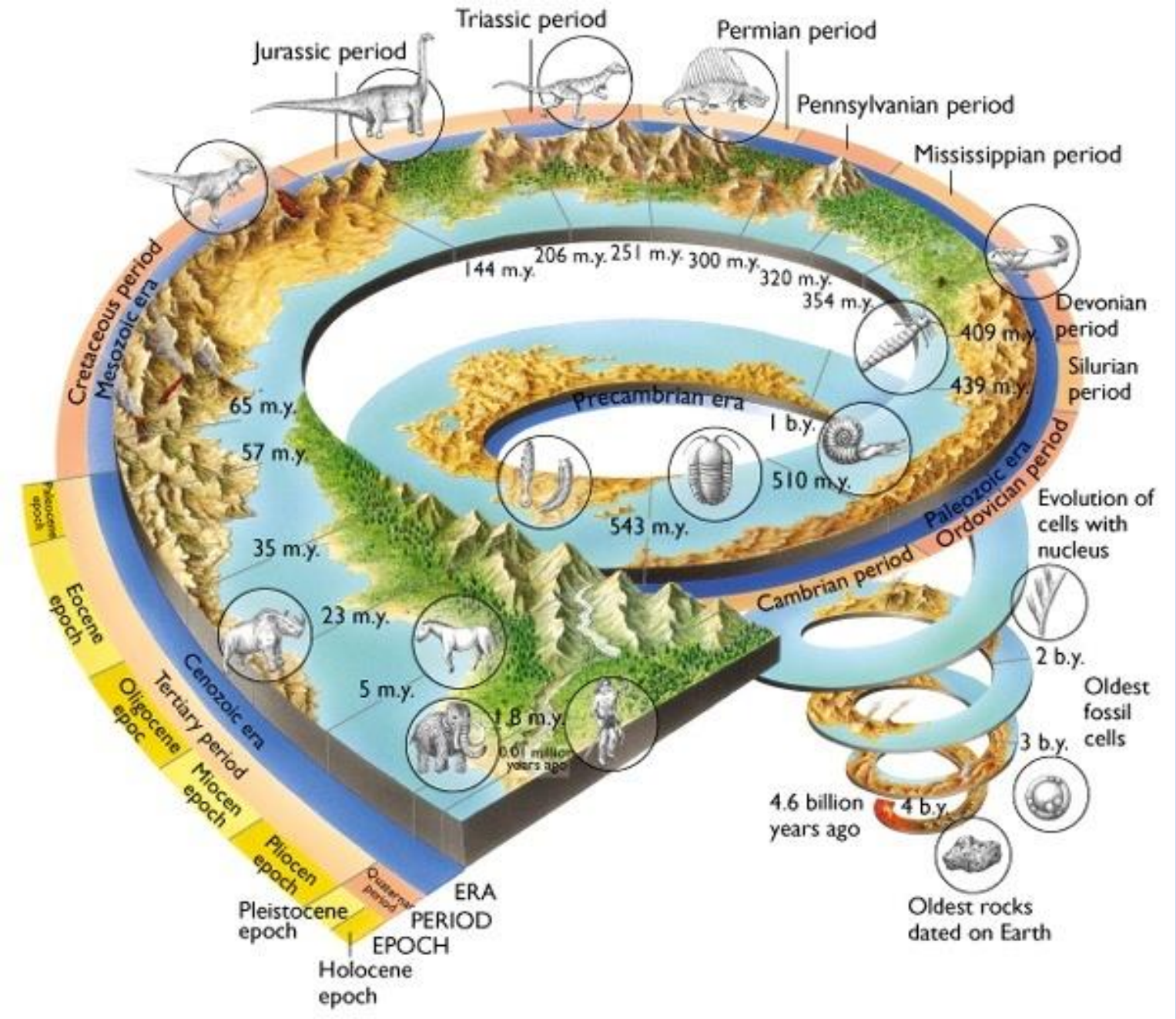
Přírodní materiály a jejich povrchy

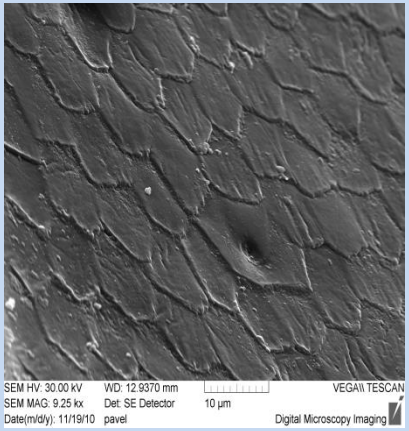
Dora Kroisová

Technická univerzita v Liberci


Triassic period
Jurassic period
Permian period
Pennsylvanian period
Mississippian period
Devonian period
Silurian period
Ordovician period
Cambrian period
Paleozoic era
Precambrian era
Mesozoic era
Cretaceous period
Cenozoic era
Tertiary period
Paleocene epoch
Eocene epoch
Oligocene epoc
Miocen epoch
Pliocen epoch
Quaternary period
Pleistocene epoch
Holocene epoch
ERA
PERIOD
EPOCH
144 m.y.
206 m.y.
251 m.y.
300 m.y.
320 m.y.
354 m.y.
409 m.y.
439 m.y.
1 b.y.
510 m.y.
543 m.y.
65 m.y.
57 m.y.
35 m.y.
23 m.y.
5 m.y.
1.8 m.y.
0.01 million years ago
Evolution of cells with nucleus
2 b.y.
Oldest fossil cells
3 b.y.
4.6 billion years ago
4 b.y.
Oldest rocks dated on Earth

Obsah

- Hydrofobní povrchy
- Hydrofilní povrchy
- Hydrofilně – hydrofobní povrchy
- Bariérové funkce
- Ochranné funkce
- Vzhled
- Odolnost vůči abrazi
- Adheze
- Proudění
- Nízko-hustotní materiály
- Mimikry
- Kompozitní materiály
- Výztuže
- Obalové materiály
- Nástroje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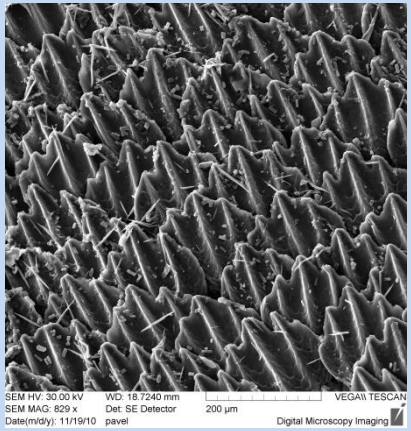
VEGA\\ TESCAN
SEM MAG: 9.25 kx
Det: SE Detector
10 µm
Date(m/d/y): 11/19/10
pavel
Digital Microscopy Imaging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Date(m/d/y): 11/19/10
pavel
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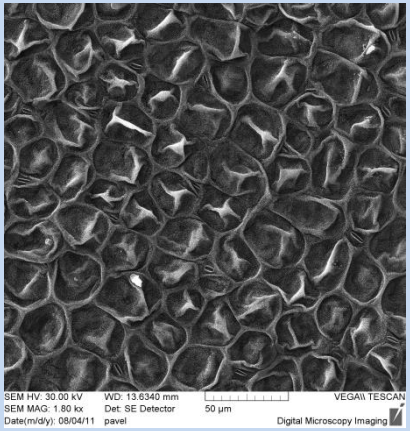
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pavel
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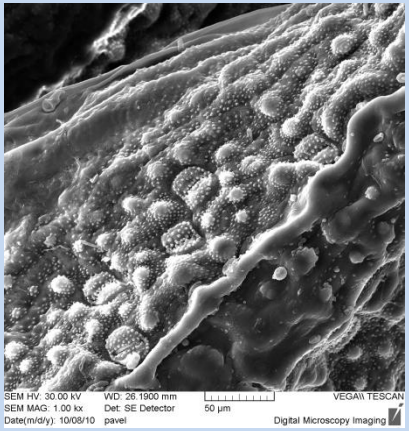
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VEGA\\ TESCAN
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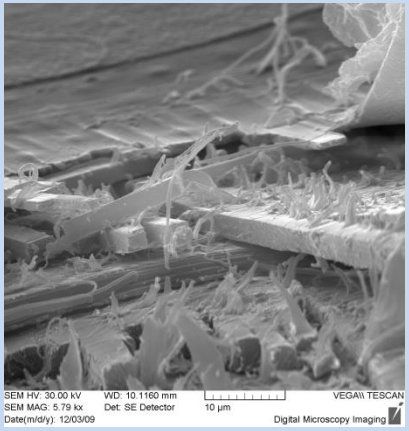
Date(m/d/y): 10/08/10
pavel
Digital Microscopy Imaging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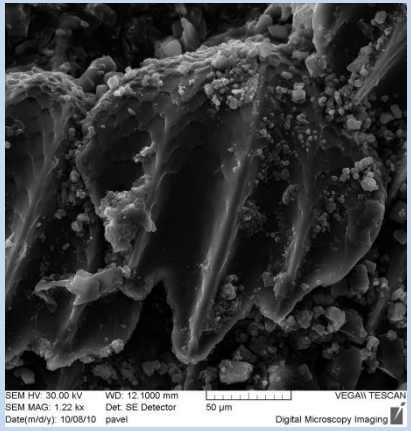
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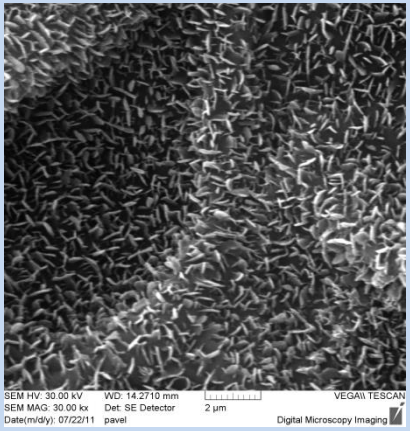
Date(m/d/y): 10/08/10
pavel
Digital Microscopy Imaging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VEGA\\ TESCAN
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Det: SE Detector
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Date(m/d/y): 07/22/11
pavel
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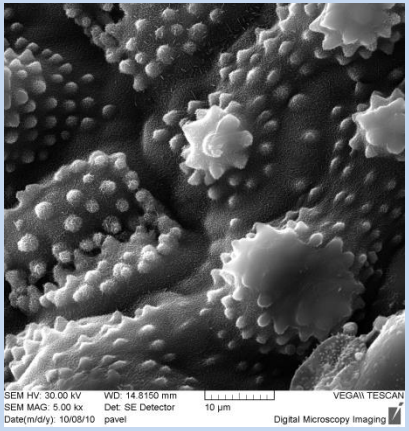
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VEGA\\ TESCAN
SEM MAG: 5.00 kx
Det: SE Detector
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Date(m/d/y): 10/08/10
pavel
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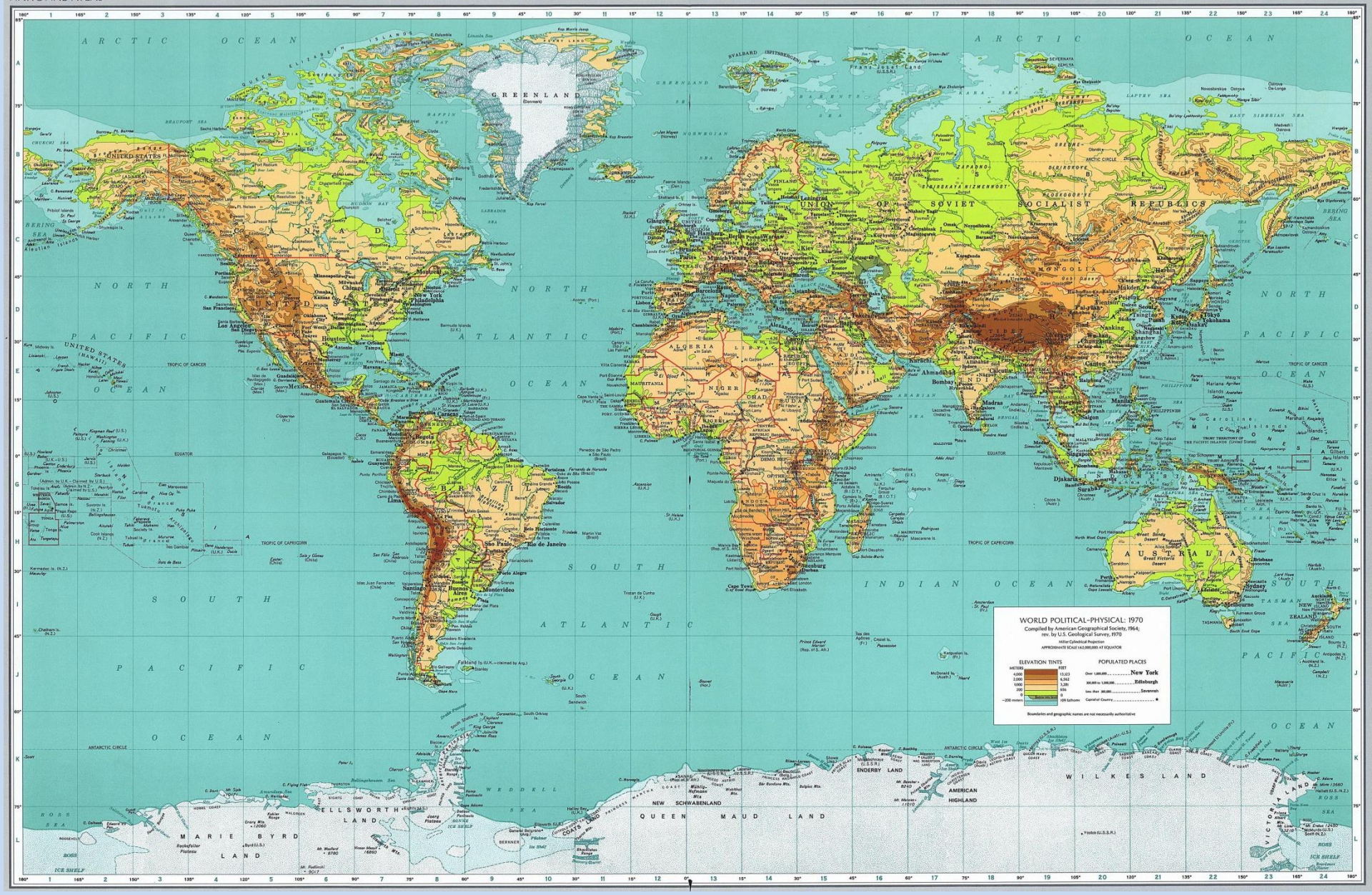
WORLD POLITICAL-PHYSICAL: 1970
Compiled by American Geographical Society, 1964;
rev. by U.S. Geological Survey, 1970
Miller Cylindrical Projection
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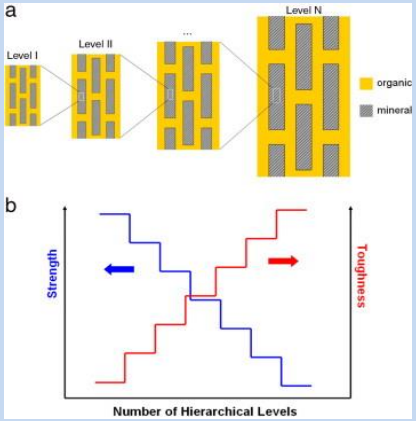
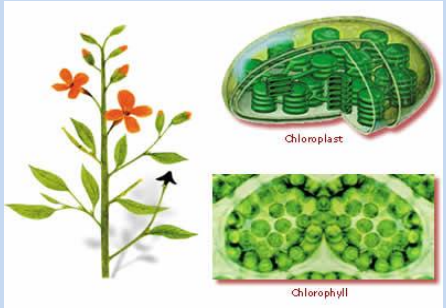
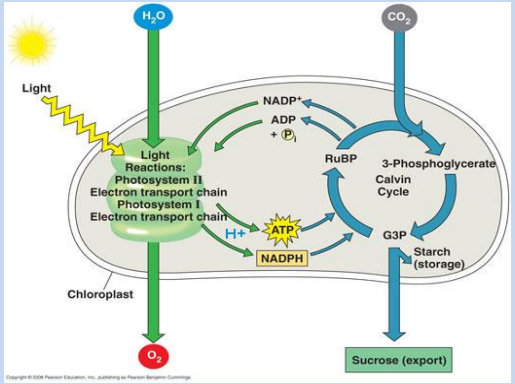
ELEVATION TINTS
METERS
FEET
4,000
2,000
1,000
200
0
–200 meters
13,123
6,562
3,281
656
0
100 fathoms
POPULATED PLACES
Over 1,000,000 ..... New York
300,000 to 1,000,000 ..... Edinburgh
Less than 300,000 ..... Savannah
Capital Country ..... ★
Boundaries and geographic names are not necessarily authoritative
ARCTIC OCEAN
NORTH PACIFIC OCEAN
NORTH ATLANTIC OCEAN
SOUTH ATLANTIC OCEAN
SOUTH PACIFIC OCEAN
INDIAN OCEAN
GREENLAND
UNITED STATES
CANADA
MEXICO
BRAZIL
ALGERIA
LIBYA
CHAD
SUDAN
INDIA
CHINA
MONGOLIA
AUSTRALIA
NEW ZEALAND
ENDERBY LAND
AMERICAN HIGHLAND
WILKES LAND
NEW SCHWABENLAND
QUEEN MAUD LAND
ELLSWORTH LAND
MARIE BYRD LAND
ROSS SEA
WEDDELL SEA
TROPIC OF CANCER
TROPIC OF CAPRICORN
EQUATOR
ANTARCTIC CIRCLE

