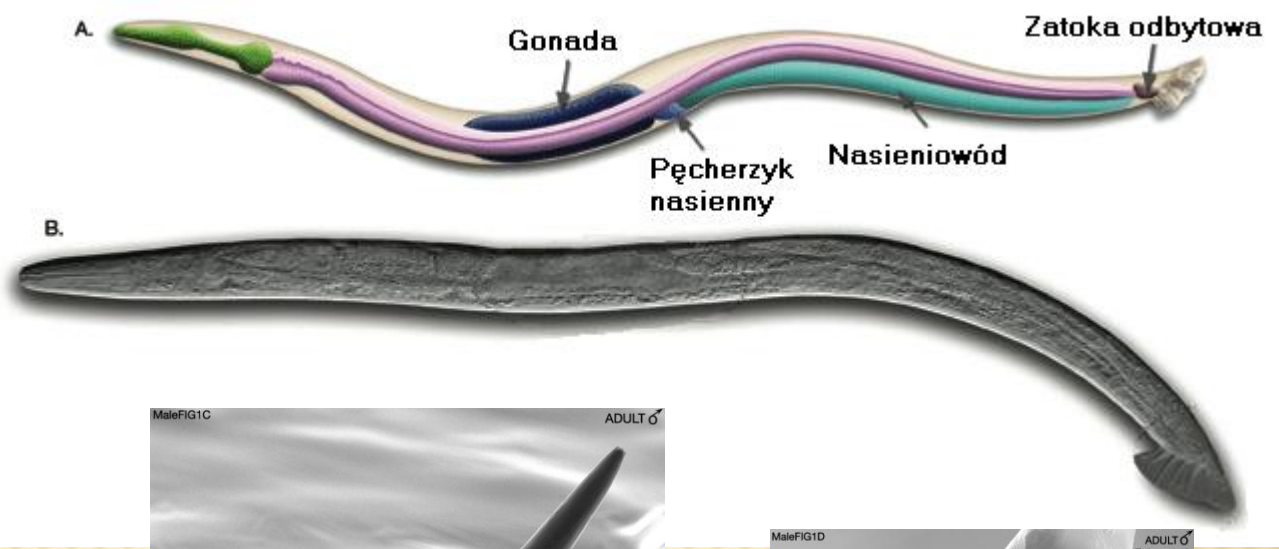


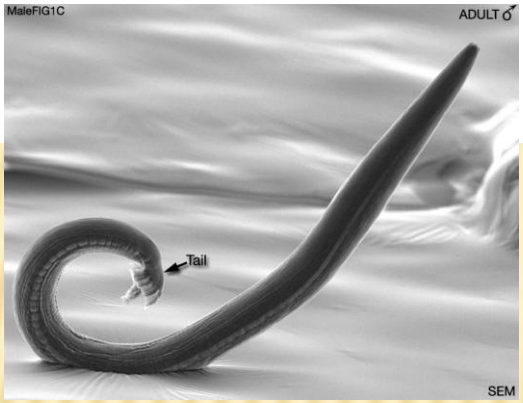


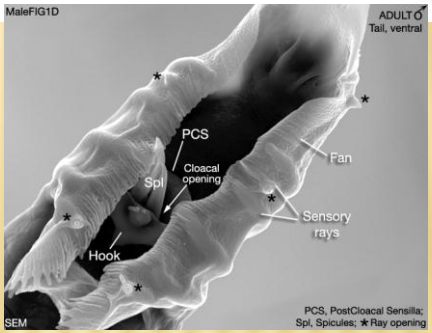

A
Seam cells
Alae
Annulus
Annular furrow
SEM
B
annular furrows
annular furrows
annulus
annulus
Surface Coat
Epicuticle
Cortical
Medial
Fibre
Basal
Hypodermis
Glycoprotein
Lipid
Cuticlin
Collagen
TEM

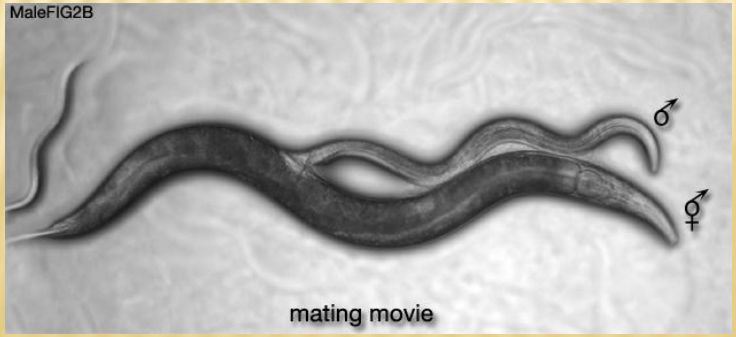

A.
B.


Gardło
Jelito
Jajnik
Spermateka
Odbyt
Srom
Pień nerwowy brzuszny
Macica


A.
Gonada
Zatoka odbytowa
Pęcherzyk nasienny
Nasieniowód
B.


MaleFIG1C
ADULT ♂
Tail
SEM


MaleFIG1D
ADULT ♂
Tail, ventral
PCS
Cloacal opening
Spl
Fan
Sensory rays
Hook
SEM
PCS, PostCloacal Sensilla; Spl, Spicules; ★Ray opening


MaleFIG2B
♂
♀
mating movie

C. elegans jest diploidalnym organizmem z 6 parami chromosomów.

Płeć jest określana przez liczbę chromosomów X

Para homologicznych chromosomów

Hermafrodyta

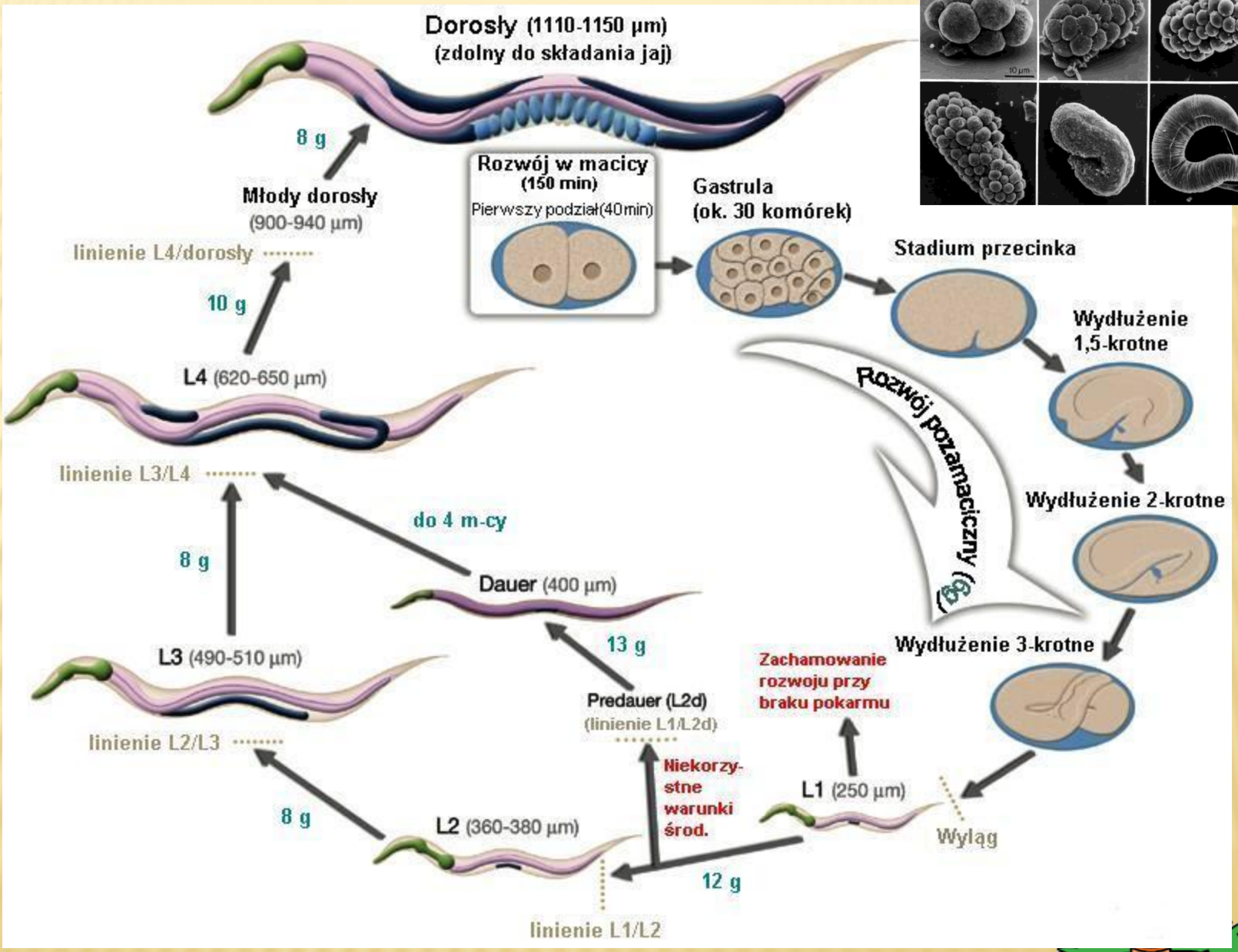
5 autosomów

1 chromosom płci

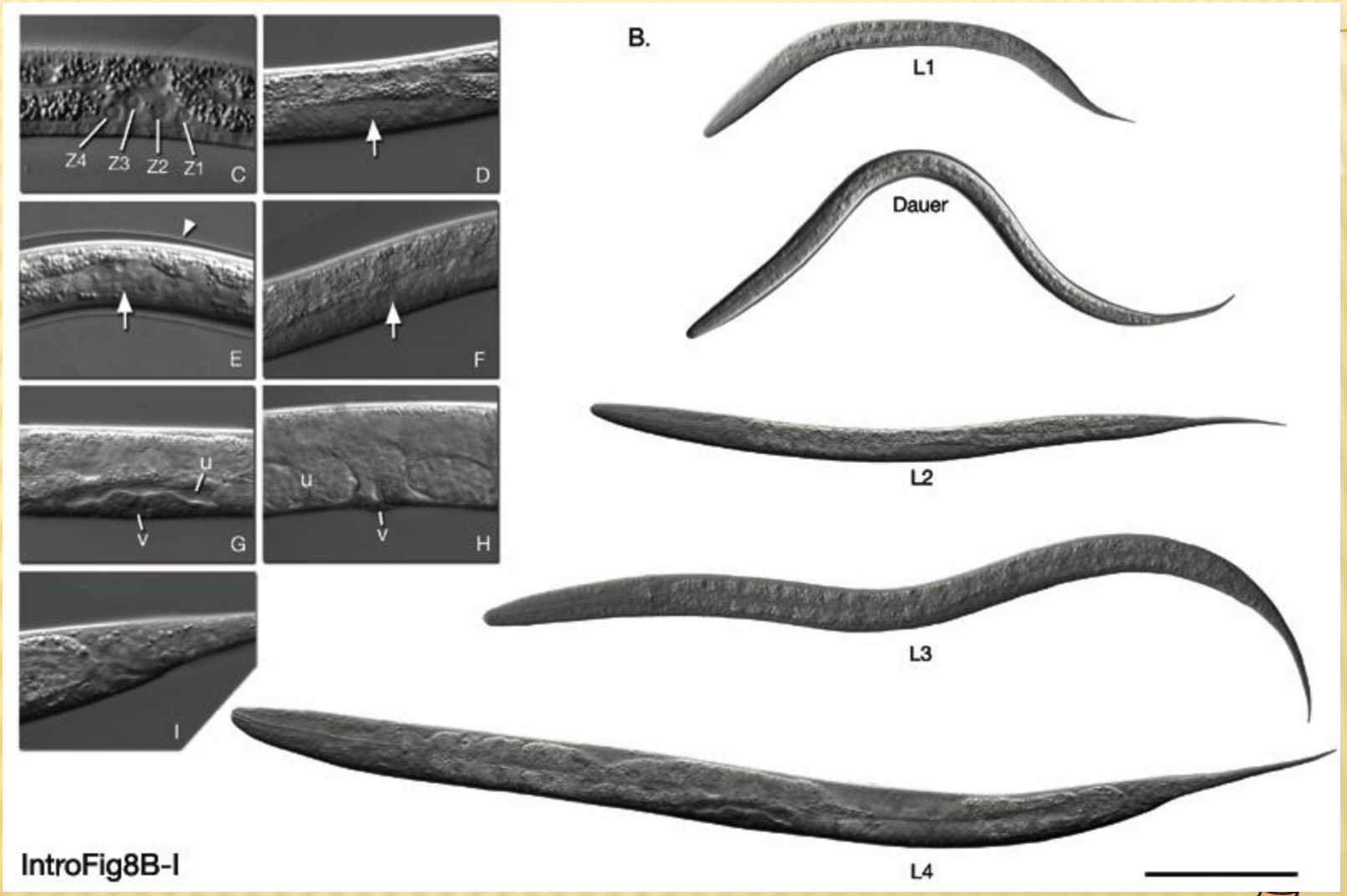
Osobnik męski

5 autosomów

1 chromosom płci

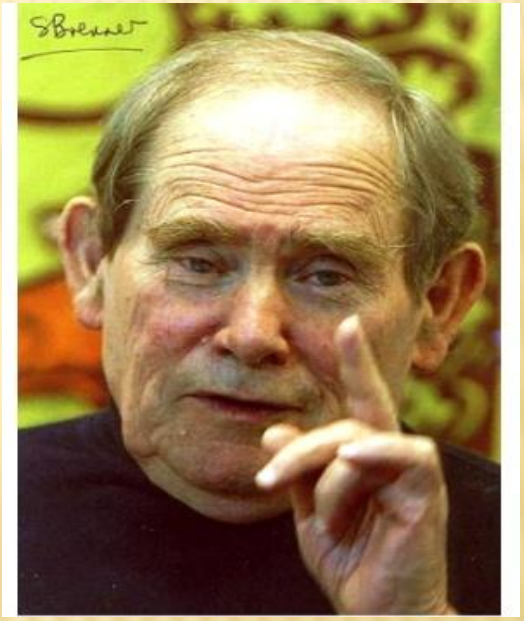


C. elegans life cycle at 22˚C (artwork by Altun and Hall, © Wormatlas)

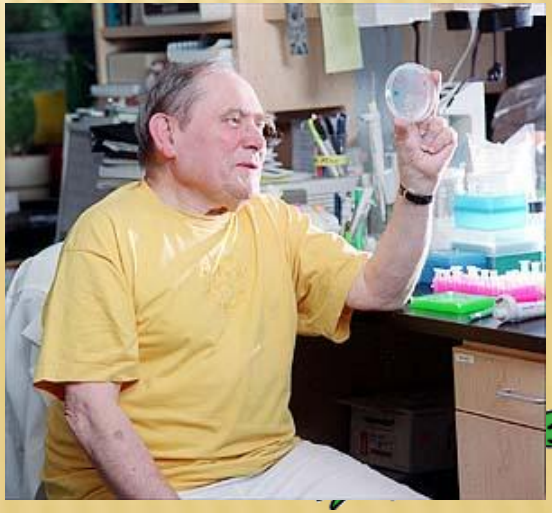

Z4
Z3
Z2
Z1
C
D
E
F
u
v
G
u
v
H
I
B.
L1
Dauer
L2
L3
L4
IntroFig8B-I

SYDNEY BRENNER (1927 -)