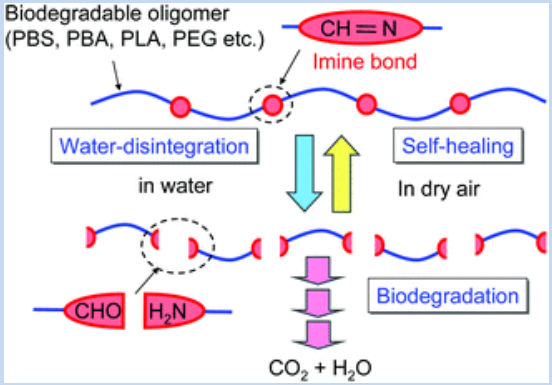
Hierarchie struktur +
chemické složení +
technologie probíhající za
normální teploty a tlaku +
schopnost samoopravování +
schopnost remodelace +
biodegradace +
přizpůsobení se daným
klimatickým podmínkám

= přírodní materiály =
materiály zajišťující kontinuitu
v předávání informací



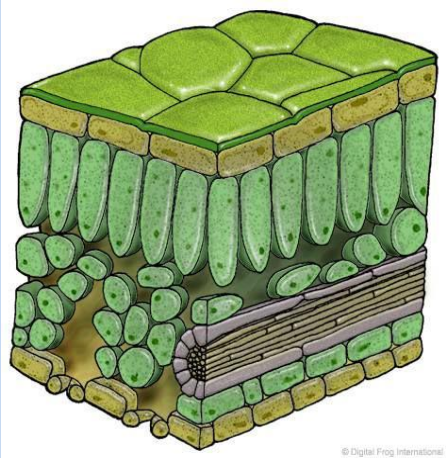


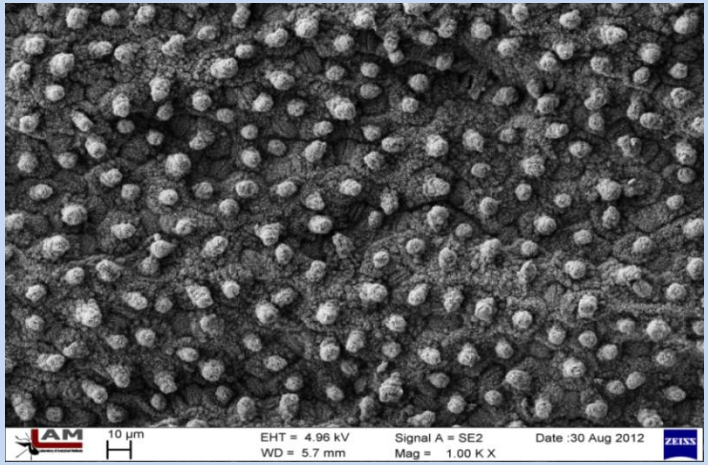


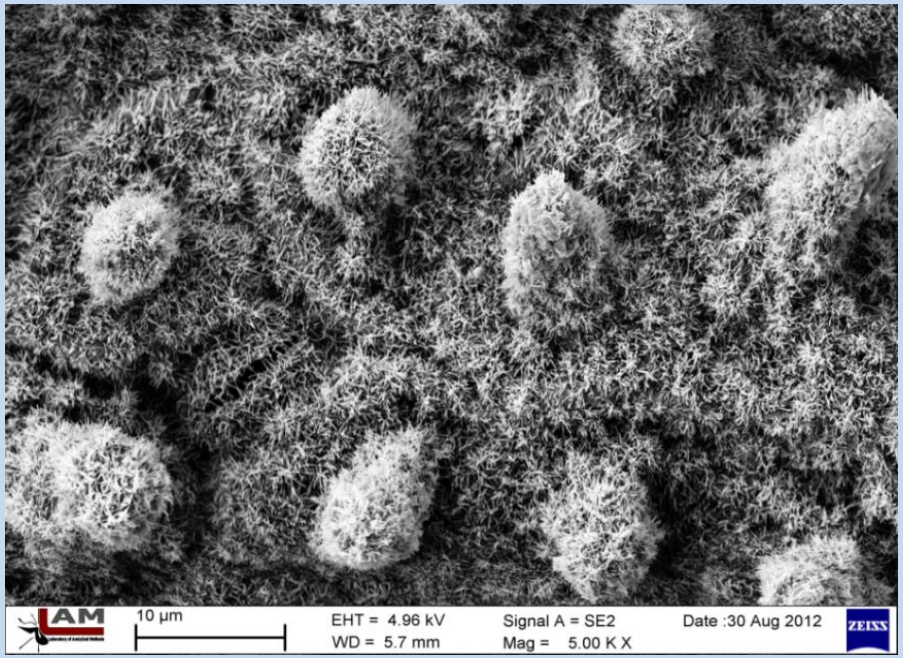


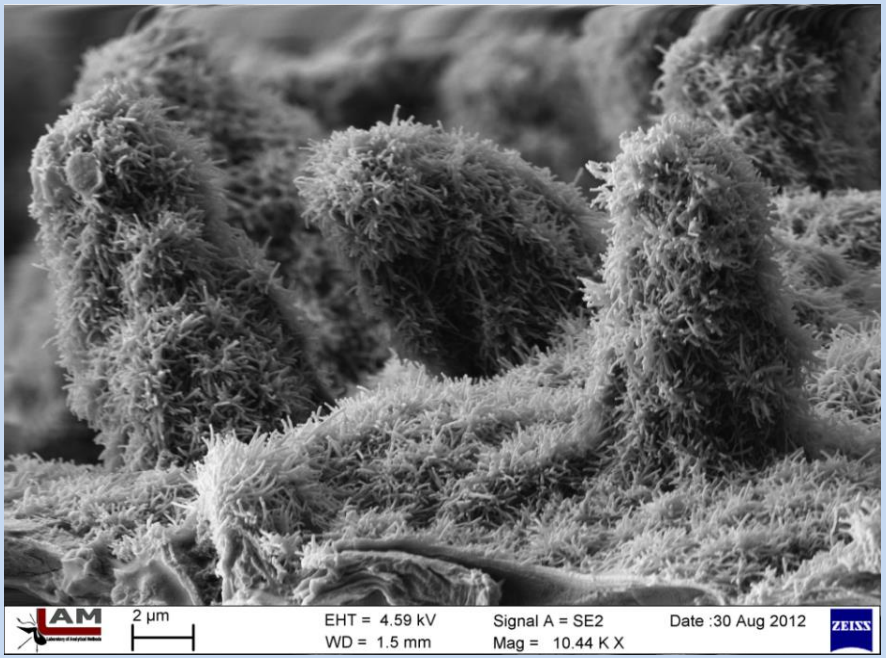
Hydrofobní povrchy

Lotosový list – lotosový jev – samočisticí schopnosti rostlin

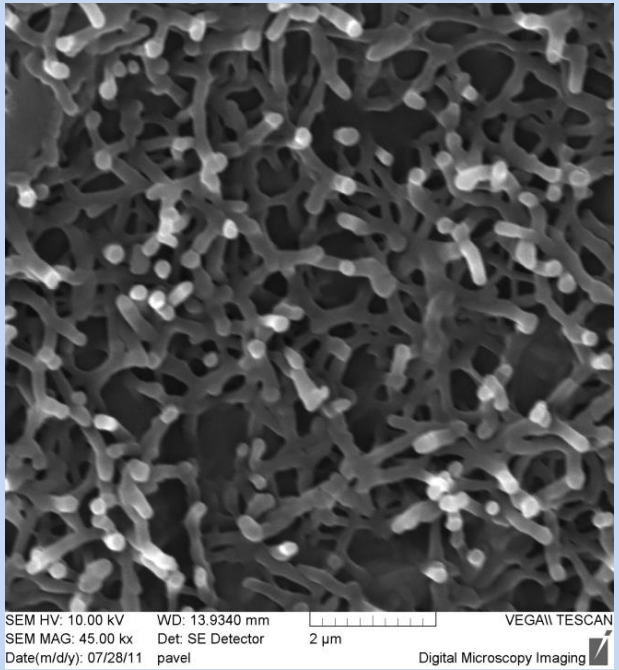


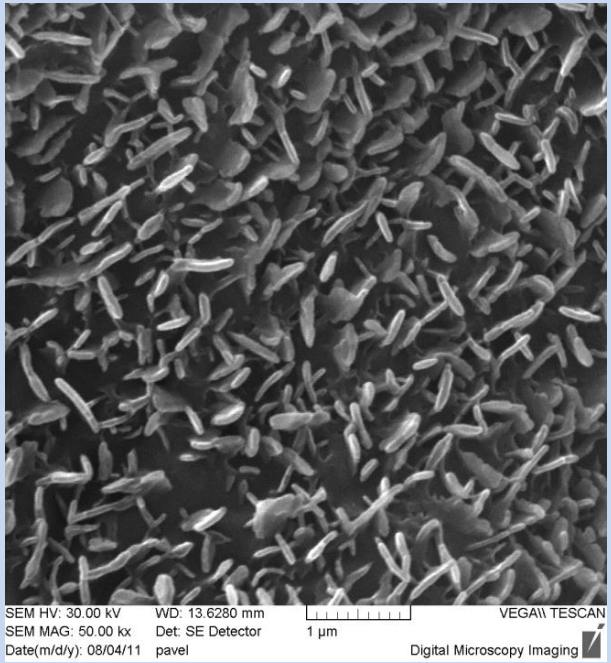


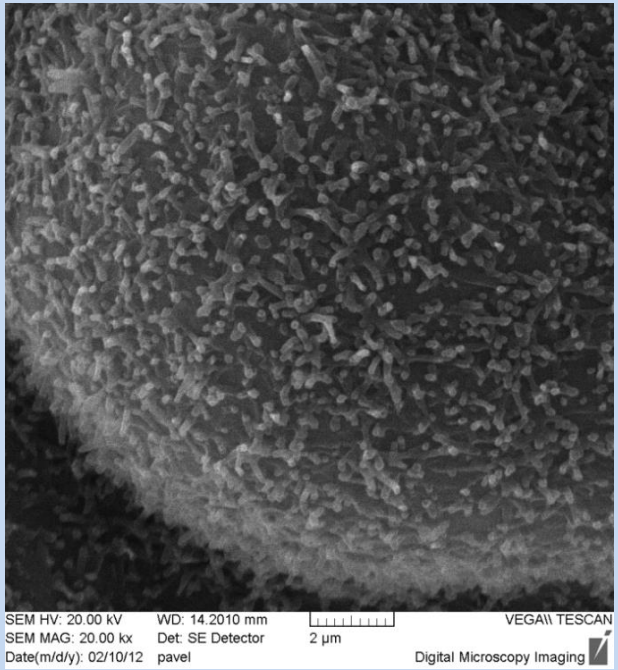




Lichořeřišnice – jetel plazivý – pámelník bílý

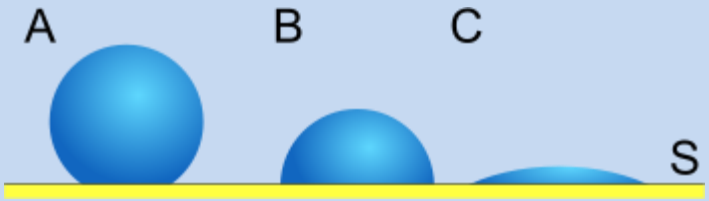