The Genetics of Caenorhabditis Elegans, 1973



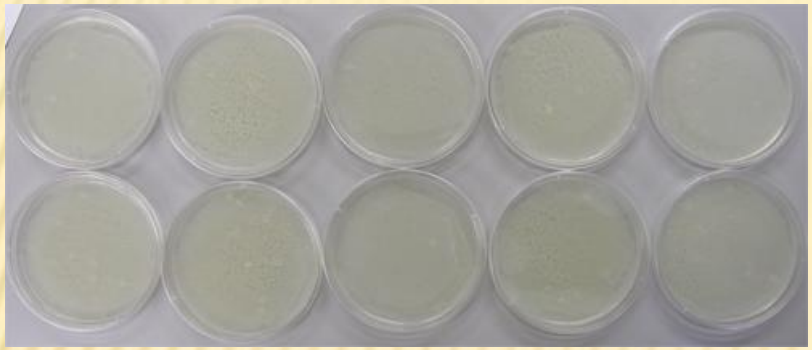
- Biolog z RPA
- Doktorat zrobił na Uniwersytecie Oksfordzkim
- W 2001 podjął pracę na Uniwersytecie Kalifornijskim w Berkeley
- Otrzymał w 2002 Nagrodę Nobla, wspólnie z Robertem Horvitzem i Jonem Sulstonem

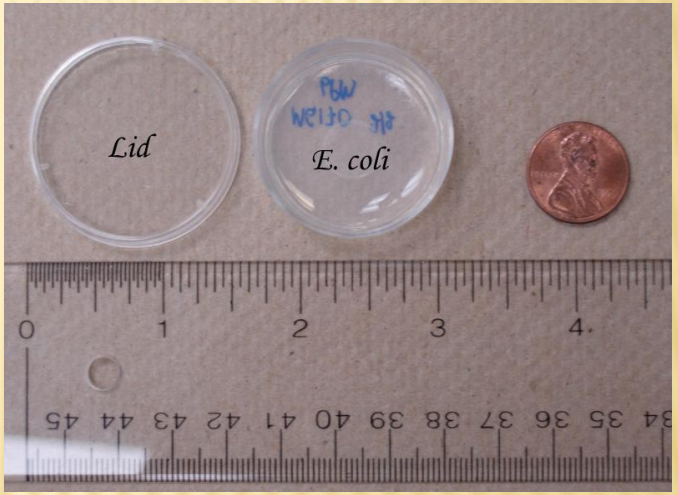


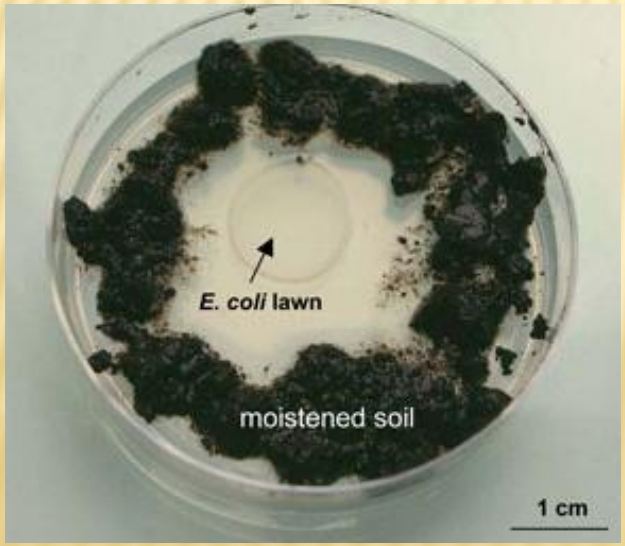
Nowy gatunek nicienia - *C. brenneri*

Organizm modelowy:

- Łatwy w hodowli (odporny na zamrażanie)

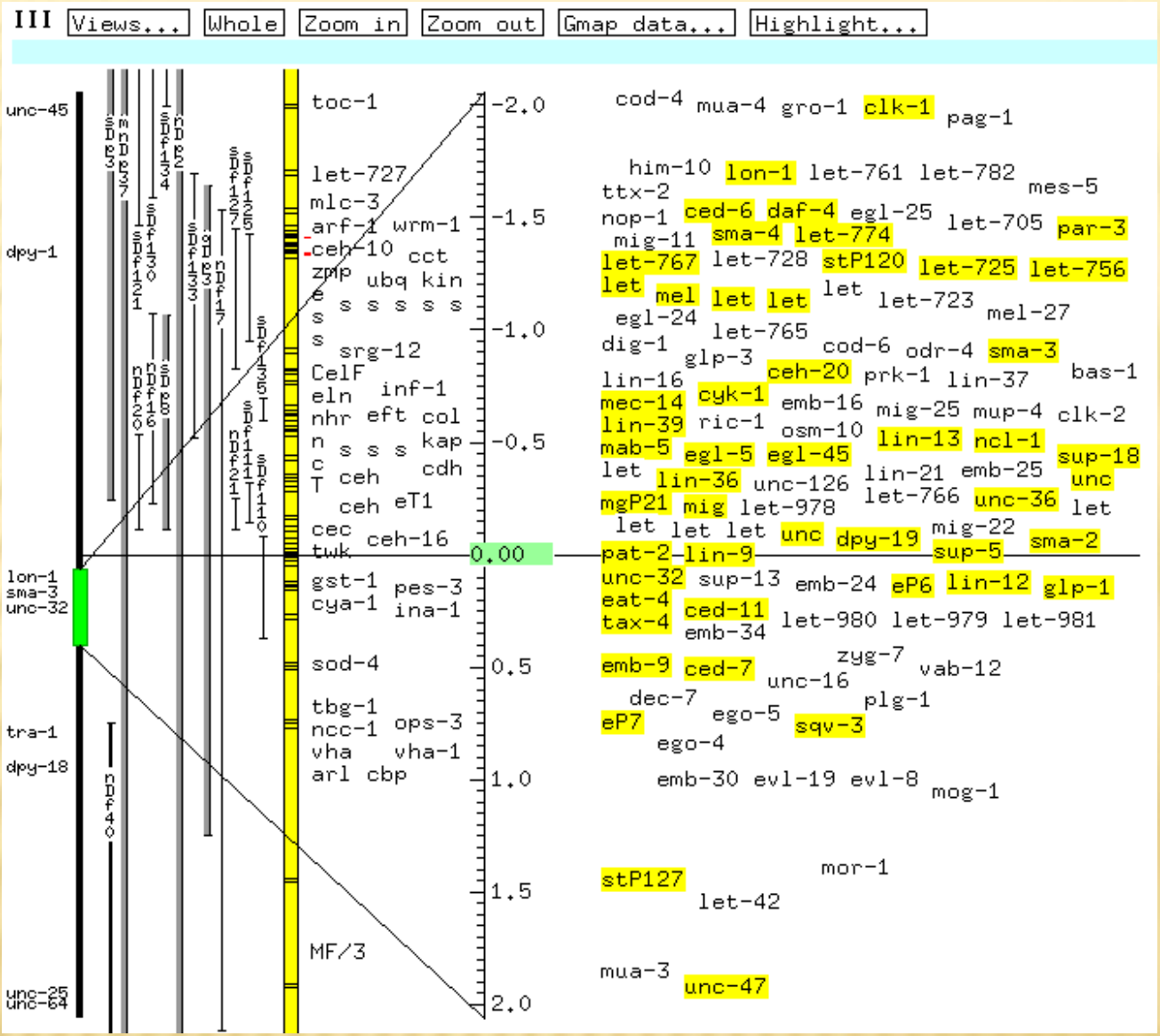






Organizm modelowy

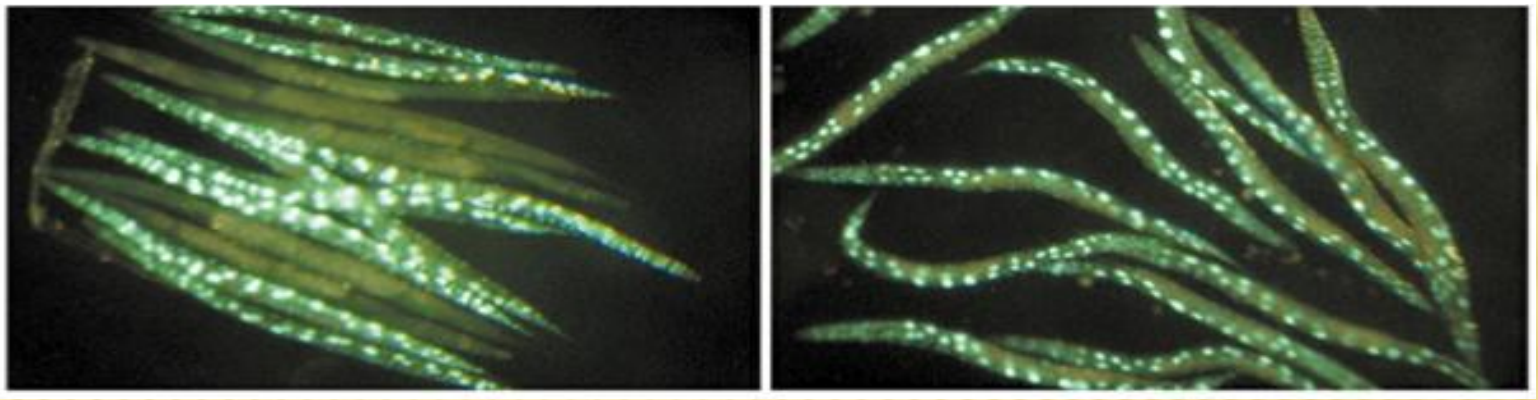
- Krótki okres życia 2-3 tygodnie
- Szybki cykl życiowy – ok. 3 dni (od jaja do jaja)
- Jest stosunkowo niewielki i przezroczysty
- Prymitywny organizm wielokomórkowy ale o cechach organizmu tkankowego o wyraźnie wyodrębnionych narządach
- Poznana liczba komórek
- Zsekwencjonowany genom (100 mln pz; ok. 20 000 genów w tym ok. 80% wykazuje homolgię z ludzkimi genami)

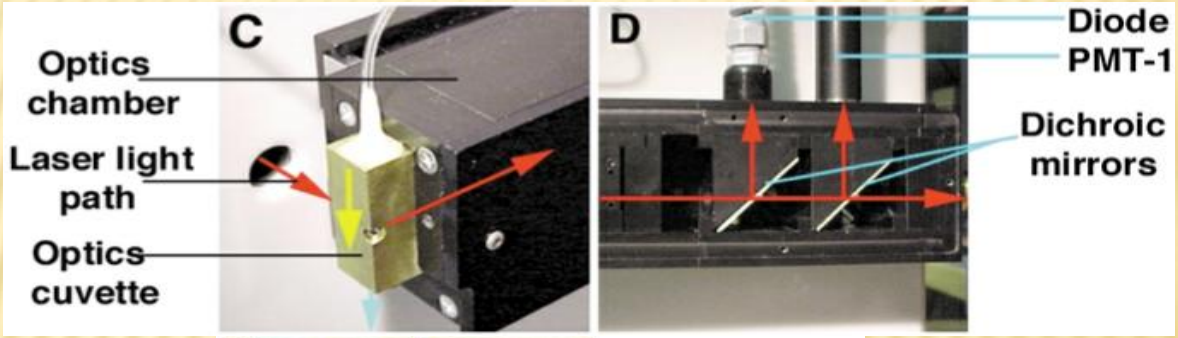


Mapa genetyczna
III chromosomu
C.elegans

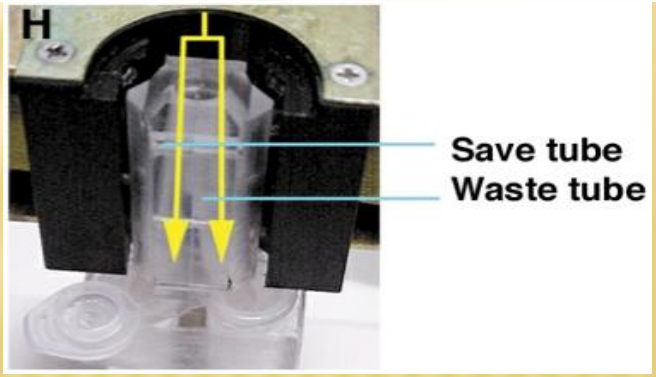
Fluorescence Measurement/Sorting of Worms