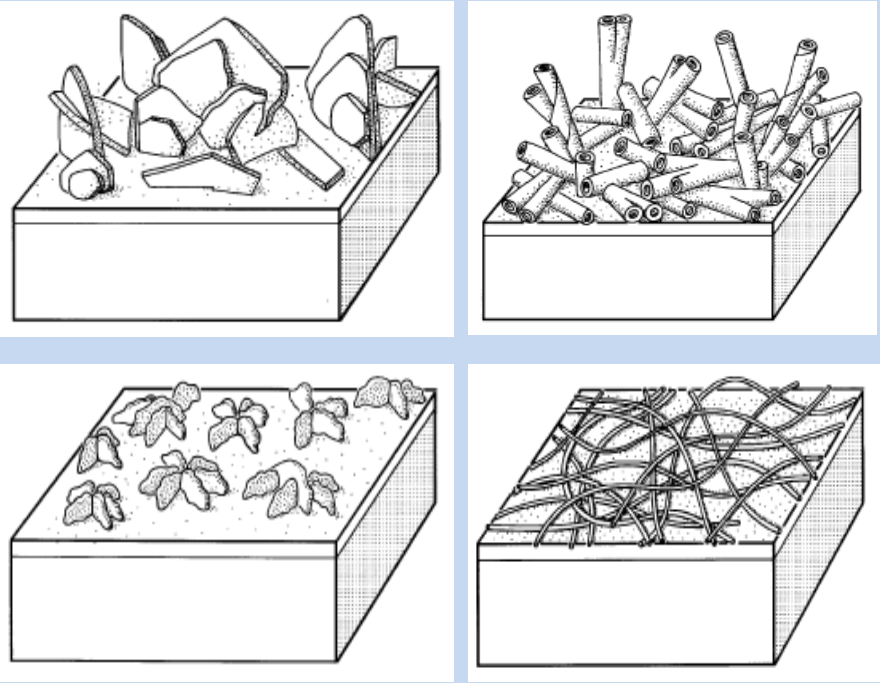


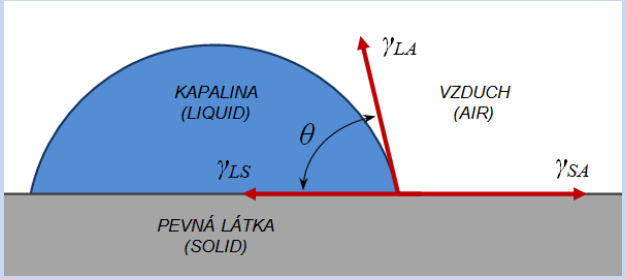


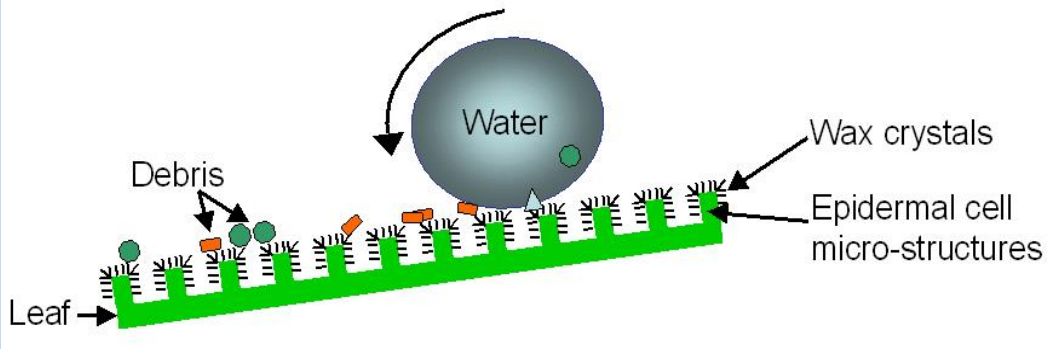
Rostlinné povrchy

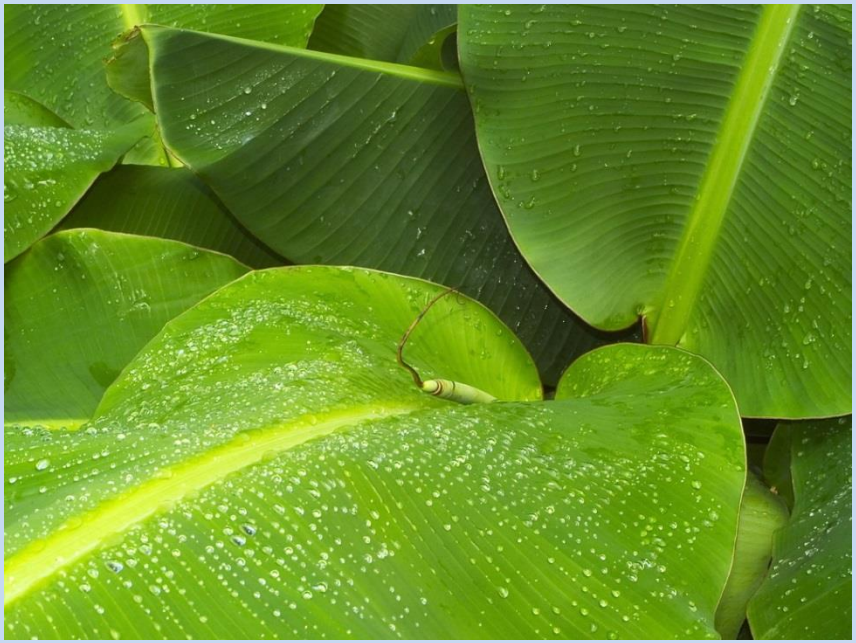
kontaktní úhel	smáčivost
$\theta = 0$	dokonalé smáčení
$0 < \theta < 90°$	vysoká smáčivost
$90° \leq \theta < 180°$	nízká smáčivost

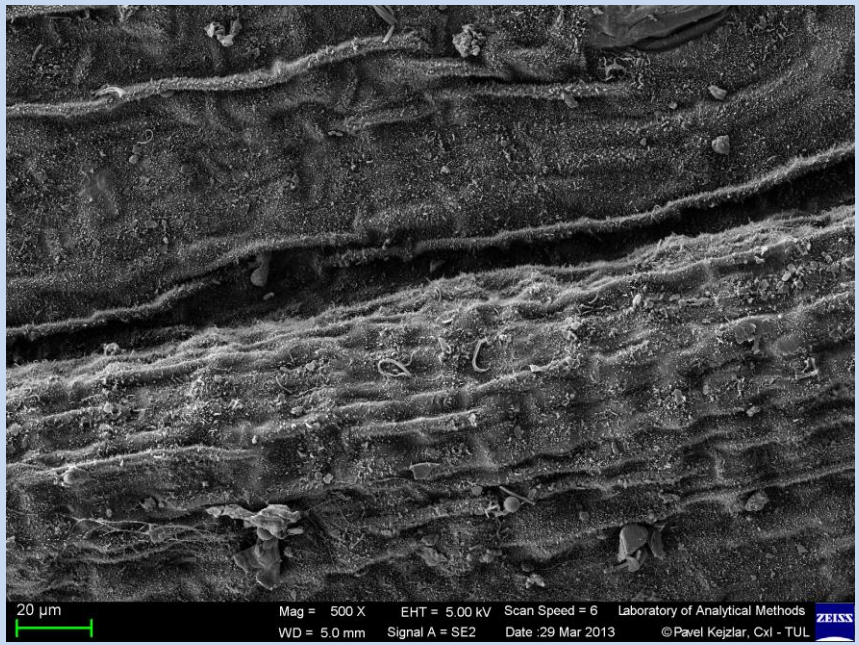








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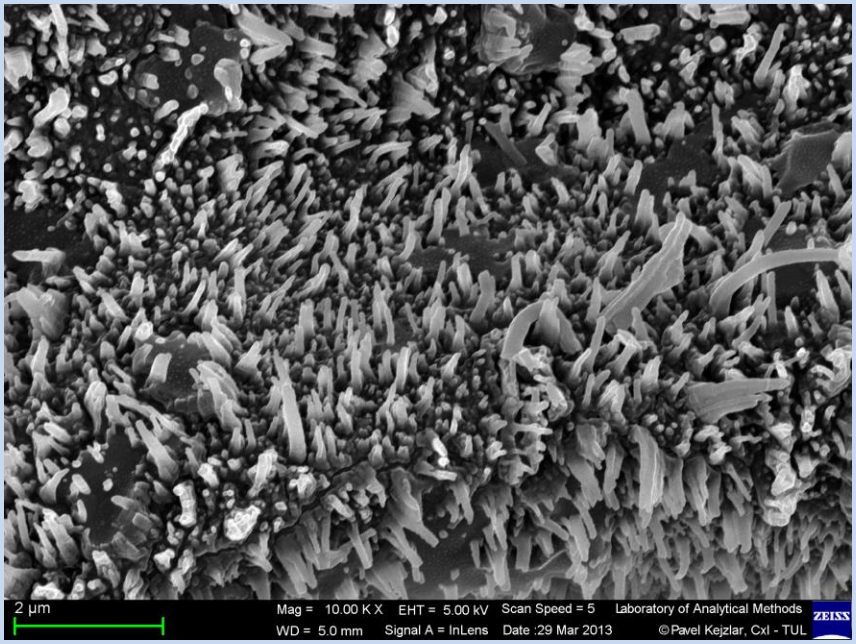
EHT = 5.00 kV
Signal A = SE2
Scan Speed = 6
Date :29 Mar 2013
Laboratory of Analytical Methods
©Pavel Kejzlar, CxI - TUL
ZEISS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Signal A = InLens
Scan Speed = 5
Date :29 Mar 2013
Laboratory of Analytical Methods
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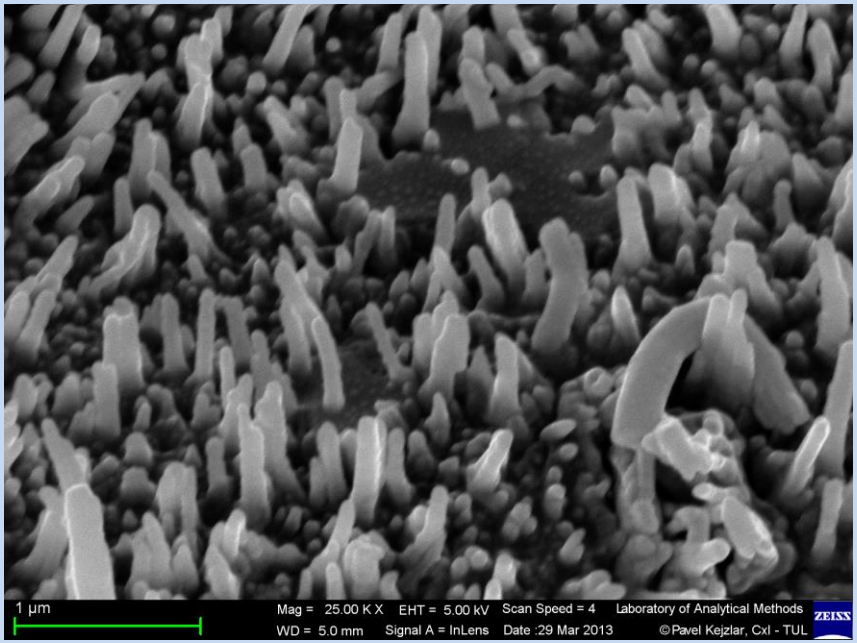
ZEISS


1 µm
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WD = 5.0 mm
EHT = 5.00 kV
Signal A = InLens
Scan Speed = 4
Date :29 Mar 2013
Laboratory of Analytical Methods
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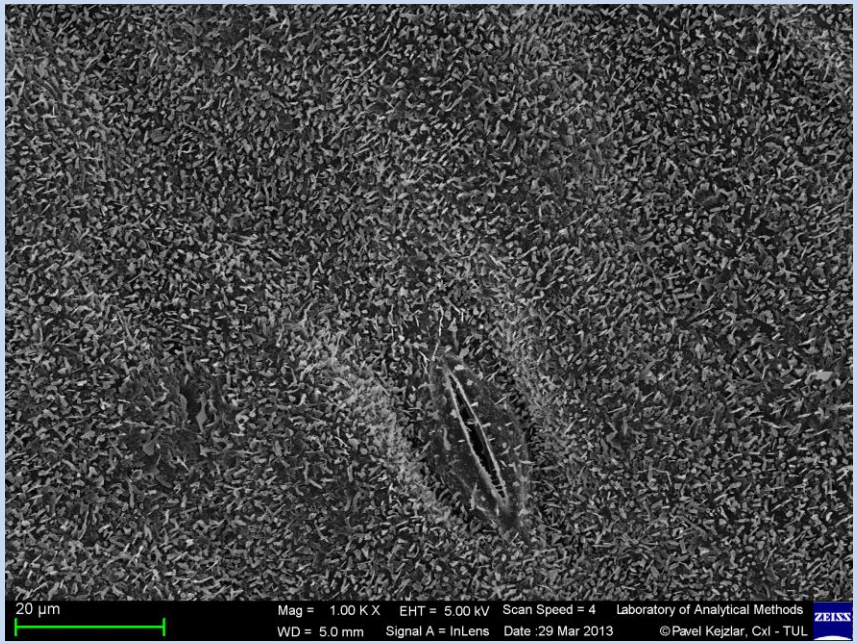
ZEISS


20 µm
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EHT = 5.00 kV
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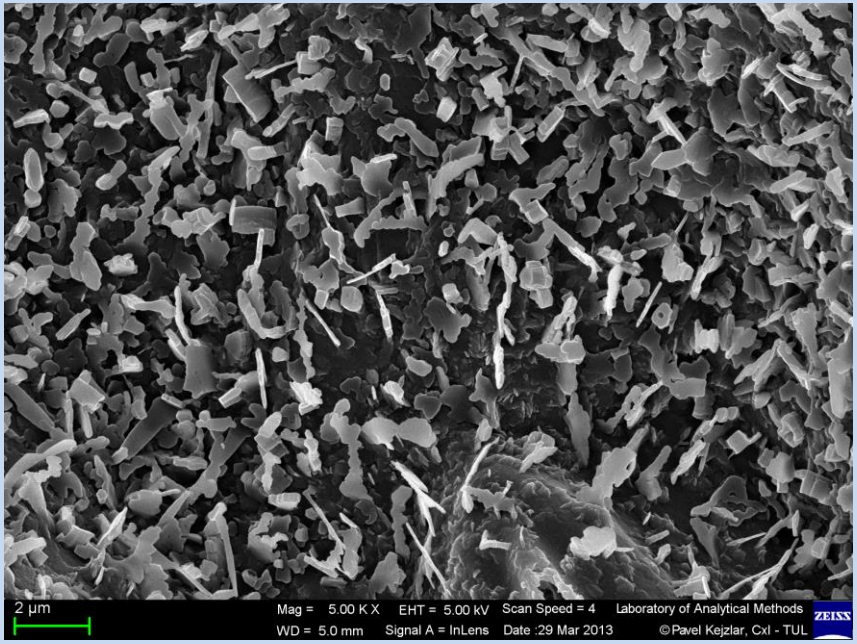
Laboratory of Analytical Methods
WD = 5.0 mm
Signal A = InLens
Date :29 Mar 2013
©Pavel Kejzlar, CxI - TUL
ZEISS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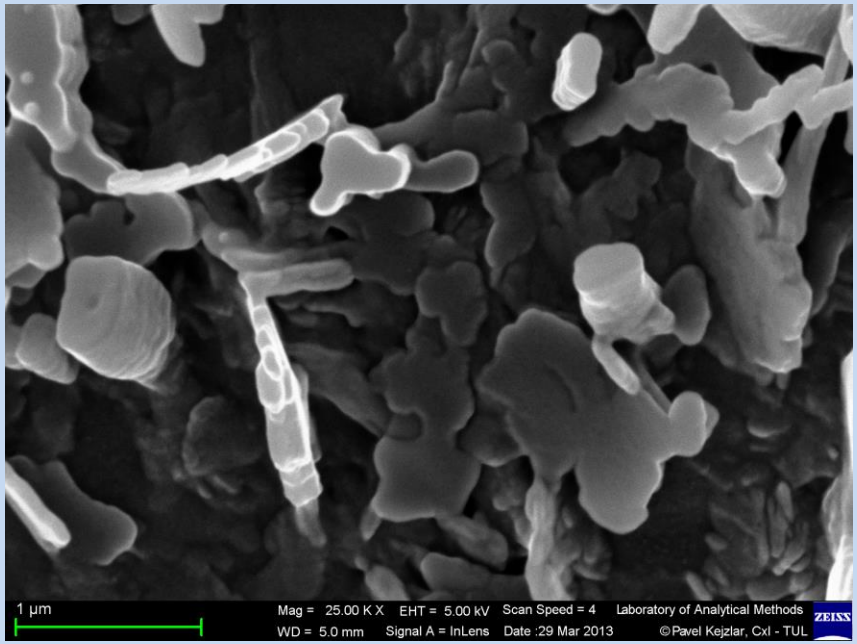
Laboratory of Analytical Methods
WD = 5.0 mm
Signal A = InLens
Date :29 Mar 2013
©Pavel Kejzlar, CxI - TUL
ZEISS


1 µm
Mag = 25.00 K X
EHT = 5.00 kV
Scan Speed = 4
Laboratory of Analytical Methods
WD = 5.0 mm
Signal A = InLens
Date :29 Mar 2013
©Pavel Kejzlar, CxI - TUL
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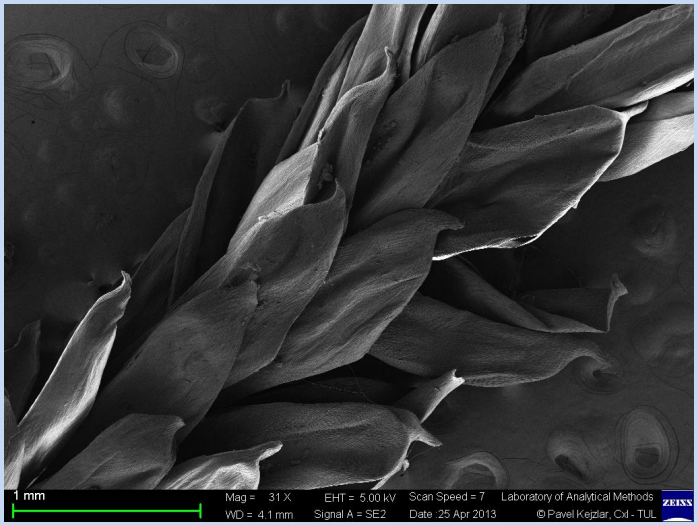
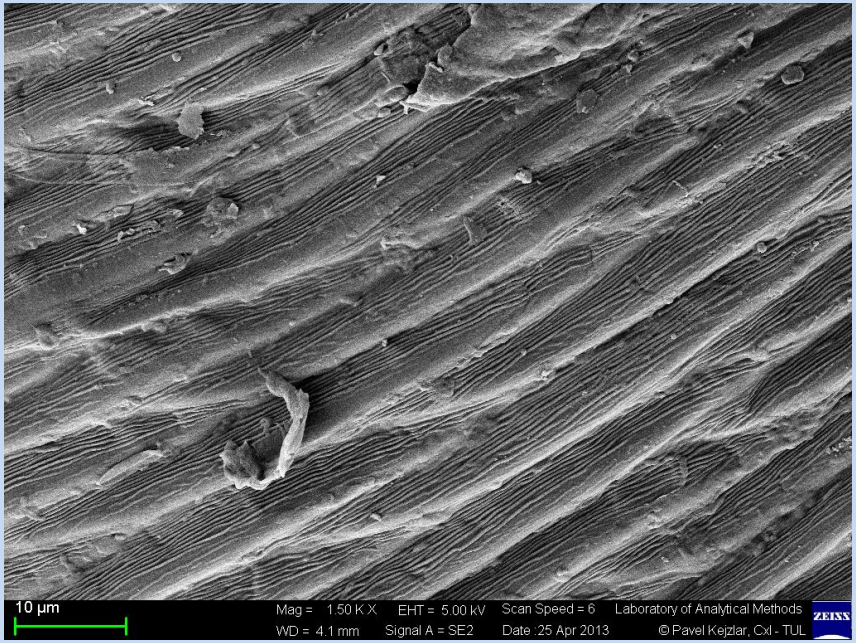
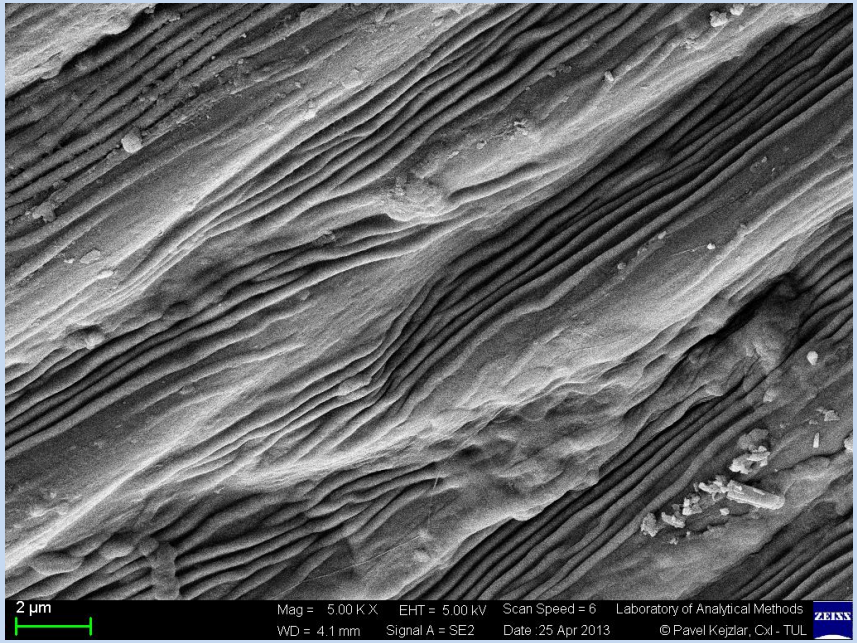
Hydrofilní povrchy

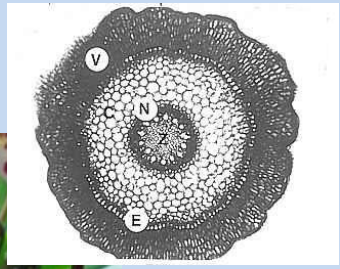
Mechy – hydrofilní strukturované povrchy