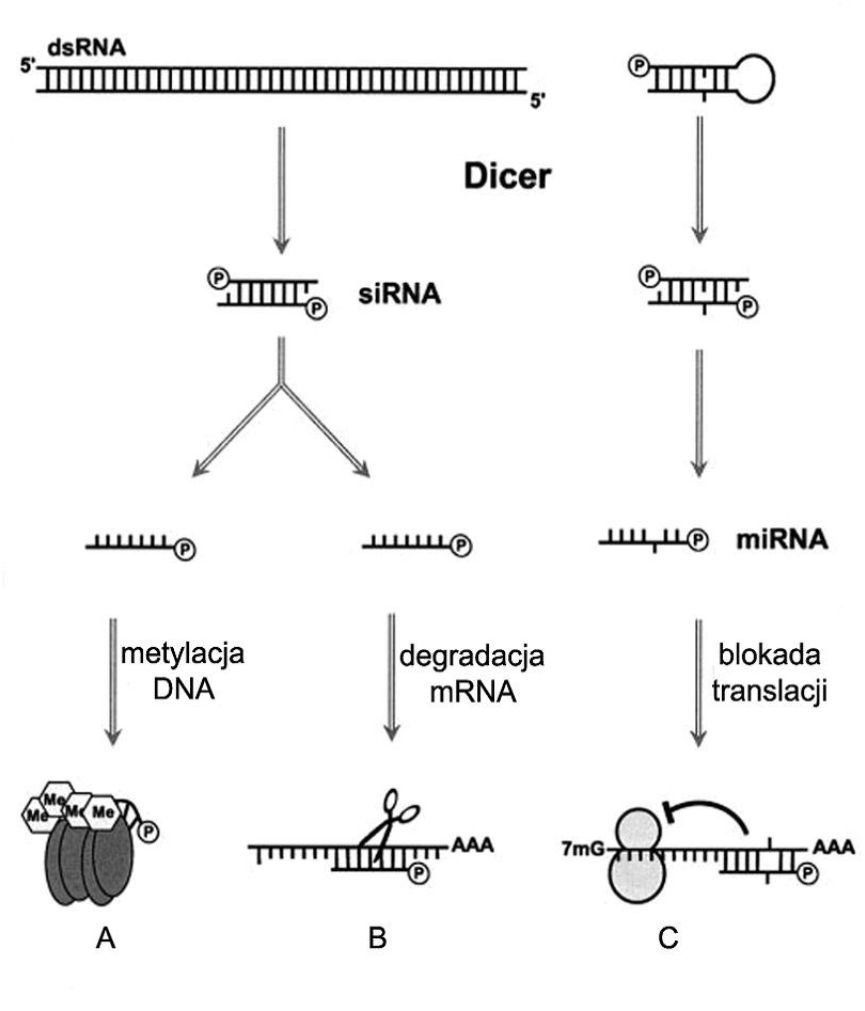
Mixed





Sorted GFP + Worms

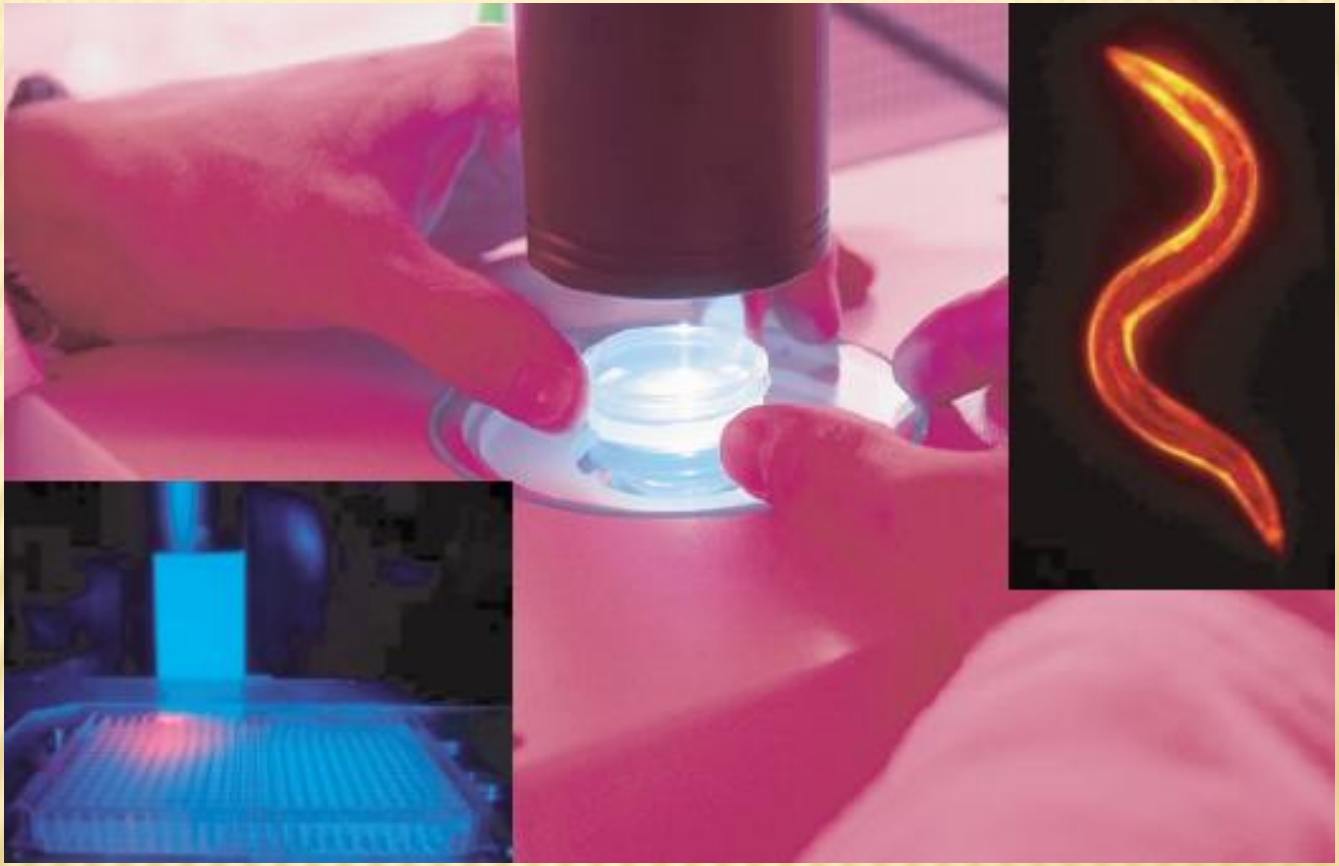




Szczupli żyją dłużej ?!

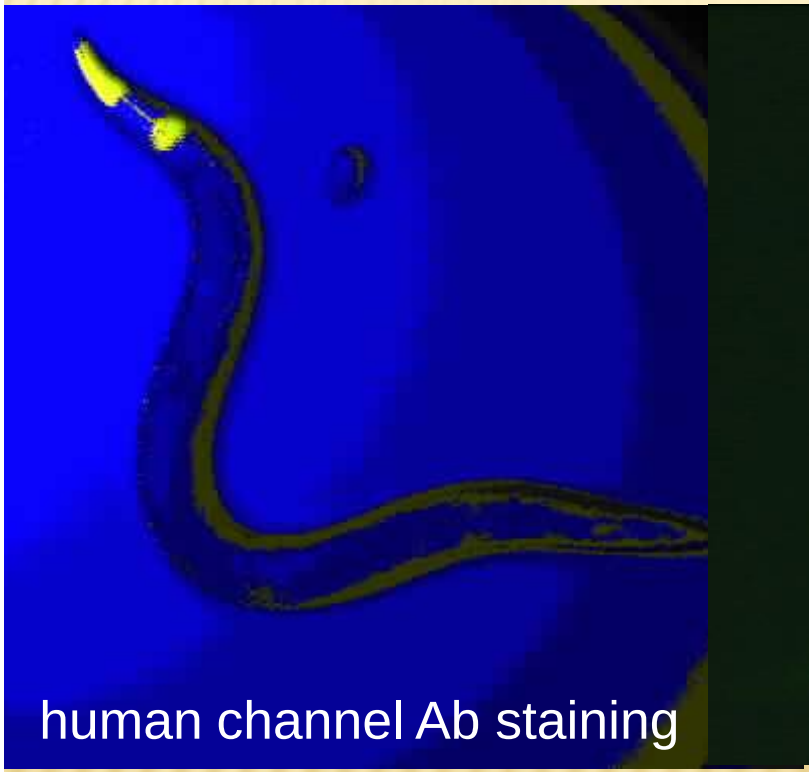
417 genów z przebadanych 16 757 reguluje metabolizm tłuszczy u *C.elegans*.

Połowa z nich nie była brana wcześniej pod uwagę.

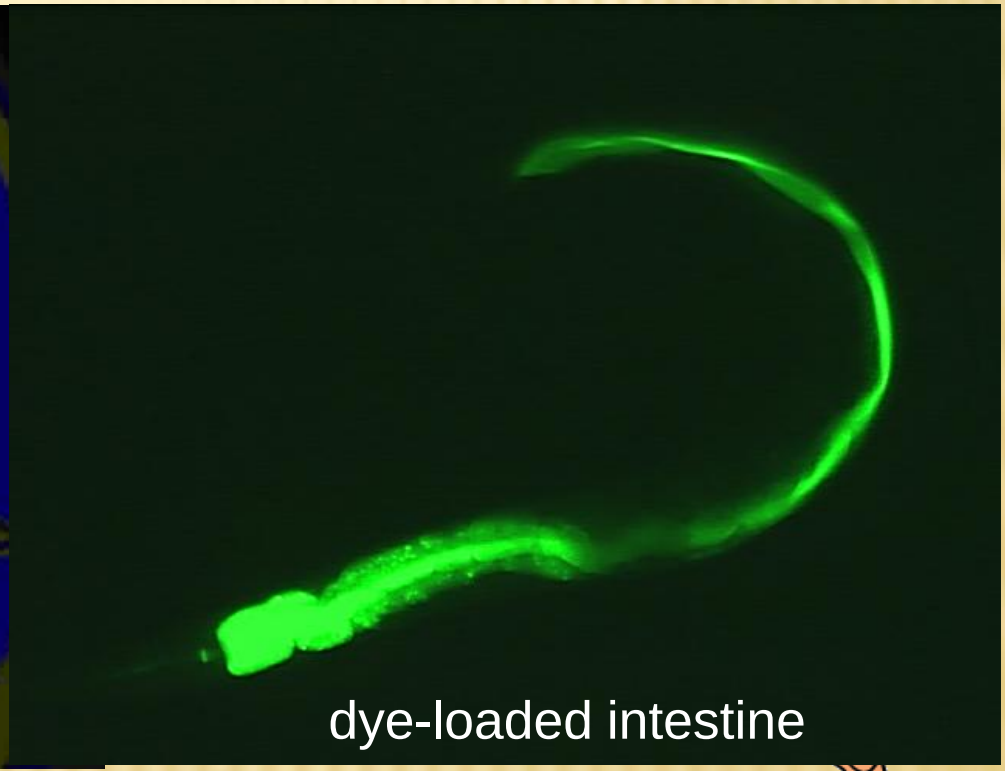


„Ludzkie robaki”

(Mutant worms rescued with human gene can pump)
(Mutant worms with non-functional pharynx would not uptake dye)