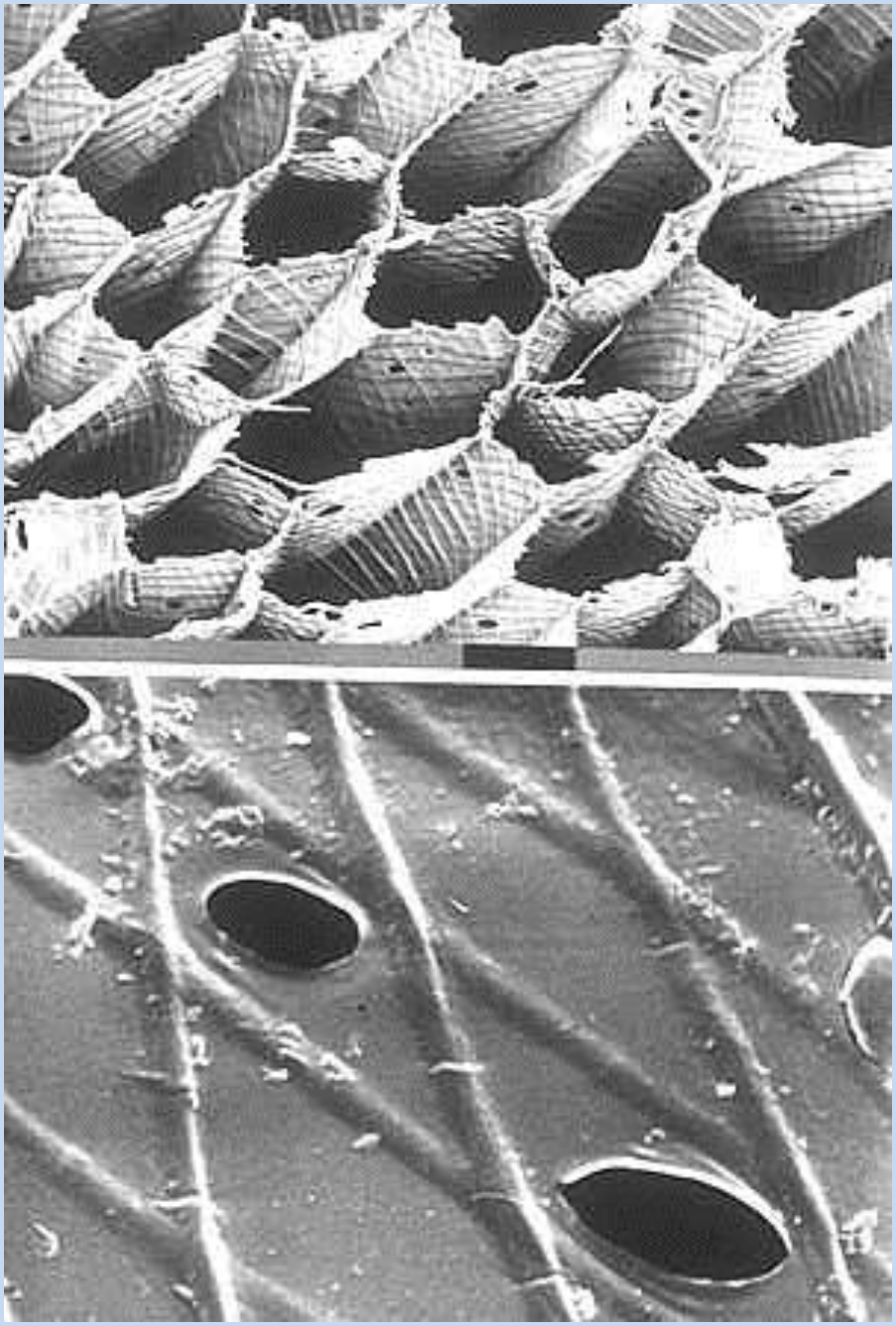






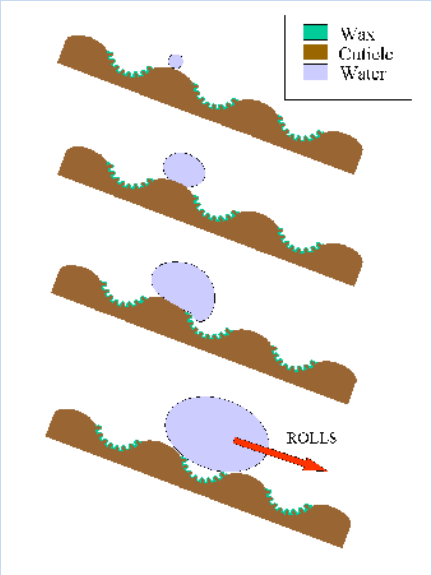
Vzdušné kořeny

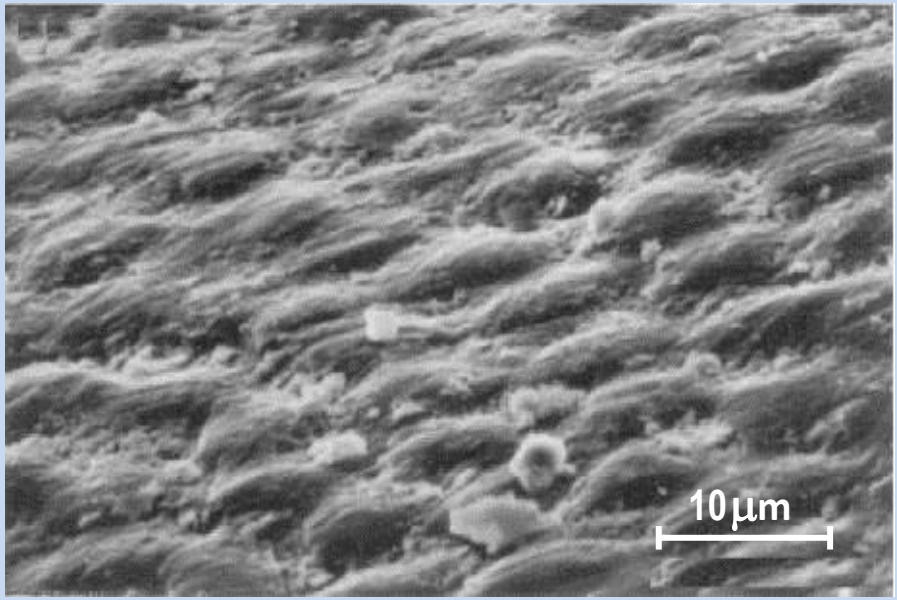




http://www.biologie.uni-hamburg.de/b-online/e05/05b.htm

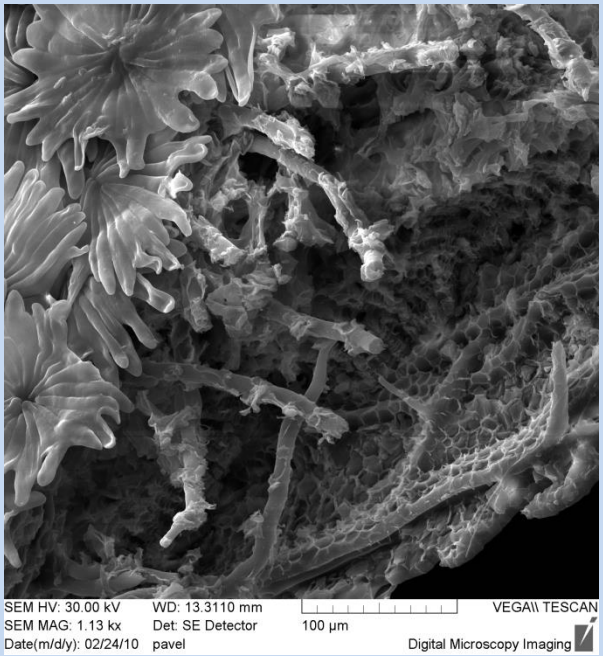
Hydrofilně – hydrofobní povrchy

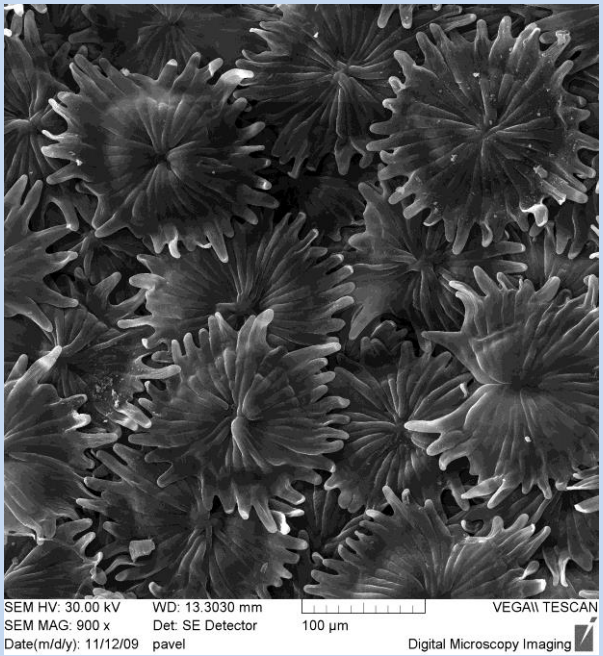


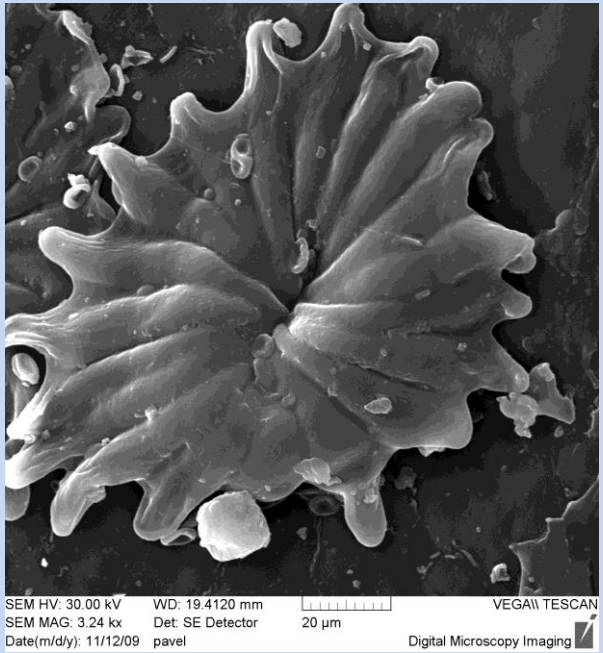


Bariérové funkce

Olivovník evropský – regulace vypařování vody

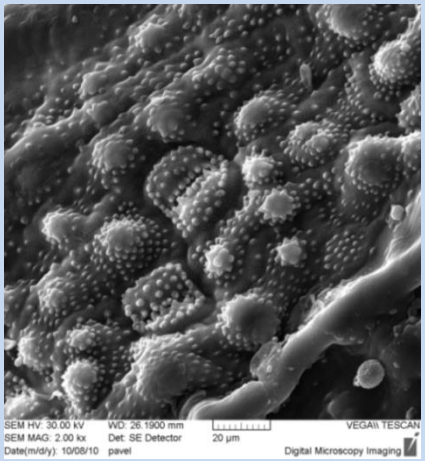


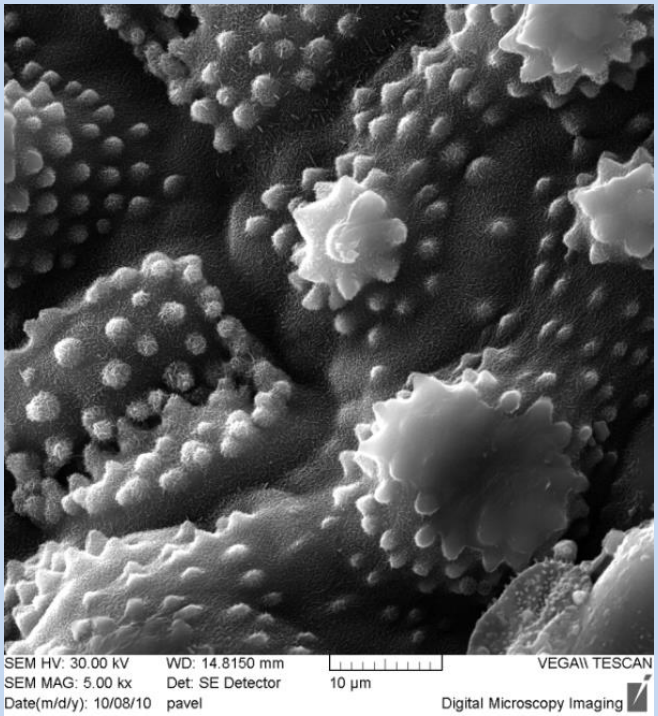


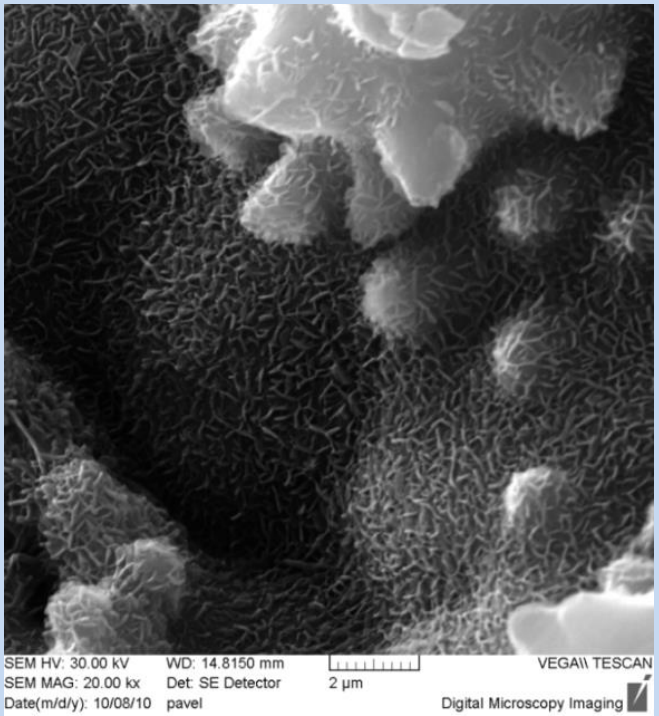


Ochranné funkce

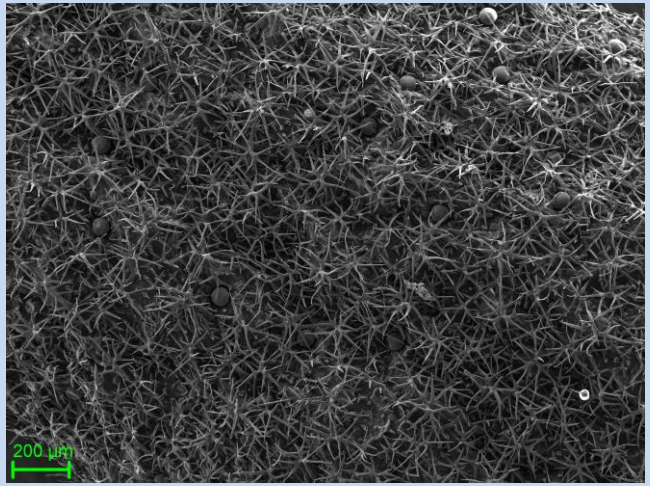
Přeslička rolní - povrchové útvary

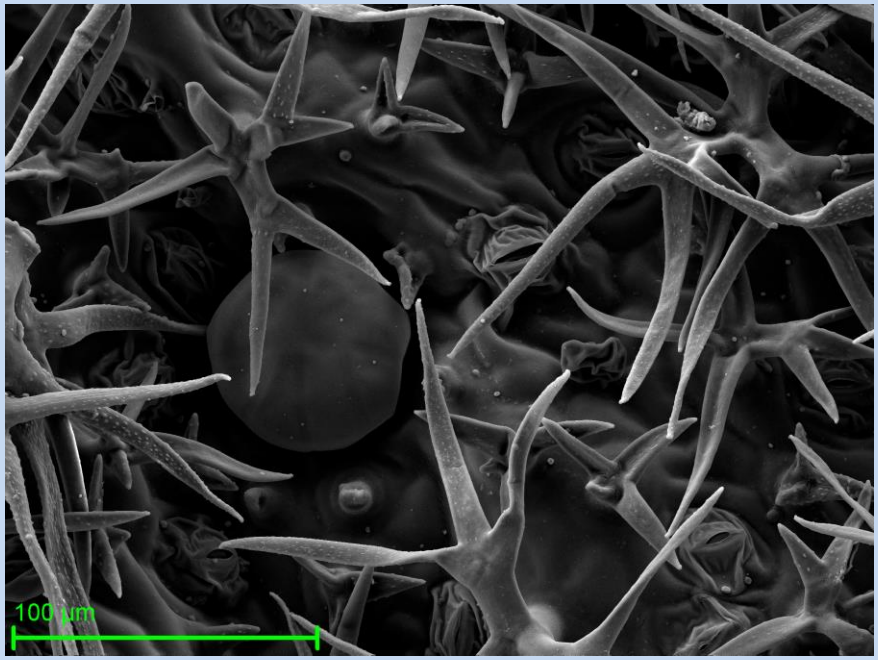


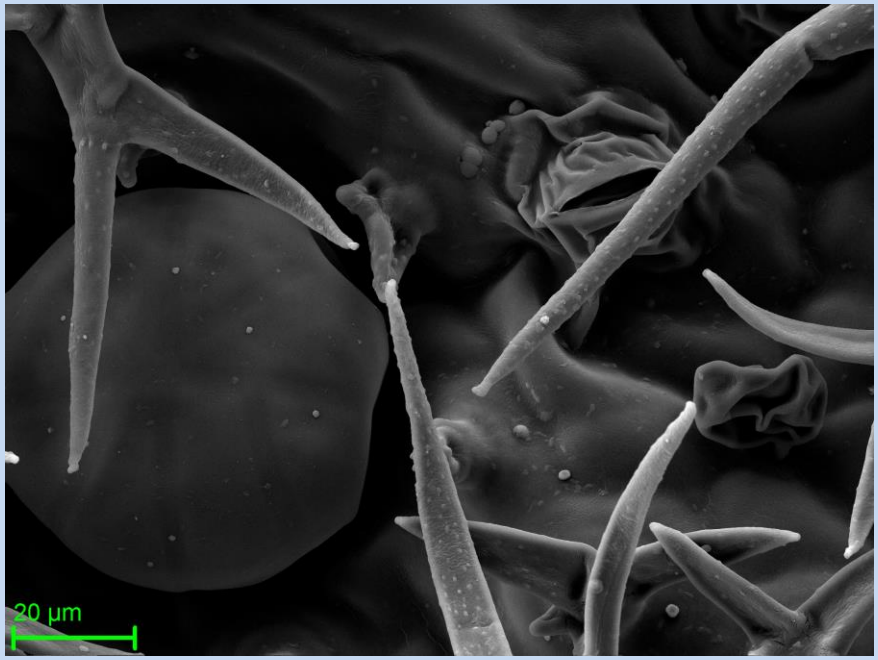




Levandule lékařská – trichomy chránící měchýřky se silicemi

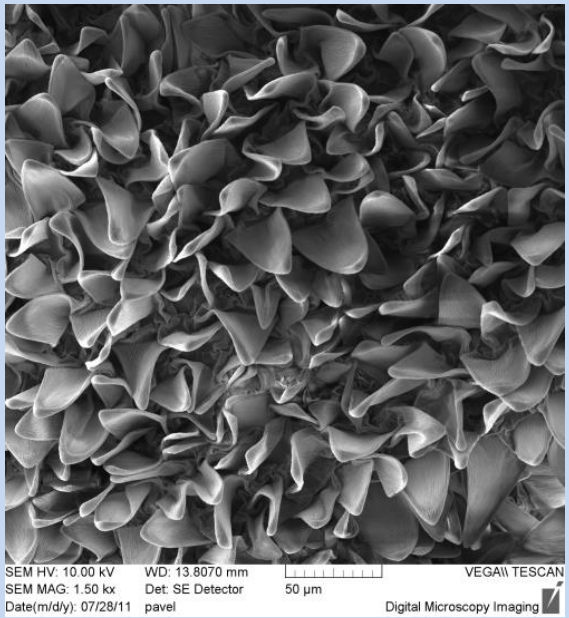


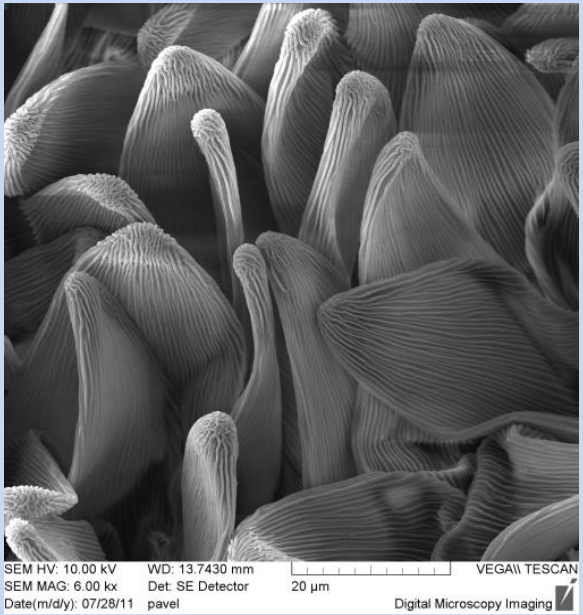


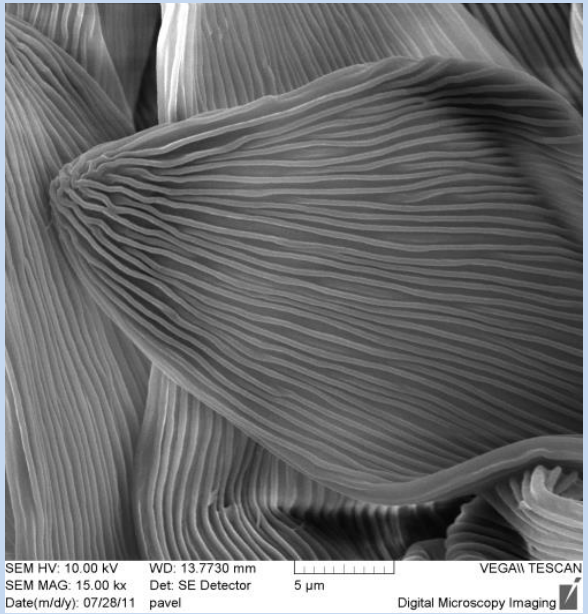


Vzhled

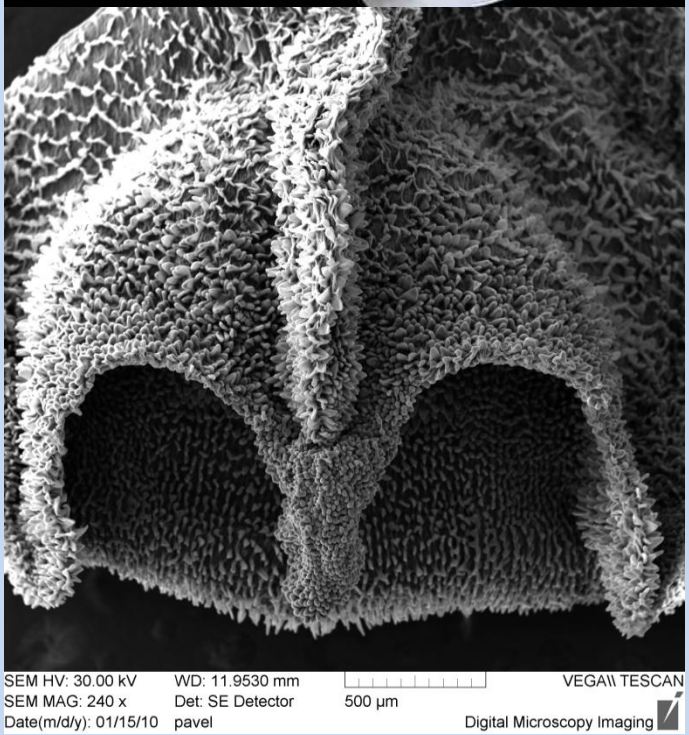
Maceška zahradní - sametový vzhled květů