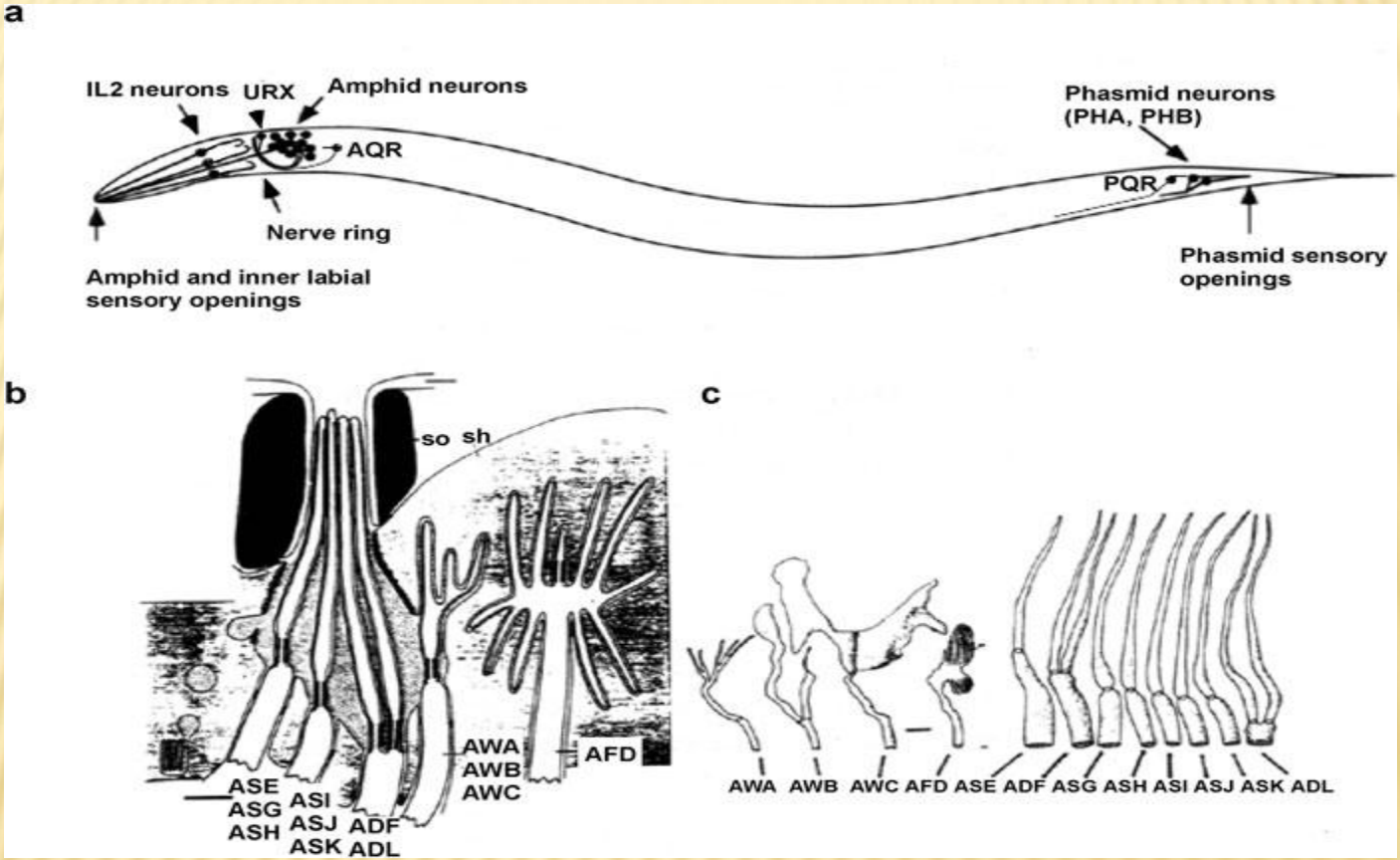


human channel Ab staining

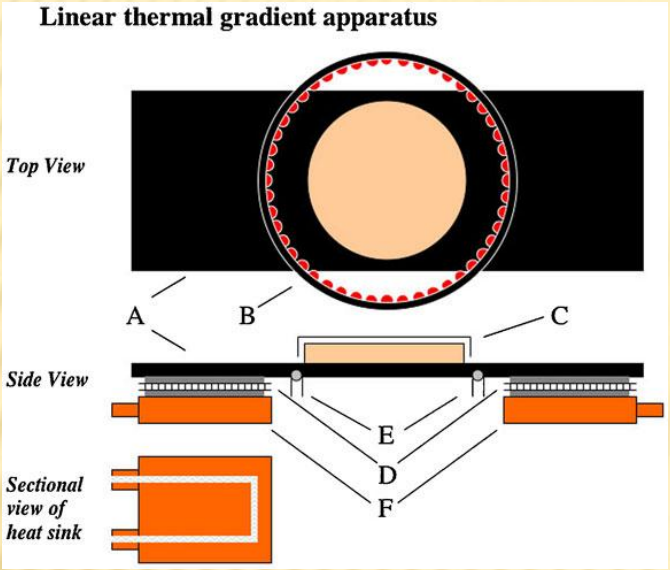


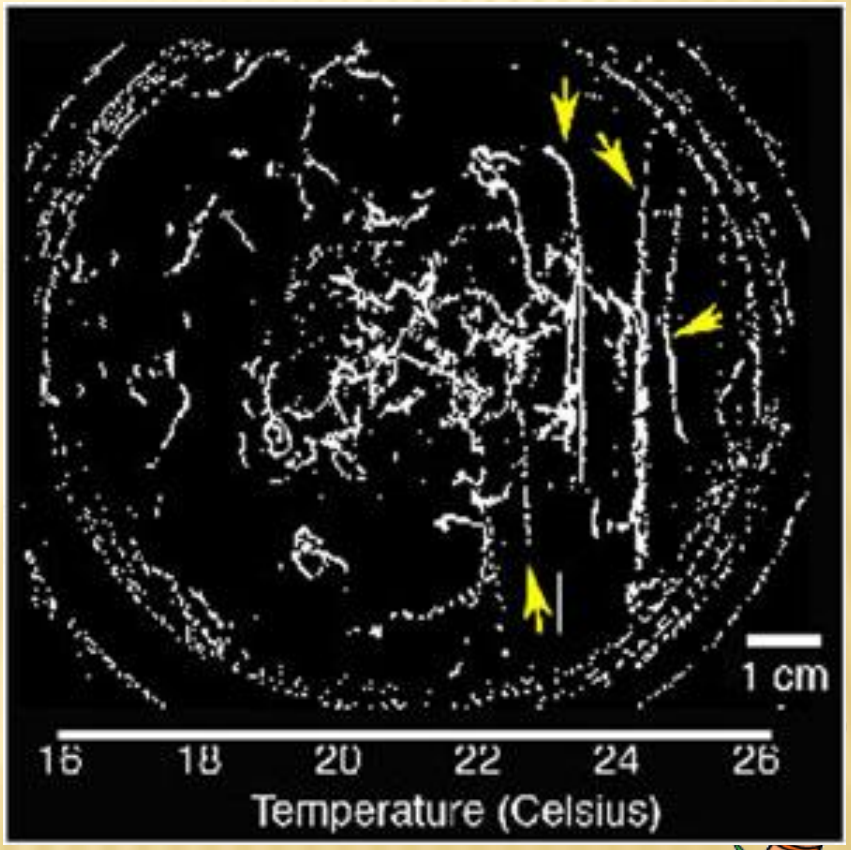
dye-loaded intestine

Choroba Alzheimer, Parkinson, Huntingtona, dystrofia mięśniowa

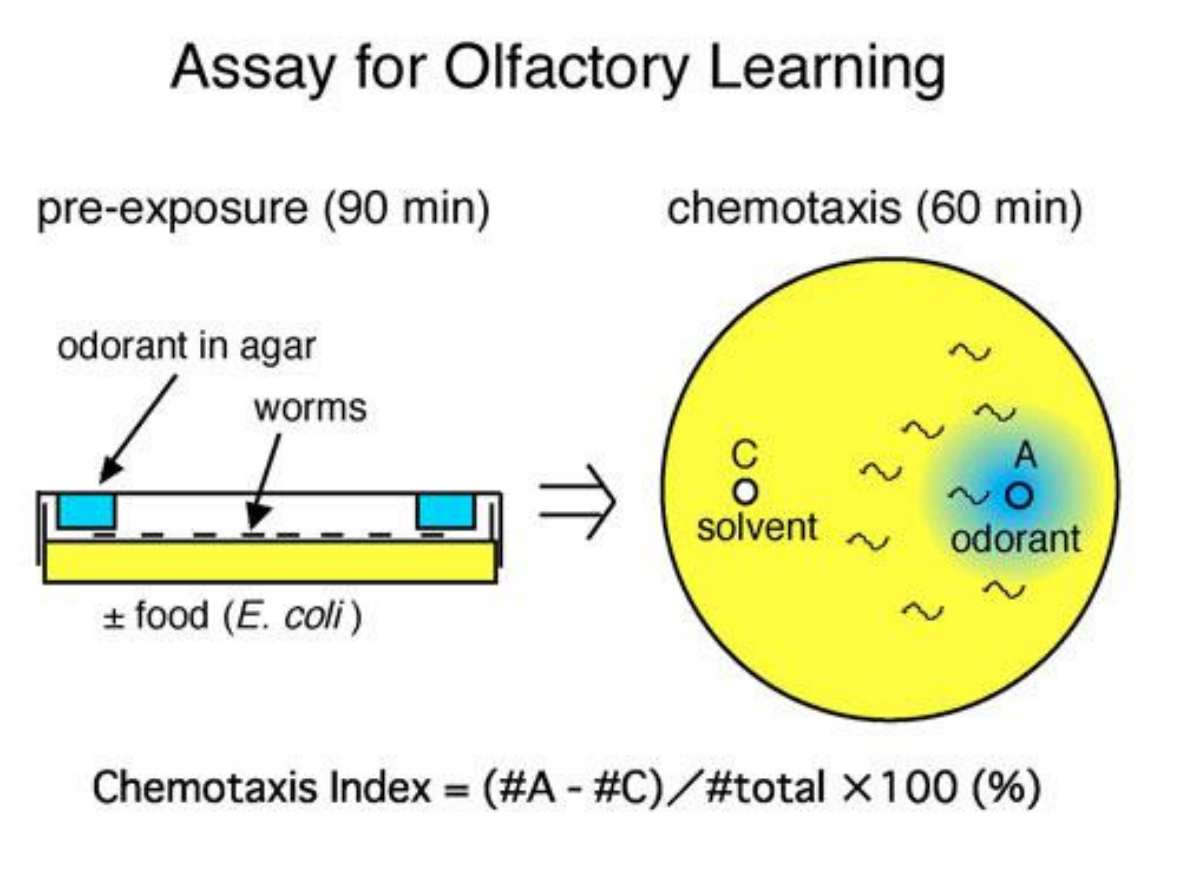

a
IL2 neurons
URX
Amphid neurons
AQR
Nerve ring
Amphid and inner labial sensory openings
Phasmid neurons (PHA, PHB)
PQR
Phasmid sensory openings
b
so
sh
AWA
AWB
AWC
AFD
ASE
ASG
ASH
ASI
ASJ
ASK
ADF
ADL
c
AWA AWB AWC AFD ASE ADF ASG ASH ASI ASJ ASK ADL

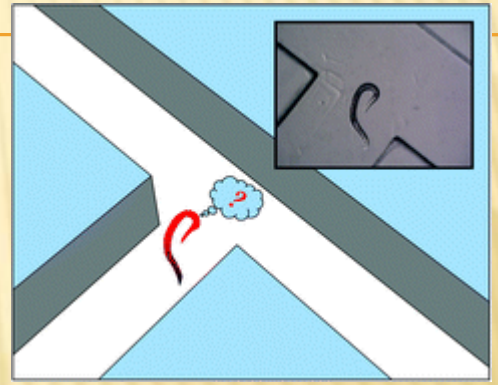
Termotaksja





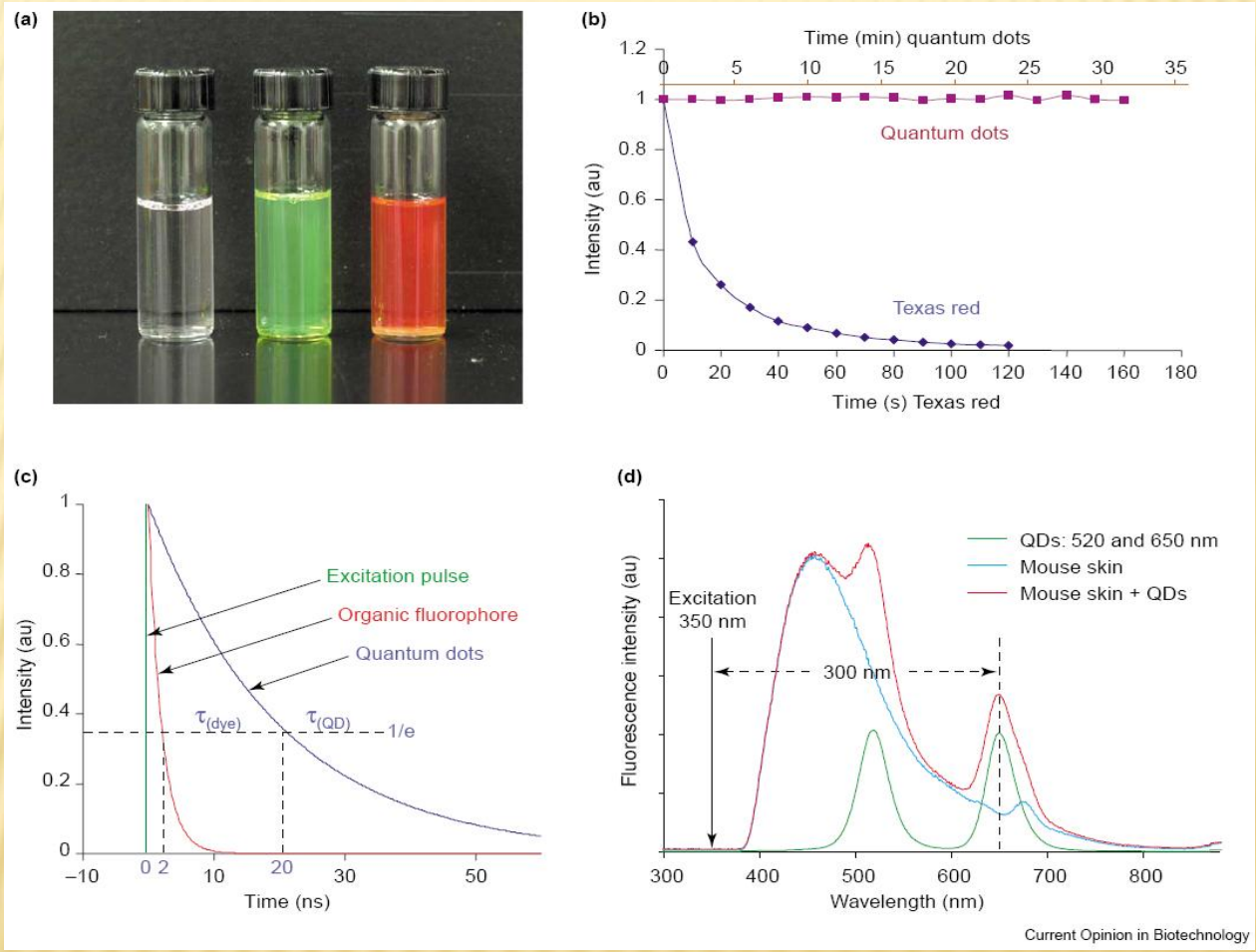
Chemotaksja i uczenie się

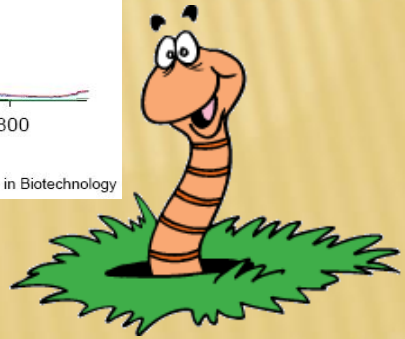


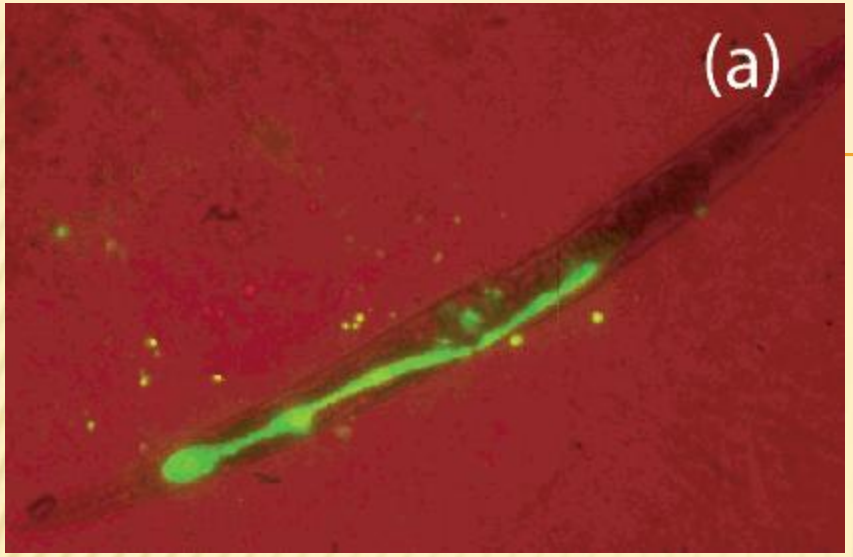


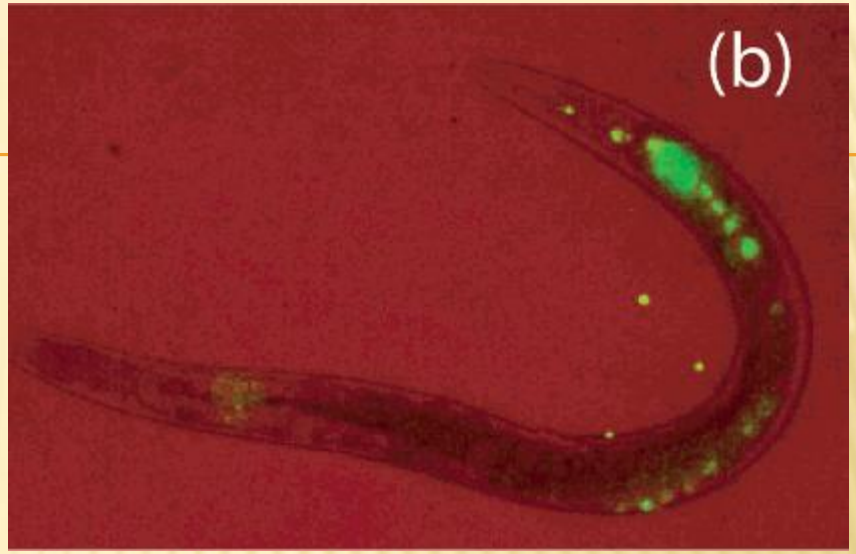
Assay of olfactory learning for the nematode *C. elegans* . Enhancement of chemotaxis to an odorant is measured after preexposure to the same odorant in the presence of food (*E. coli*).