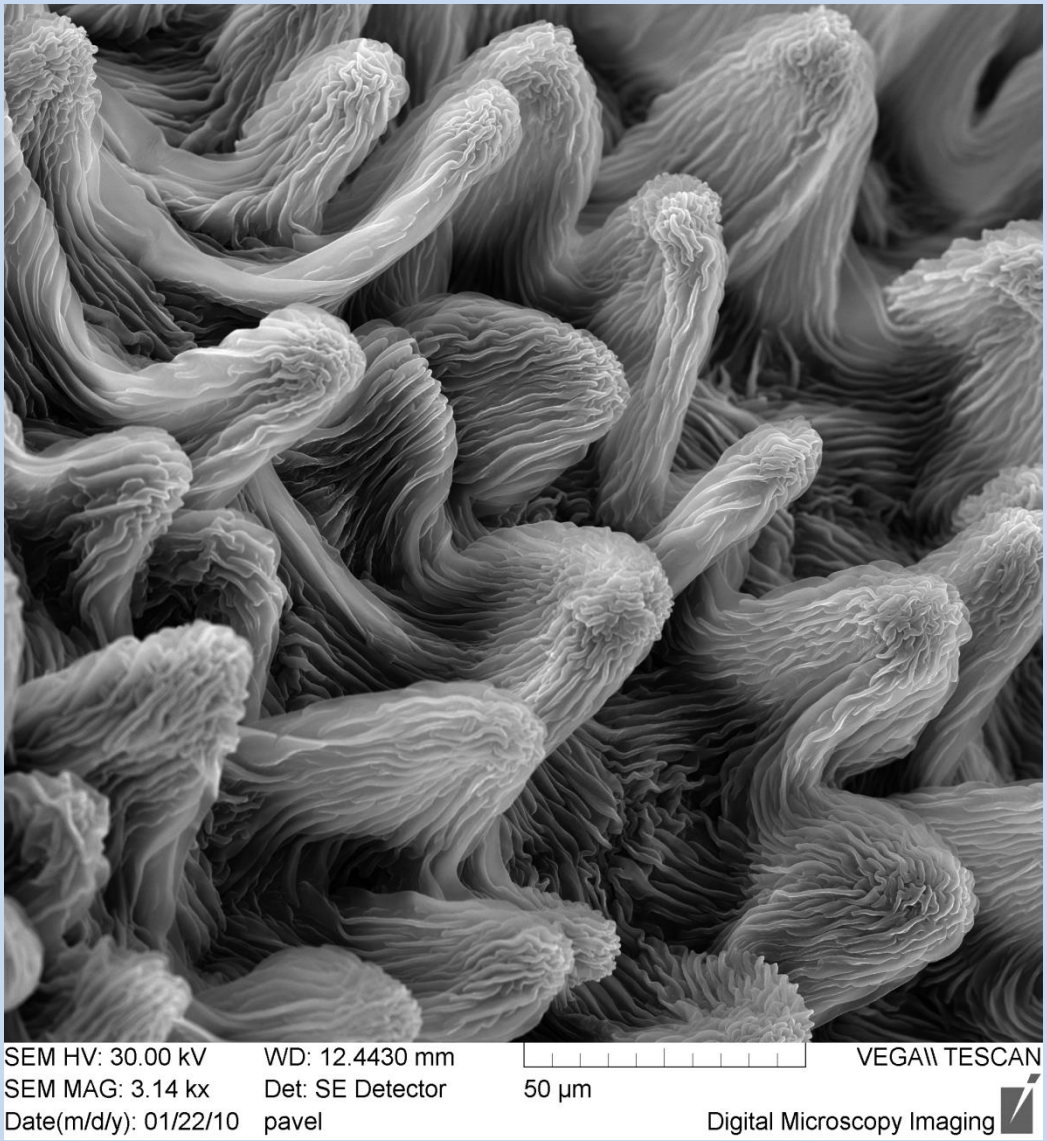




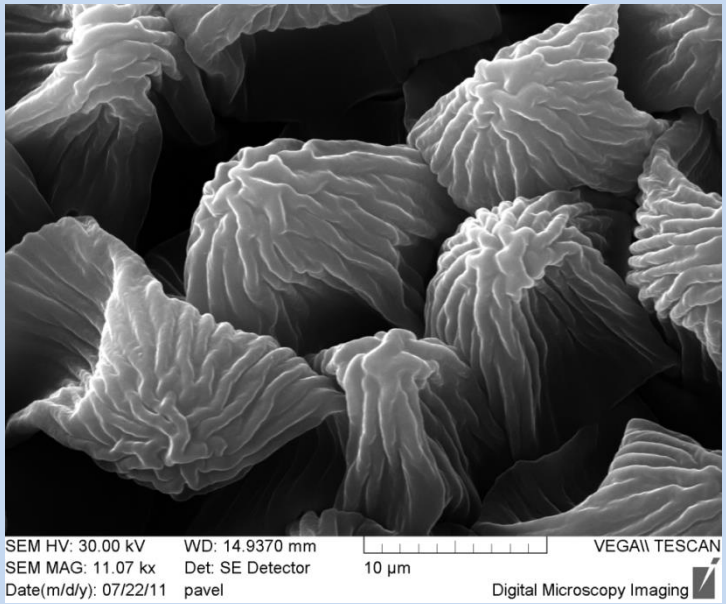


Orchidea – květ





Růže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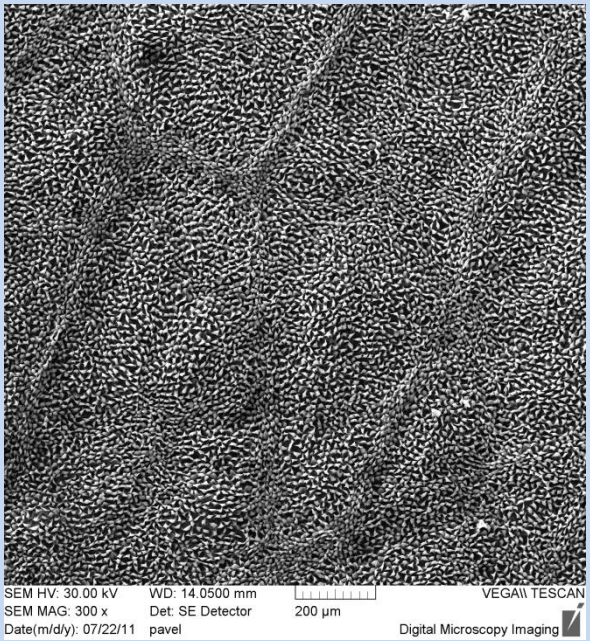
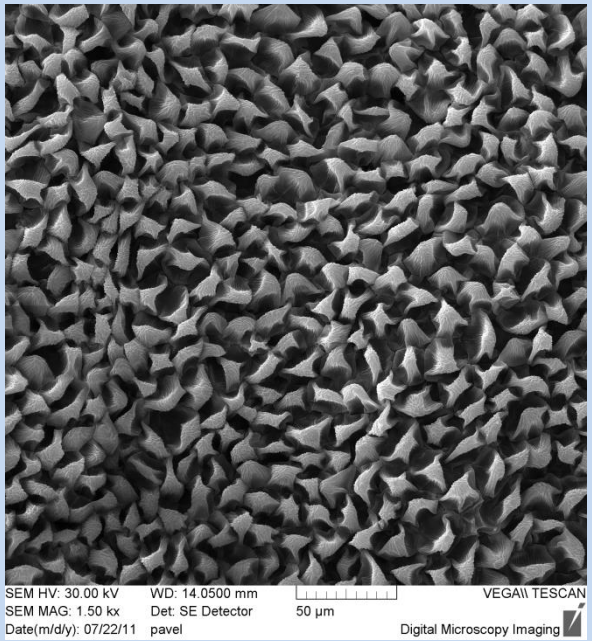
WD: 14.9370 mm
VEGA\\ TESCAN
SEM MAG: 11.07 kx
Det: SE Detector
10 µm
Date(m/d/y): 07/22/11
pavel
Digital Microscopy Imaging


SEM HV: 30.00 kV
WD: 14.0500 mm
VEGA\\ TESCAN
SEM MAG: 300 x
Det: SE Detector
200 µm
Date(m/d/y): 07/22/11
pavel
Digital Microscopy Imaging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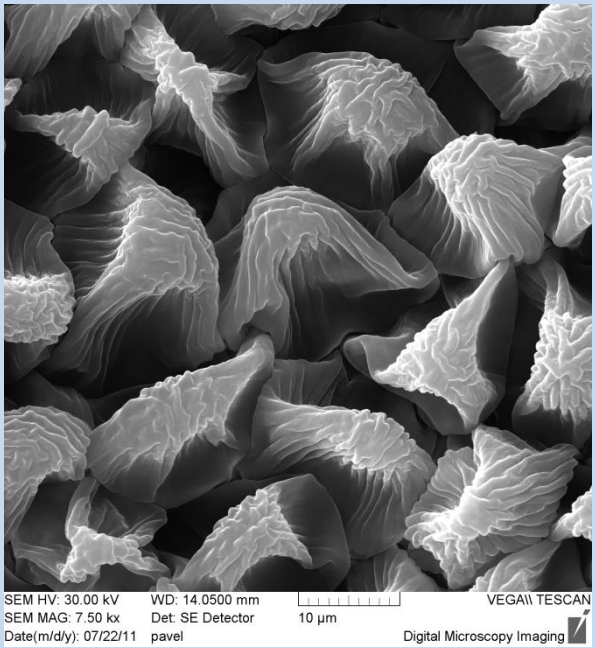
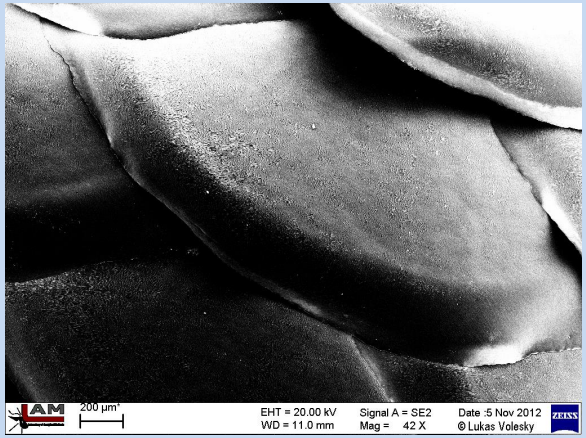
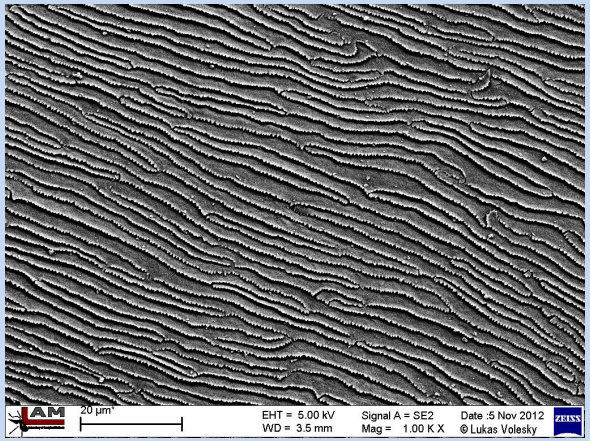
WD: 14.0500 mm
VEGA\\ TESCAN
SEM MAG: 1.50 kx
Det: SE Detector
50 µm
Date(m/d/y): 07/22/11
pavel
Digital Microscopy Imaging

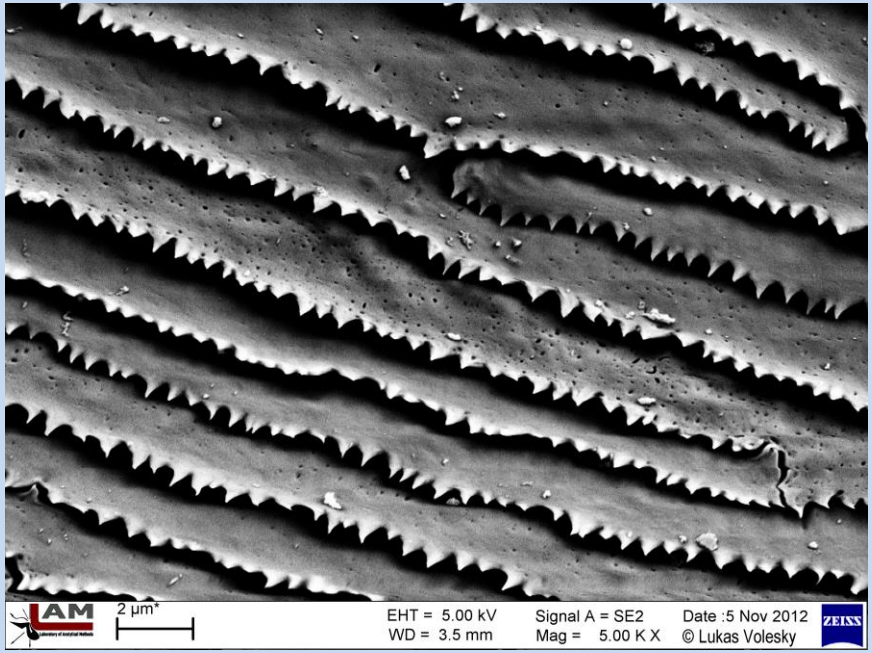

SEM HV: 30.00 kV
WD: 14.0500 mm
VEGA\\ TESCAN
SEM MAG: 7.50 kx
Det: SE Detector
10 µm
Date(m/d/y): 07/22/11
pavel
Digital Microscopy Imaging