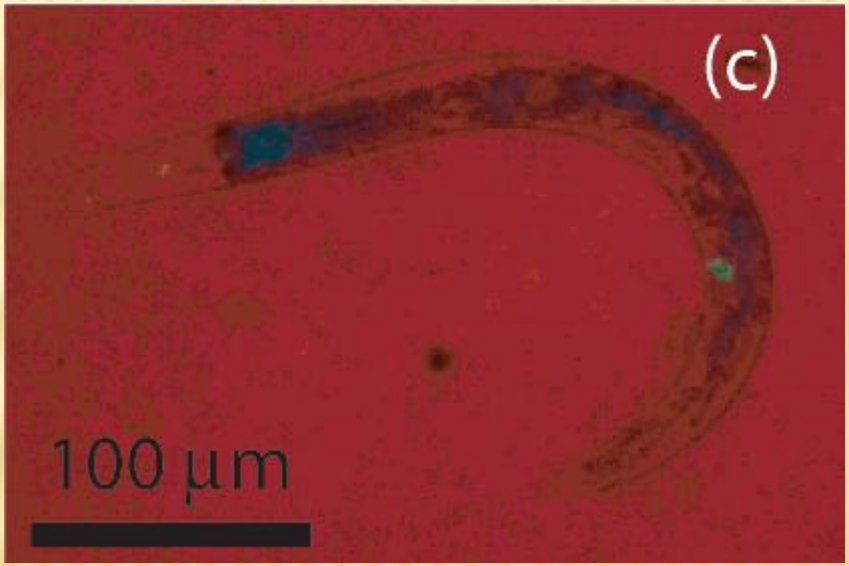
Porównanie aromatycznych sond fluorescencyjnych z QD











Lim SF, Riehn R, Ryu WS, Khanarian N, Tung Ch, Tank D, Austin HA, *Nano Lett.*, ***2006***, ***6*** (2), pp 169–174

Mechanizm otrzymywania ZnO

Dysocjacja octanu cynku:

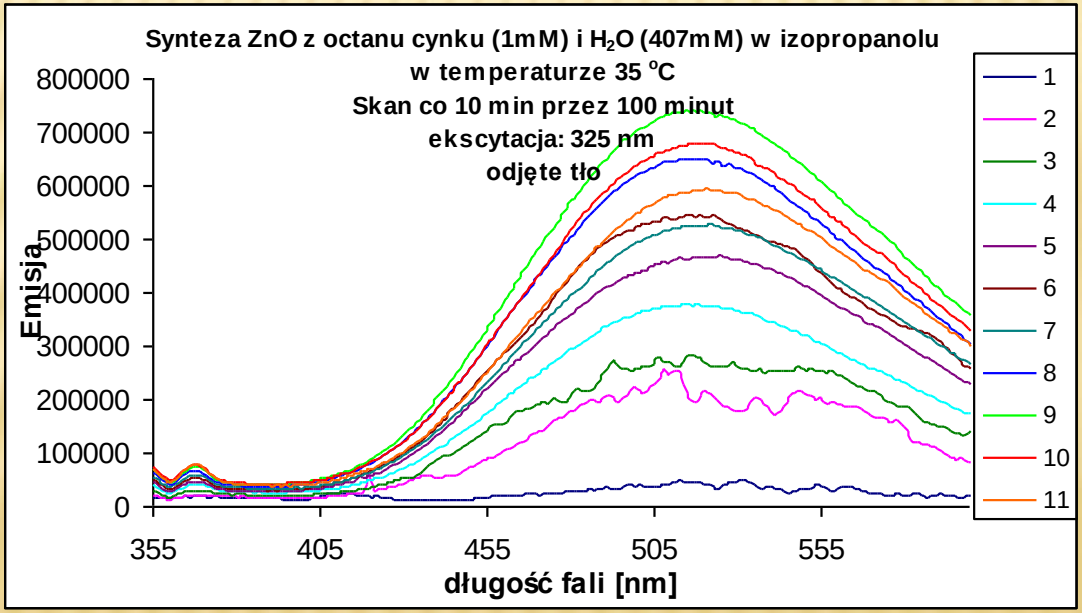
$$(CH_3COO)_2Zn \rightarrow 2CH_3COO^- + Zn^{2+}$$

Dysocjacja wody:

$$H_2O \leftrightarrow H^+ + OH^-$$

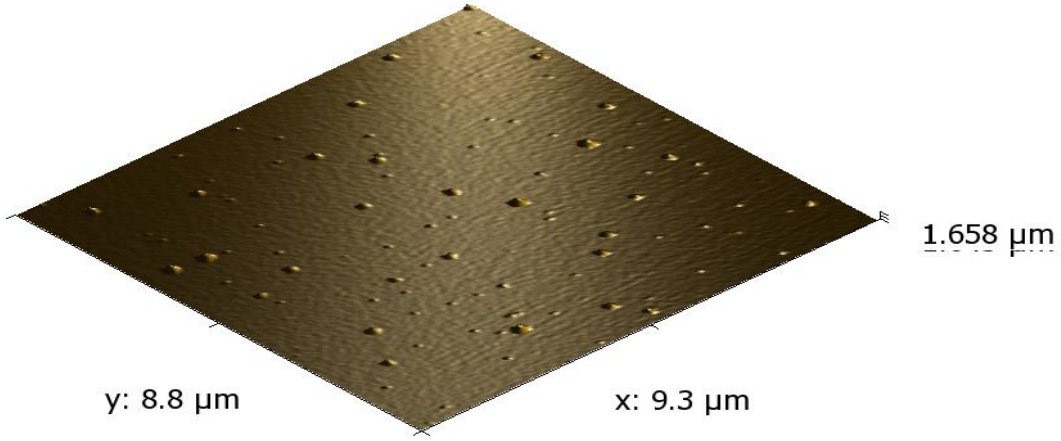
Reakcja właściwa:

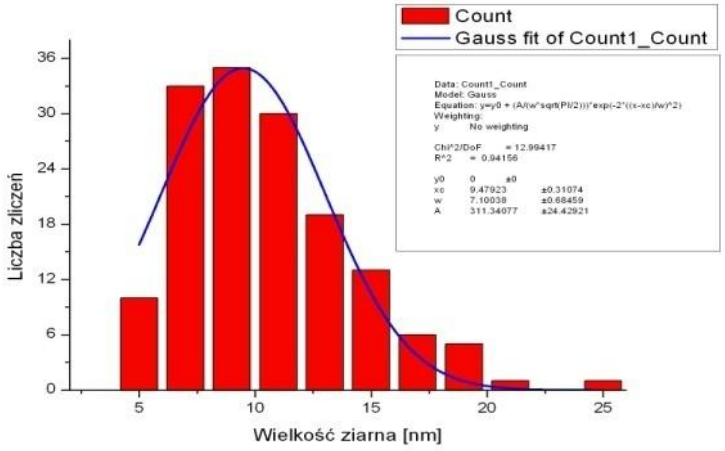
$$Zn^{2+} + 2OH^- \leftrightarrow Zn(OH)_2 \leftrightarrow ZnO + H_2O$$



AFM koloidalnego ZnO

B.Sikora





Problem:

Koloidalne nanoczasteczki ZnO spontanicznie agreguje w wodnych roztworach.

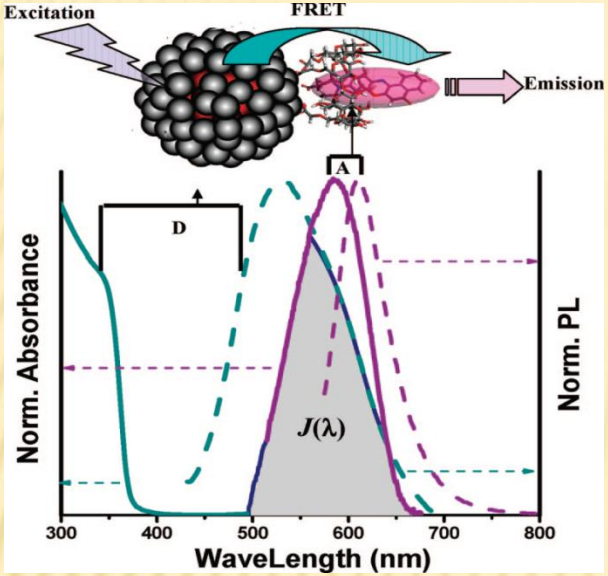
Konieczność pasywacji ZnO dla zastosowań bio-sensorycznych.

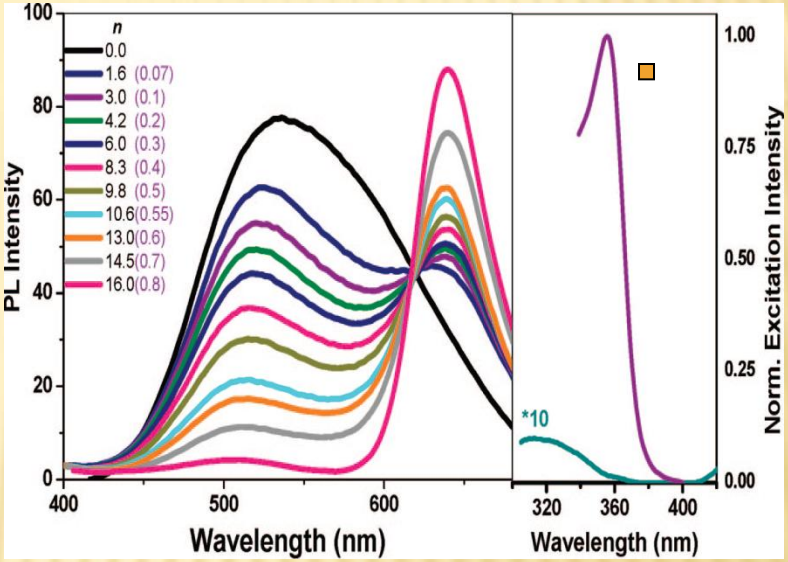
Rozwiązanie:

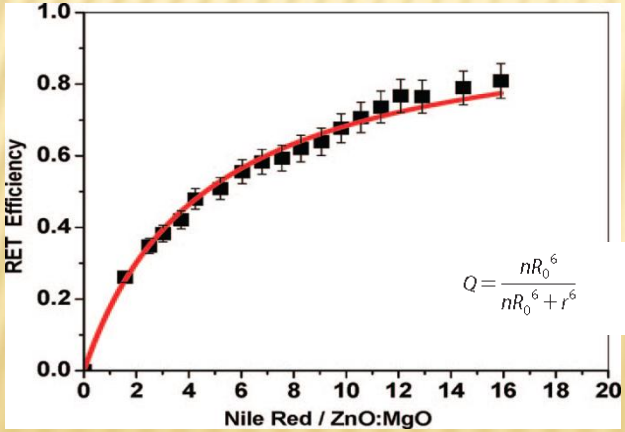
Koloidalne nanocząsteczki ZnO:MgO (core/shell)
lub inne pasywatory np. cyklodekstryny, siarka

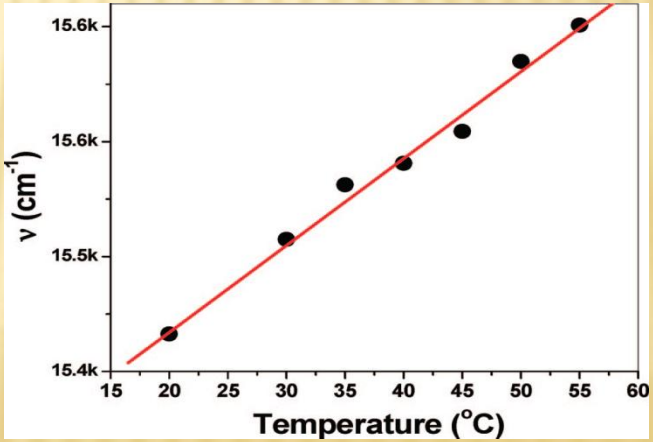
FRET between Cyclodextrin capped ZnO:MgO i Nile Red

Rakshit, 2008

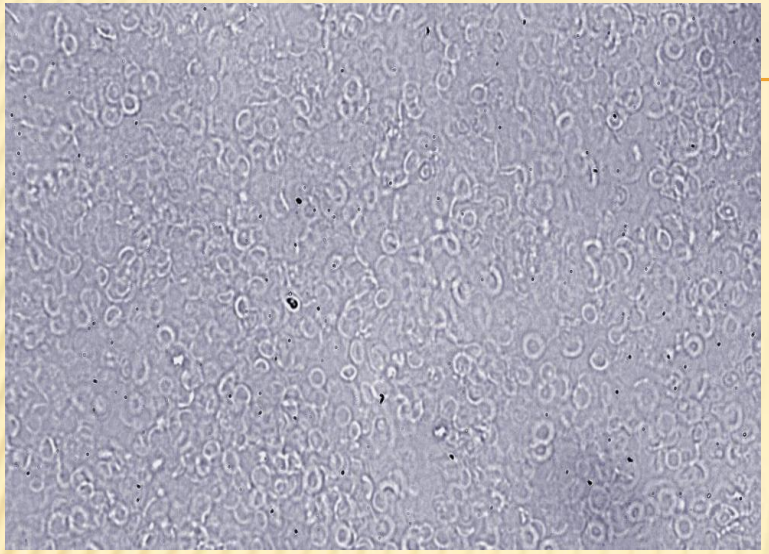






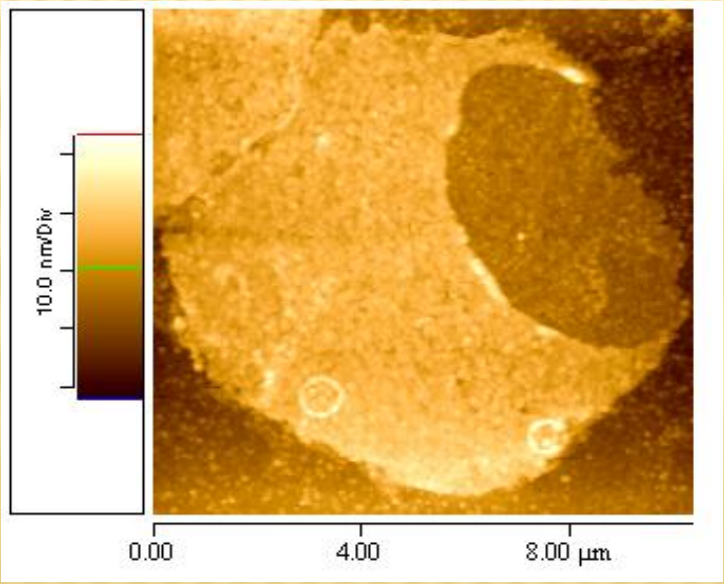


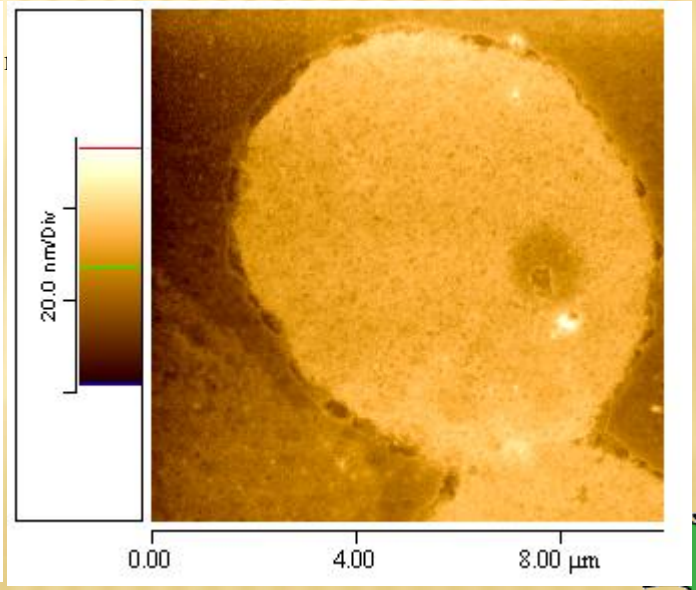
Duchy otrzymane z erytrocytów



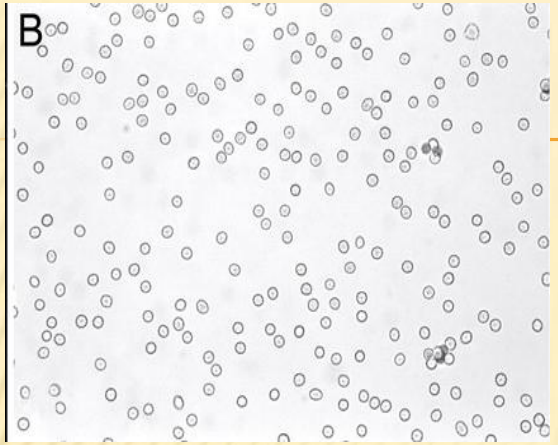
mikroskop świetlny

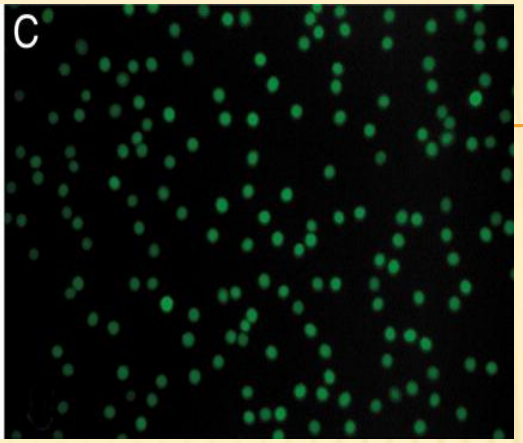
AFM

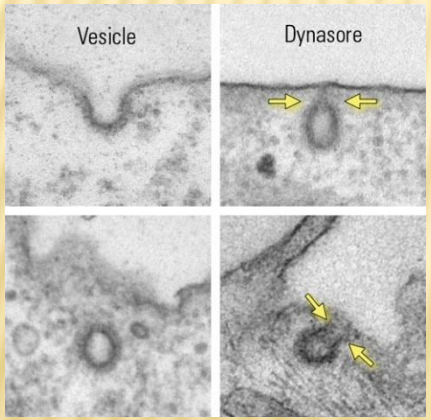


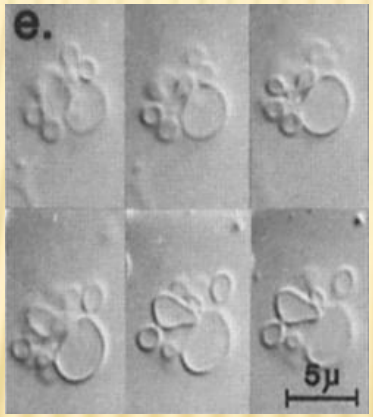


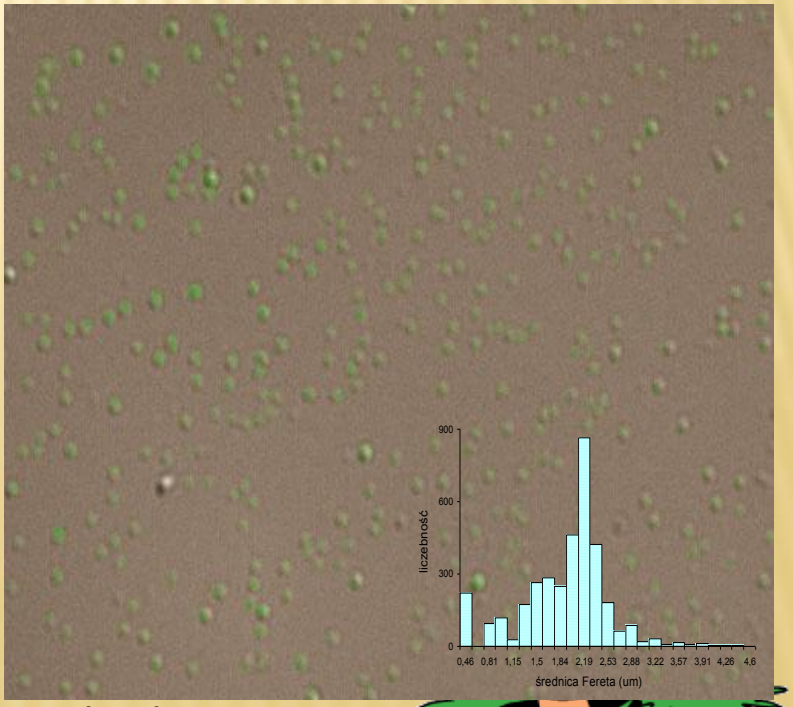
AFM





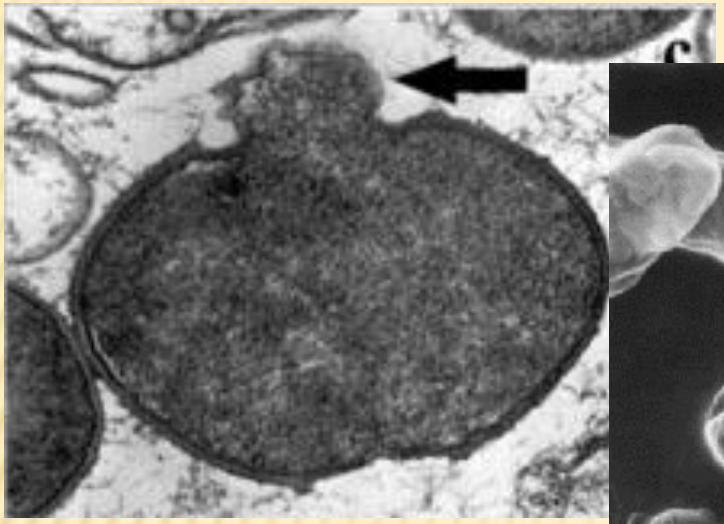


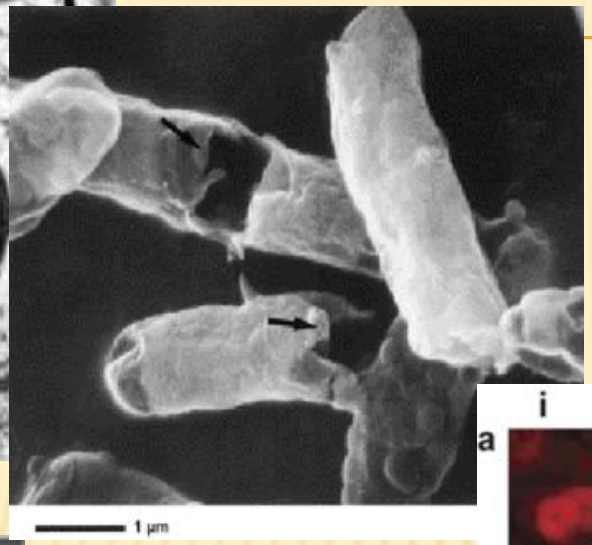


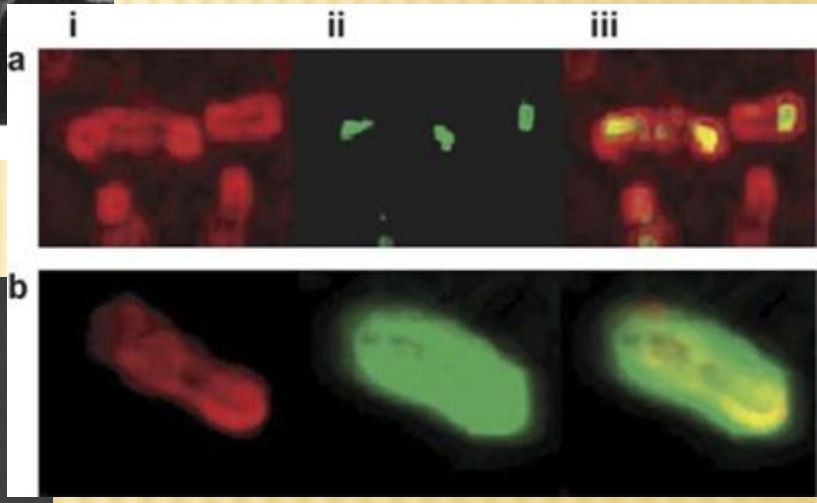


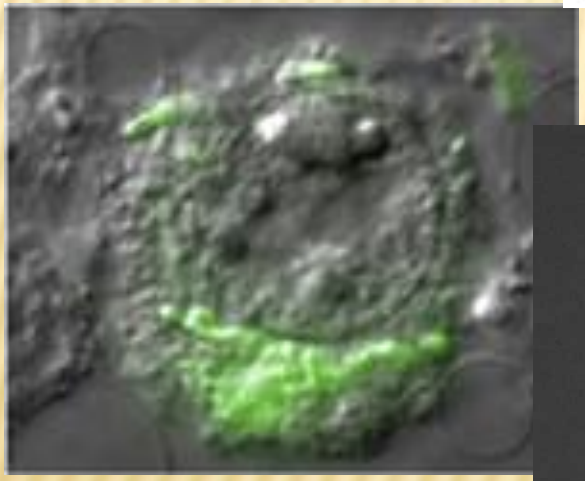
Obserwacje: mikroskop fluorescencyjny z kontrastem fazowym w świetle przechodzącym, Nowicka, 2007

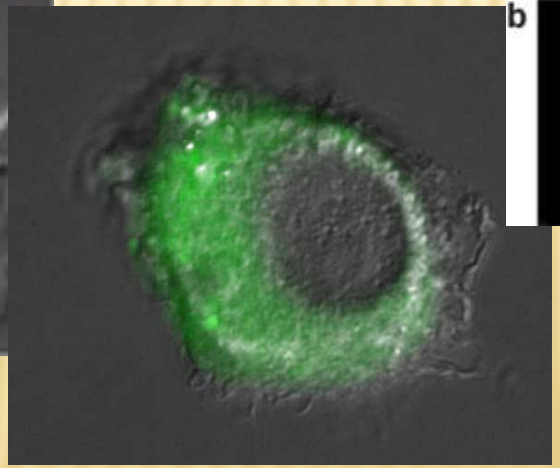
Duchy bakteryjne







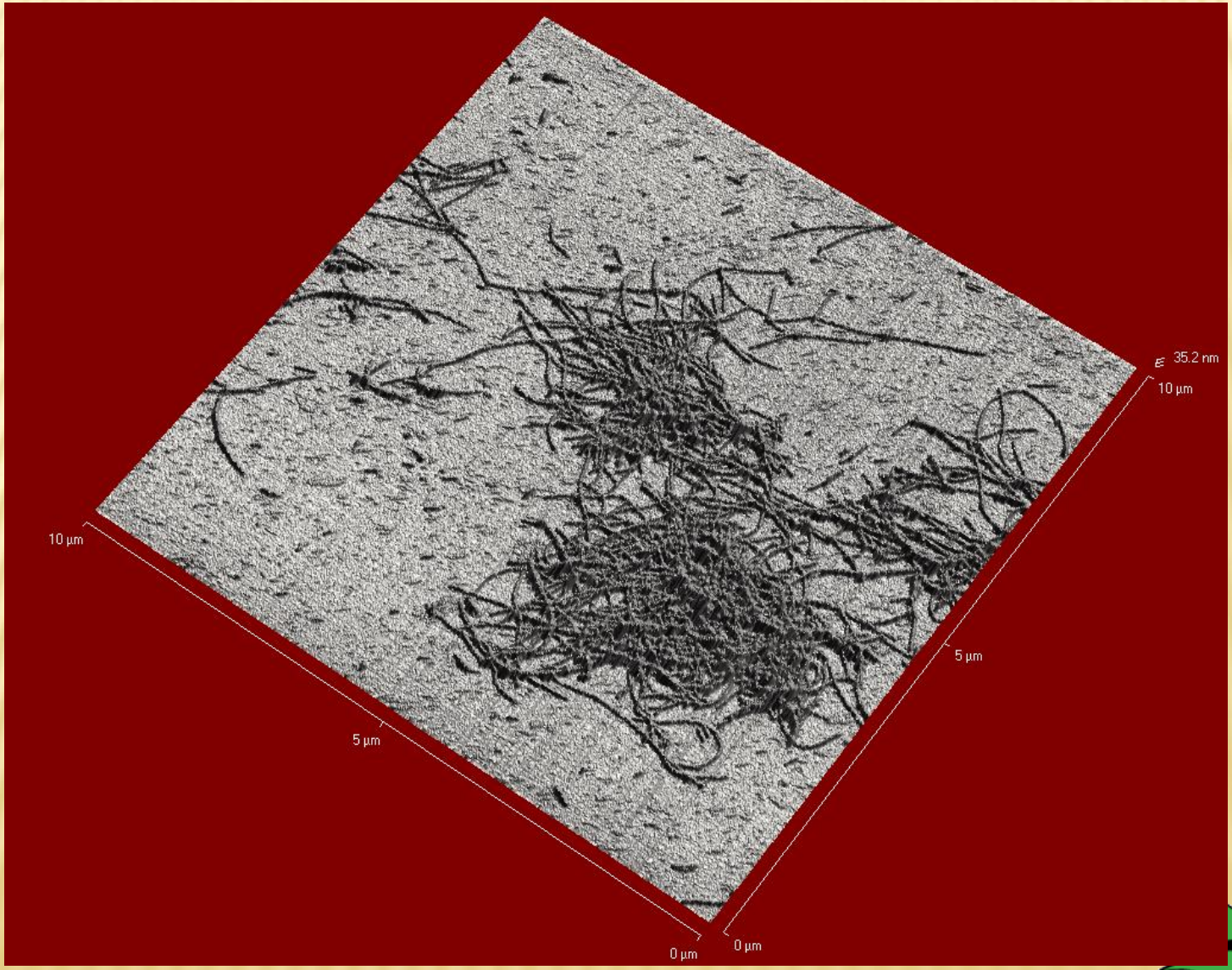




Paukner S, Kudela P, Kohl G, Schlapp T, Friedrichs S, Lubitz W. MOLECULAR THERAPY 2005 Vol. 11: 215 - 223

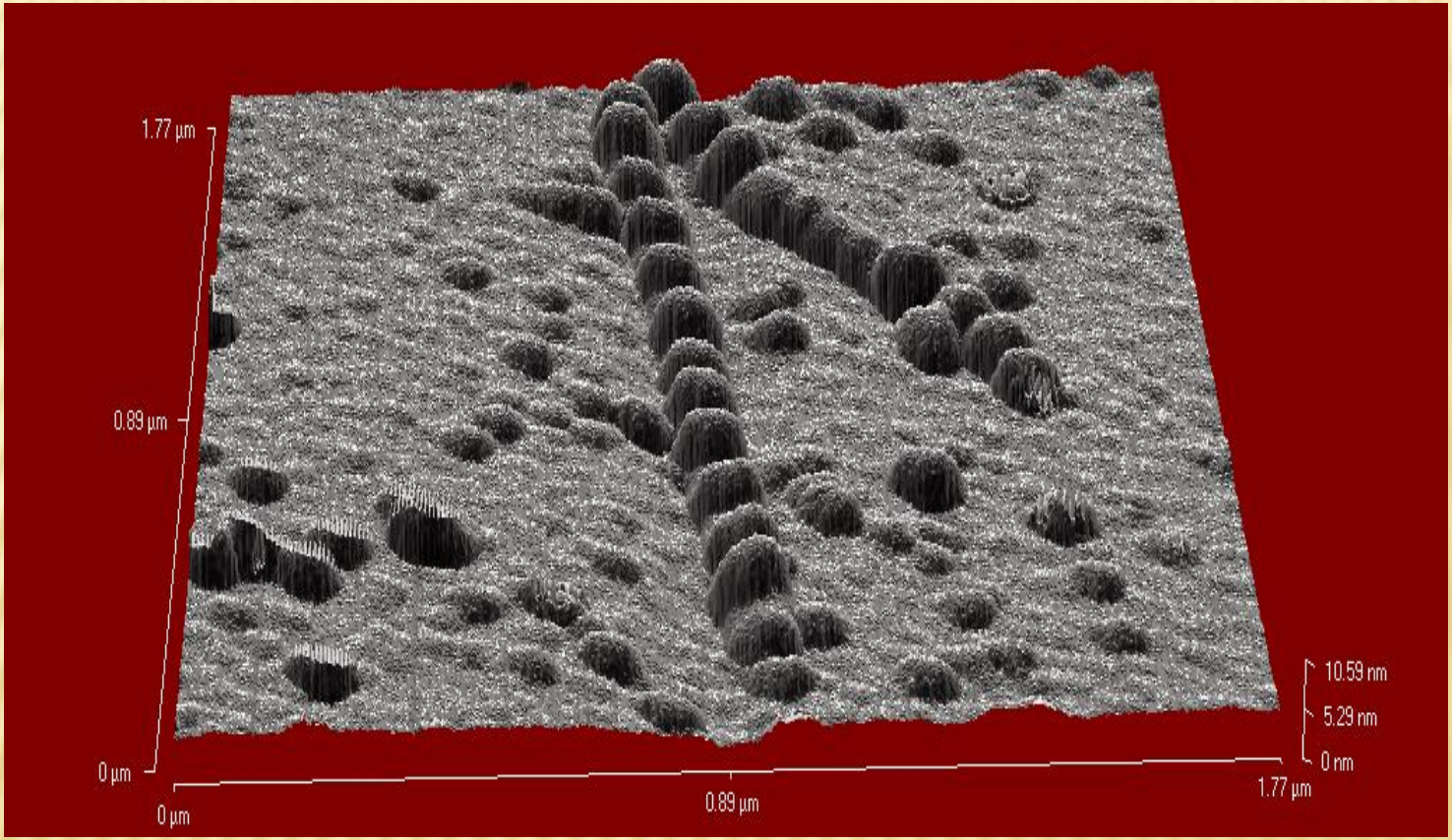
Beta-amyloid (1-40), Protoplasta złogu

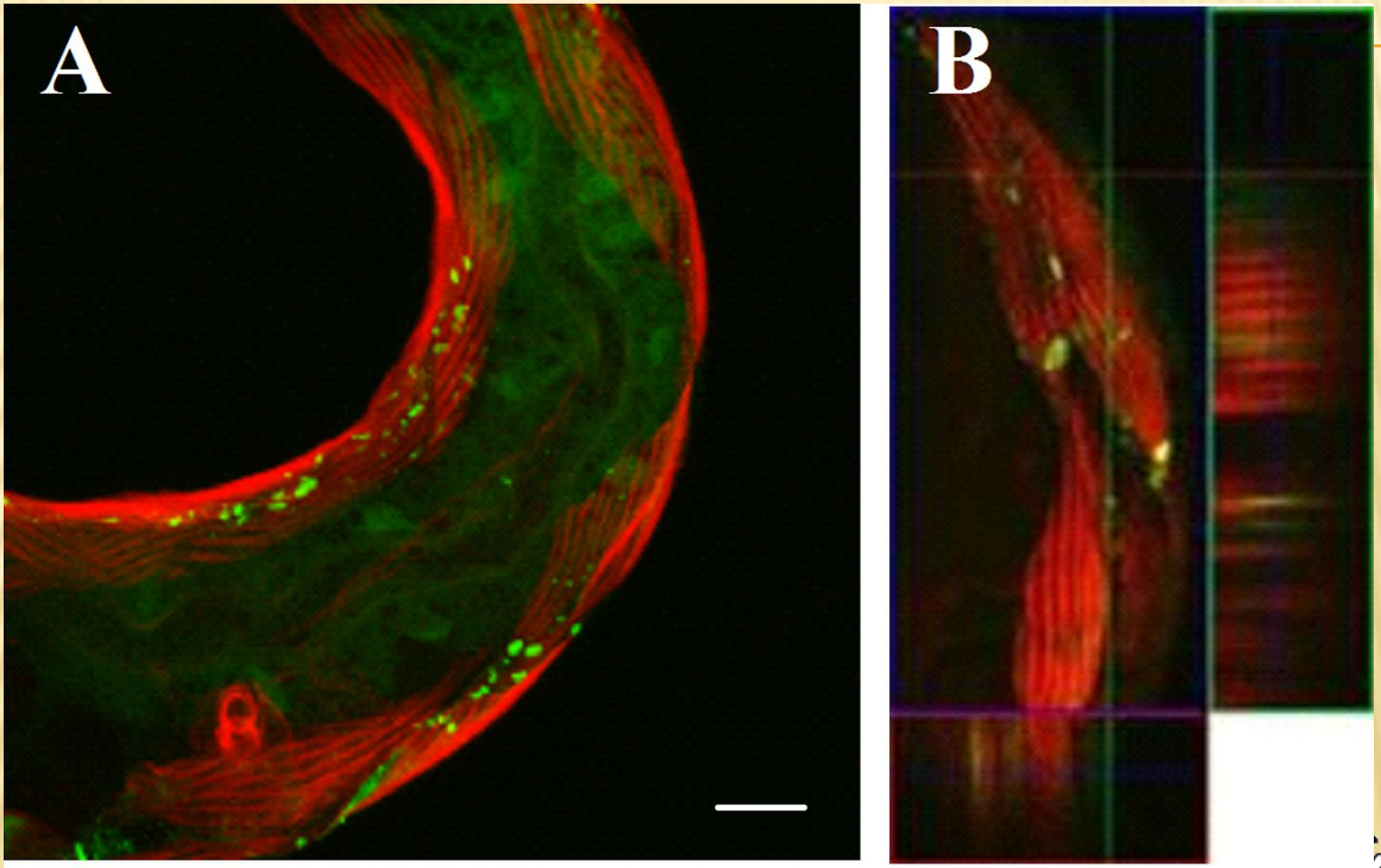
Szczepankiewicz,Elbaum 2007



Włókna beta-amyloidu(1-40), AFM

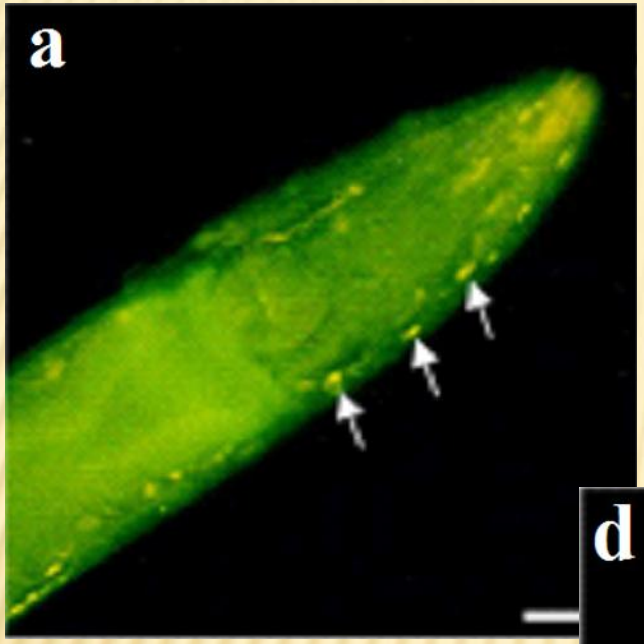
Szczepankiewicz, Elbaum,2007

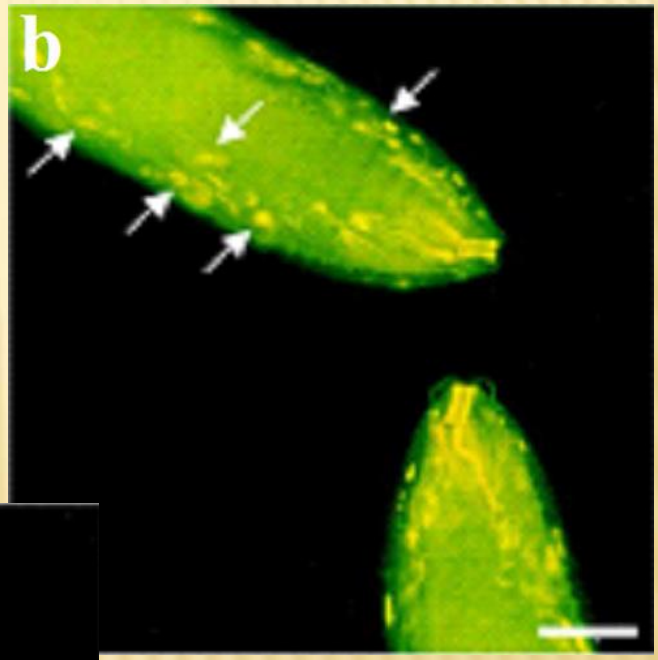




Minniti AN, Rebolledo DL, Grez PM, Fadic R, Aldunate R, Volitakis I, Cherny RA, Opazo C, Masters C, Bush A, Inestrosa NC. *Molecular Neurodegeneration* **2009**, 4:2

Miedź



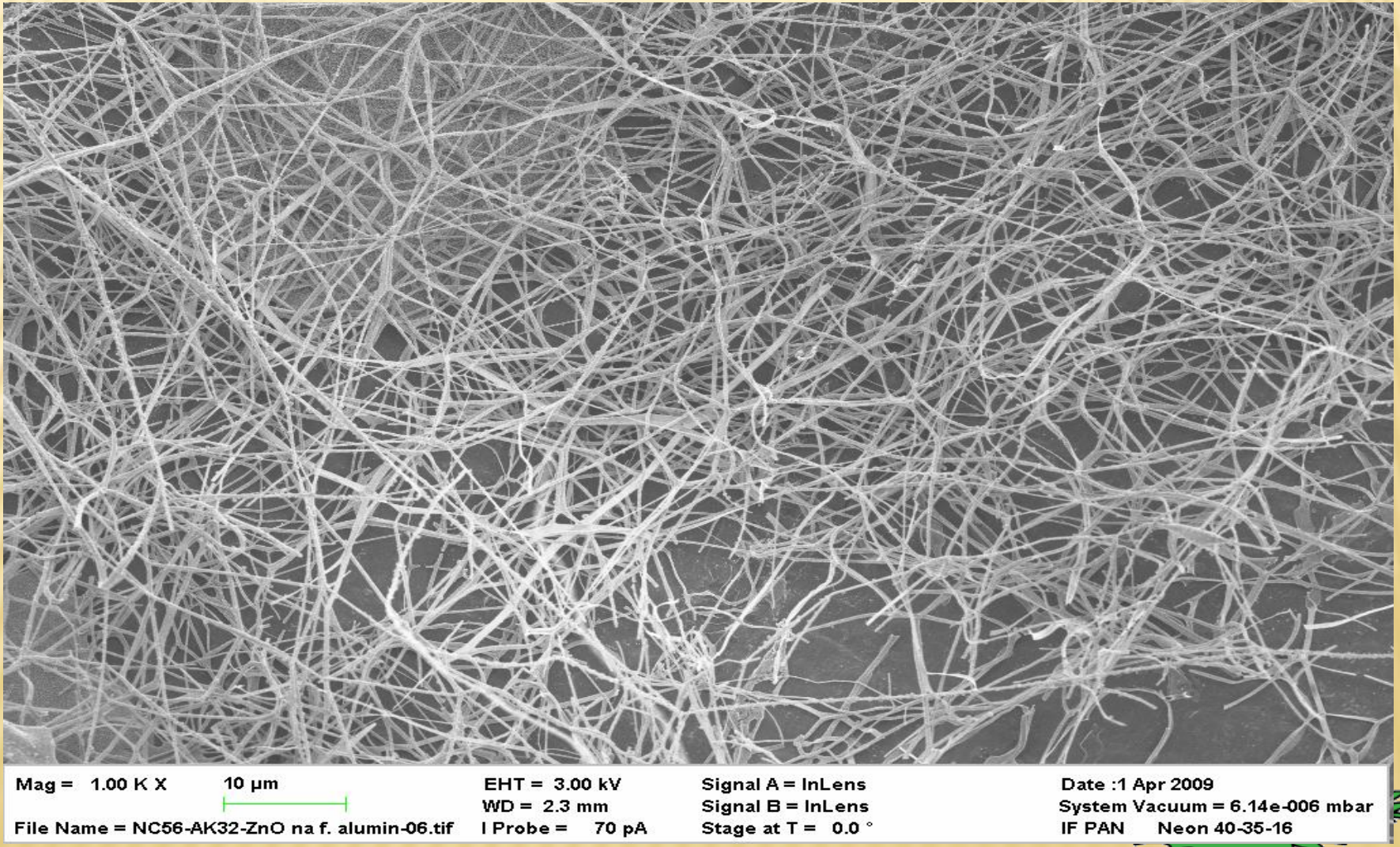


Chelator

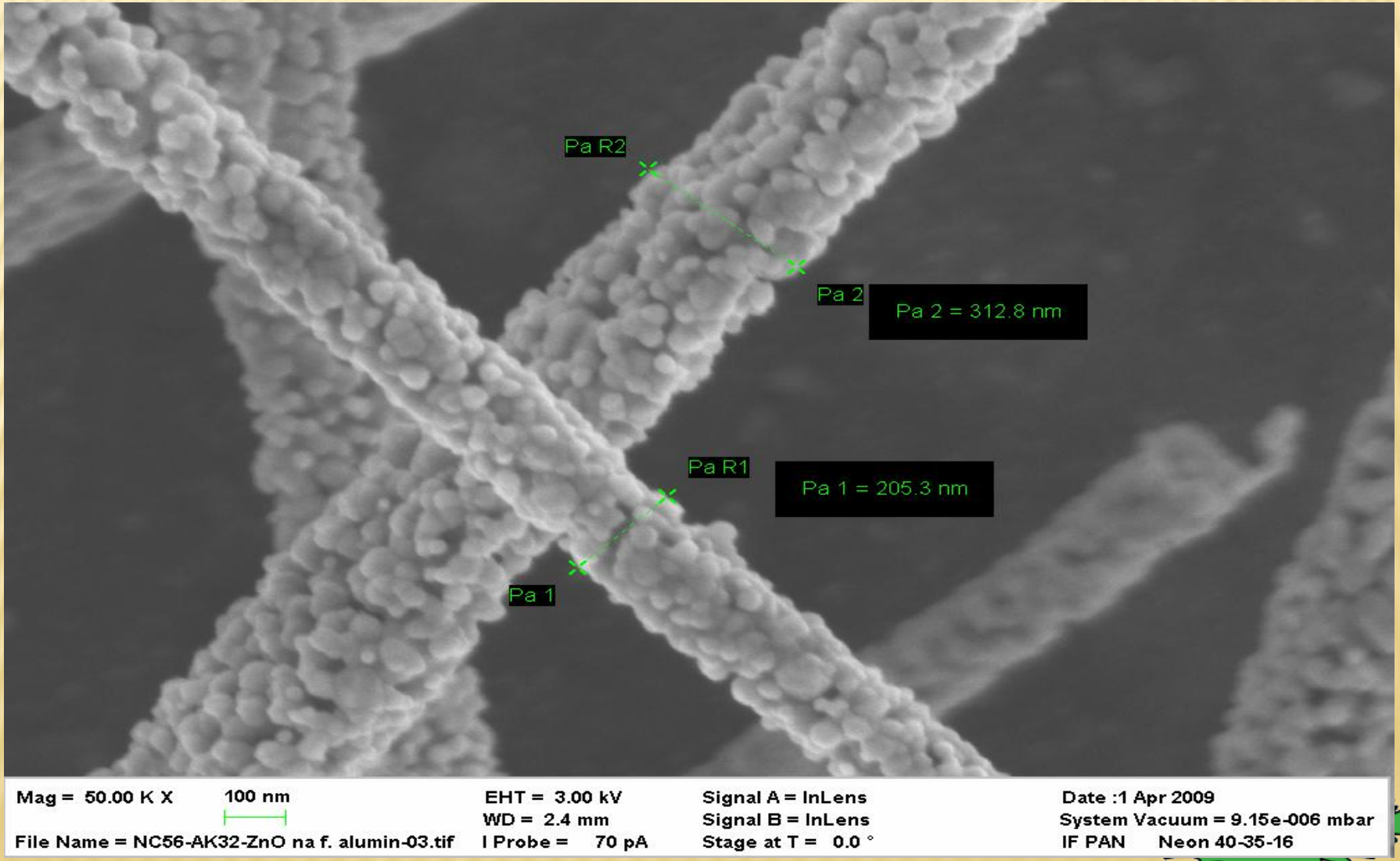
Minniti, 2009

Elektroprzedzone włókna ZnO

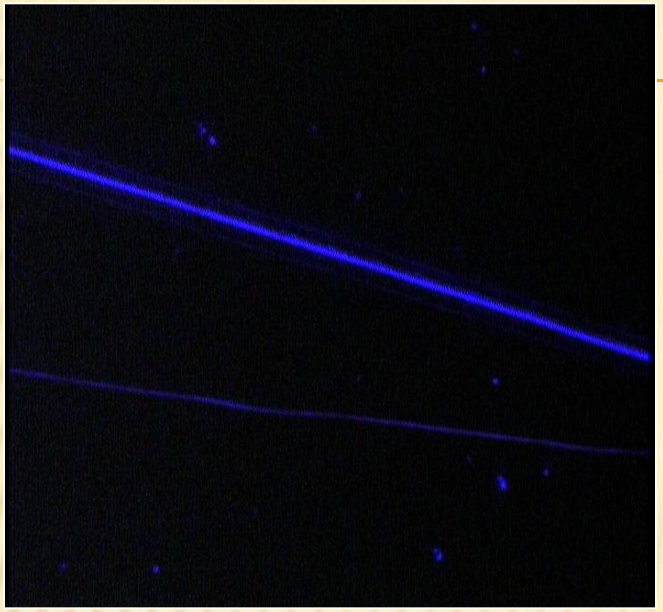
Ania Baranowska-Korczyc. Wojciech Zaleszczyk

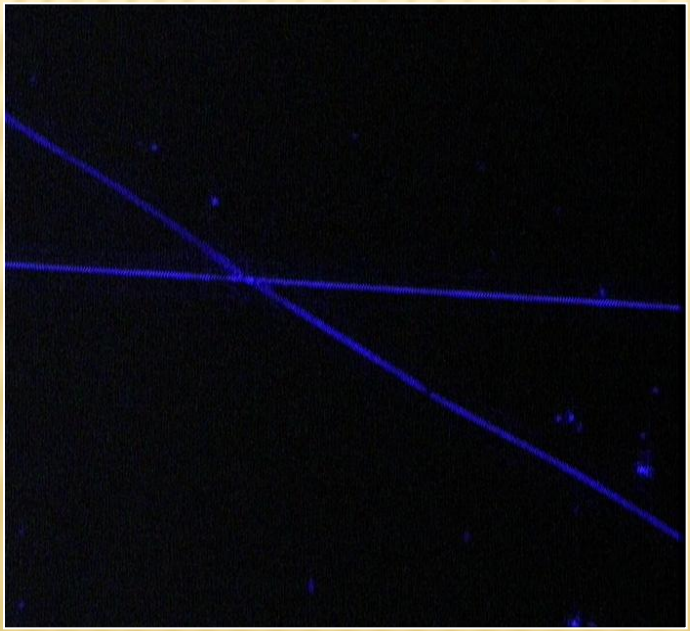


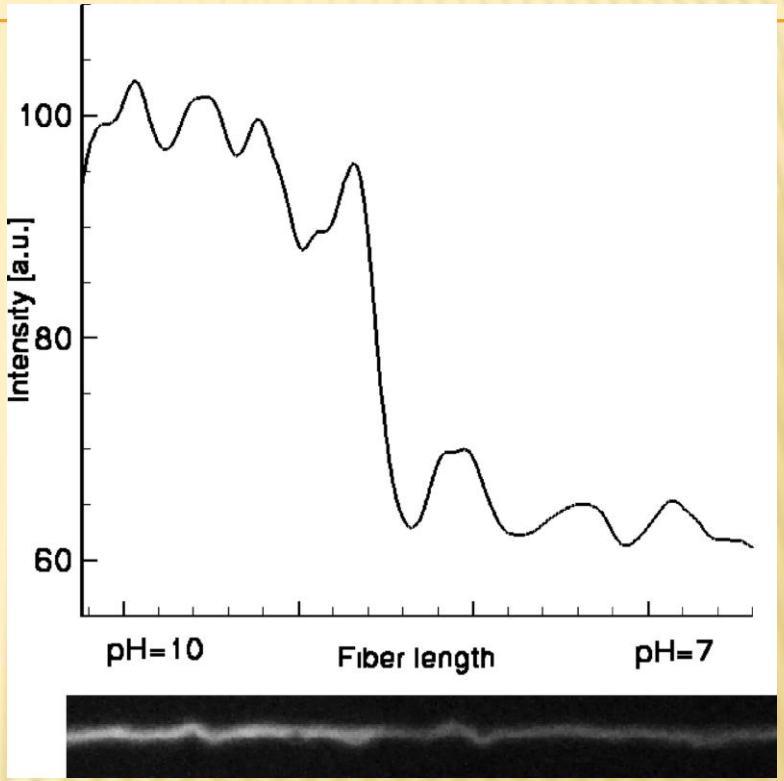
ZnO po wypaleniu



ZnO po wypaleniu (Ext. 473 nm)







Effect of pH on fluorescence of FITC-BSA fibers.
Kowalczyk 2008

A couple of intro genetics textbooks
http://www.wormbook.org/chapters/www_nematodeisolation/nematodeisolation.html
http://www.wooster.edu/biology/wmorgan/bio306/C.elegans_Week3_Directions.html
http://www.sanger.ac.uk/Projects/C_elegans/
http://www.wormbook.org/chapters/www_dominantmutations/dominantmutations.html
http://www.wormatlas.org/handbook/anatomyintro/anatomyintro.htm
http://www.wormclassroom.org/ge.html
http://www.ncbi.nlm.nih.gov/books/bv.fcgi?indexed=google&rid=ce2.section.100
http://fruitfly4.aecom.yu.edu/labmanual/16a.html
http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/C/Caen.elegans.html
http://en.wikipedia.org/wiki/Caenorhabditis_elegans
http://en.wikipedia.org/wiki/Apoptosis
http://www.bio.unc.edu/faculty/goldstein/lab/movies.html
http://www.loci.wisc.edu/outreach/text/celegans.html
http://www.nematodes.org/teaching/devbio3/index.shtml
http://www.translational-medicine.com/content/2/1/39/figure/F1

Wszelkie podobieństwo do realnych postaci i sytuacji jest całkowicie ***przypadkowe.***

ZESPÓŁ

Aniołki Elbauma

Szef Aniołków