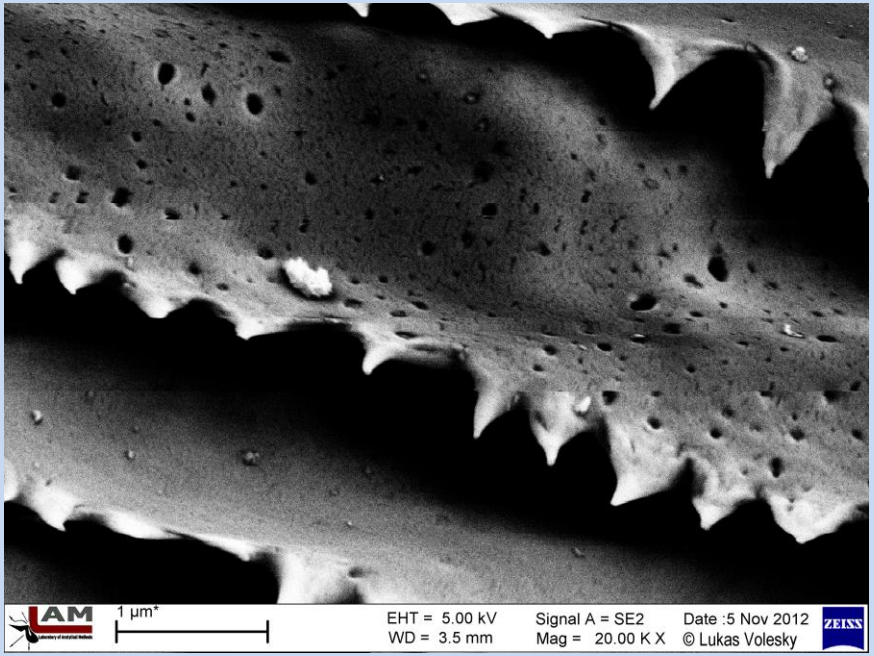
Odolnost vůči abrazi

Písečná ryba – neabrazivní povrch těla

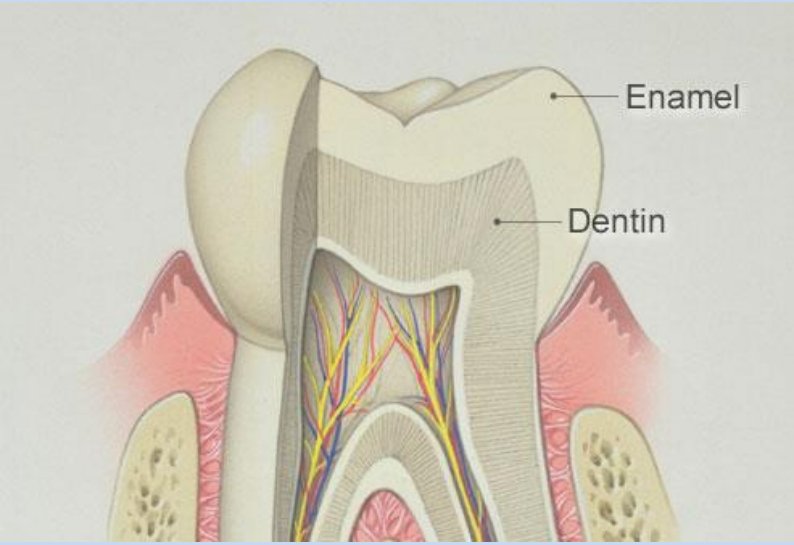


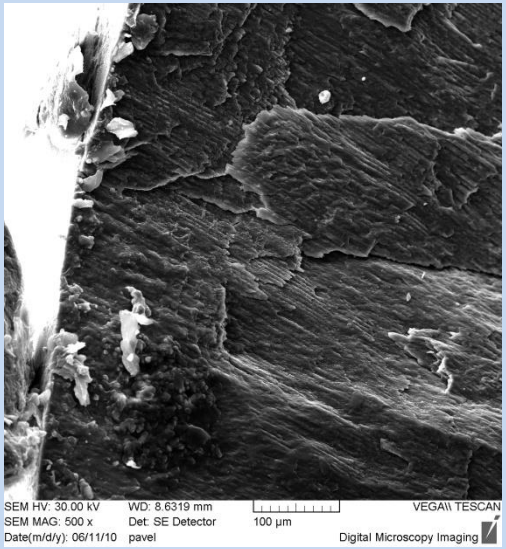


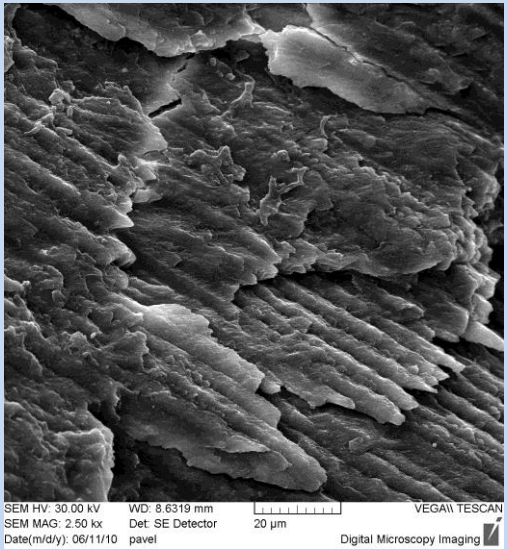


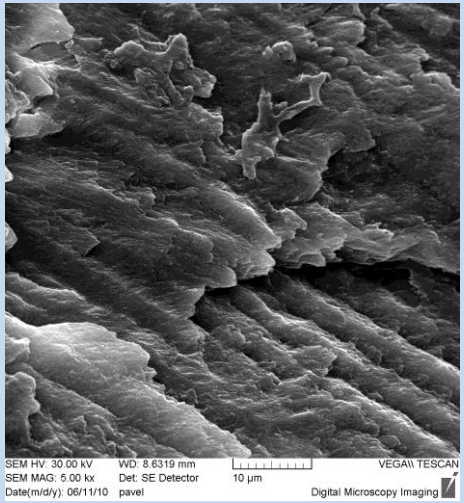


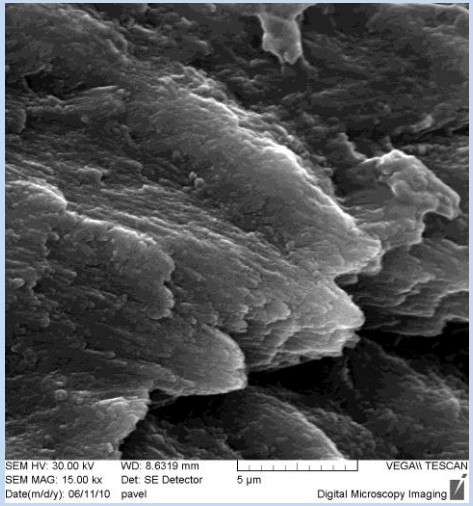
Zuby – zubní sklovina

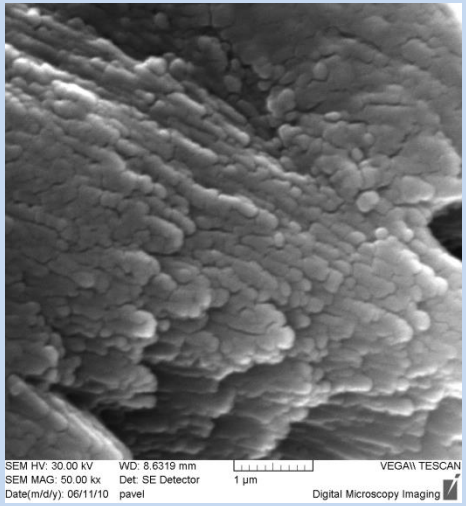


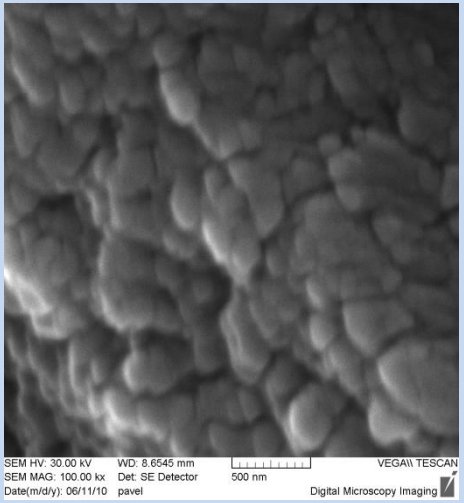






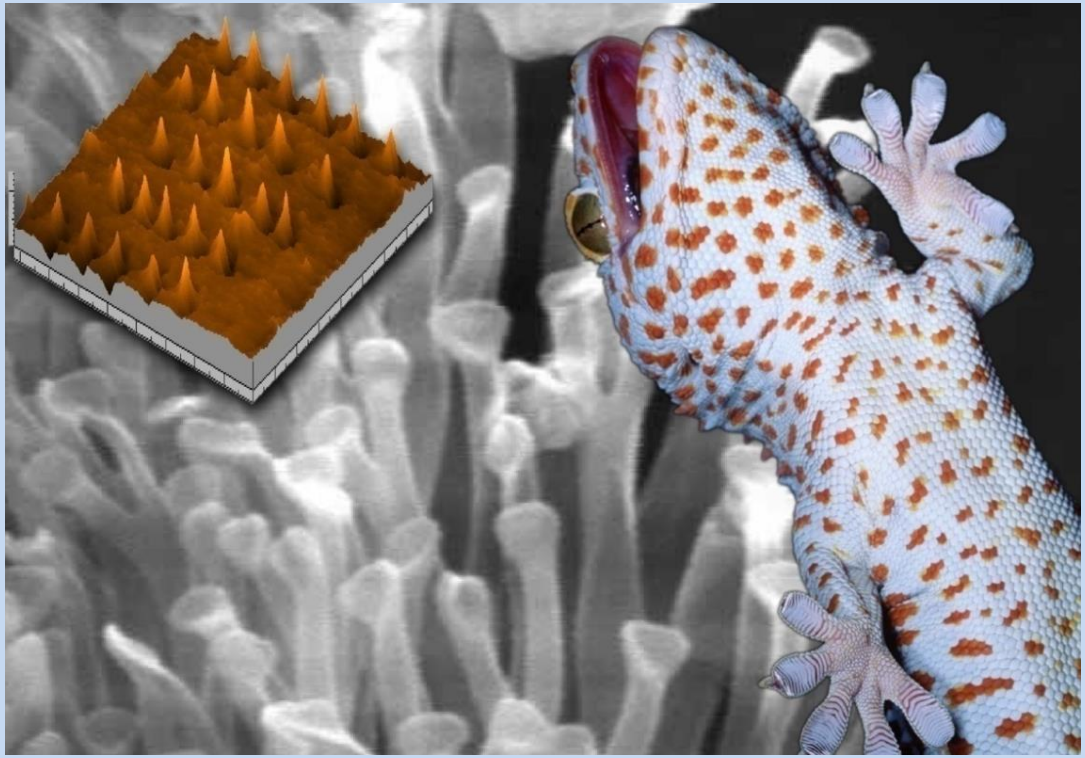


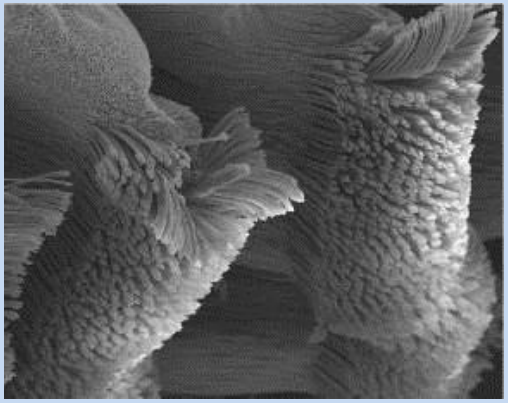


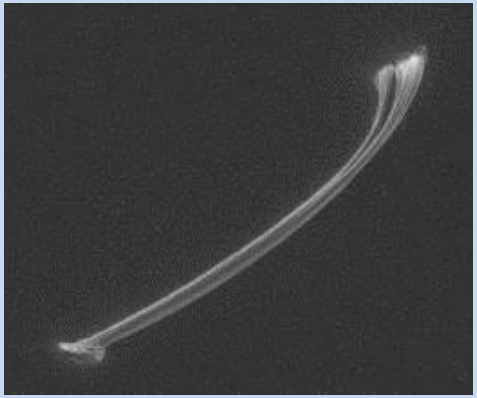


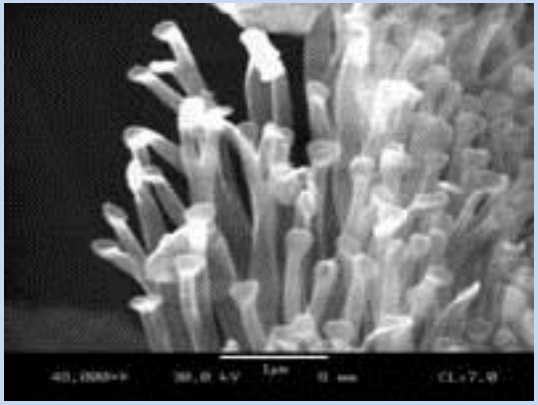
Adheze

Hierarchie struktur – „lepení bez lepidel“

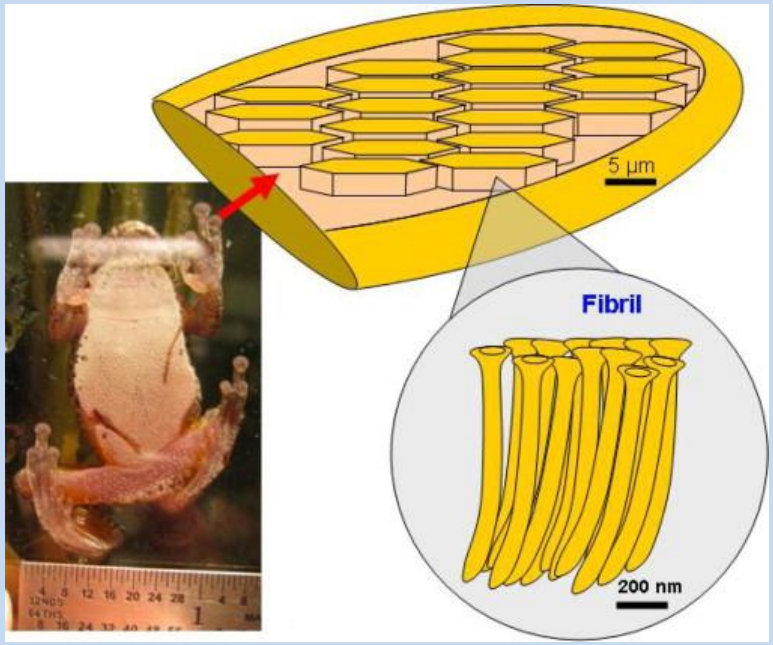


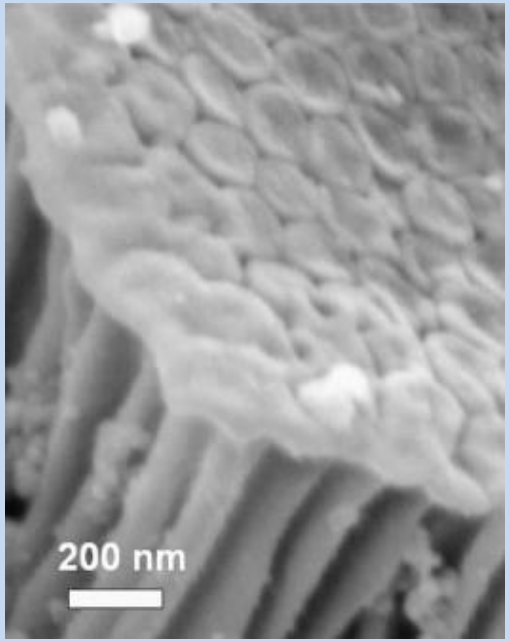


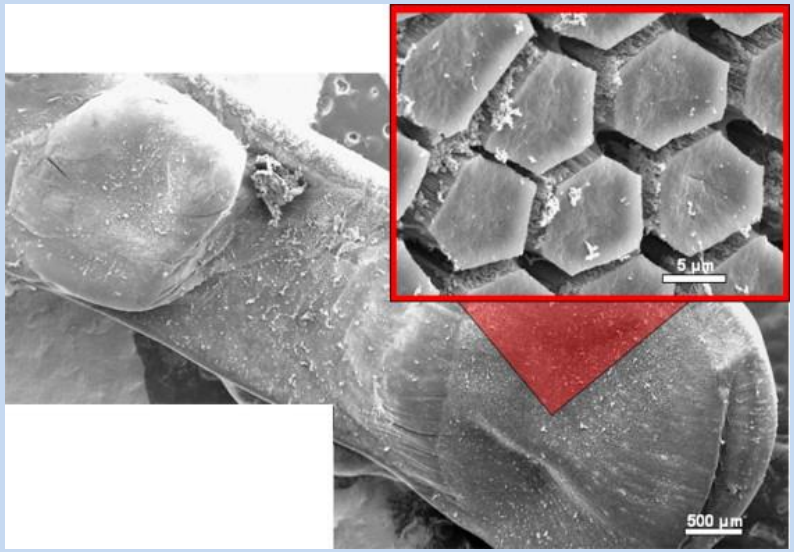


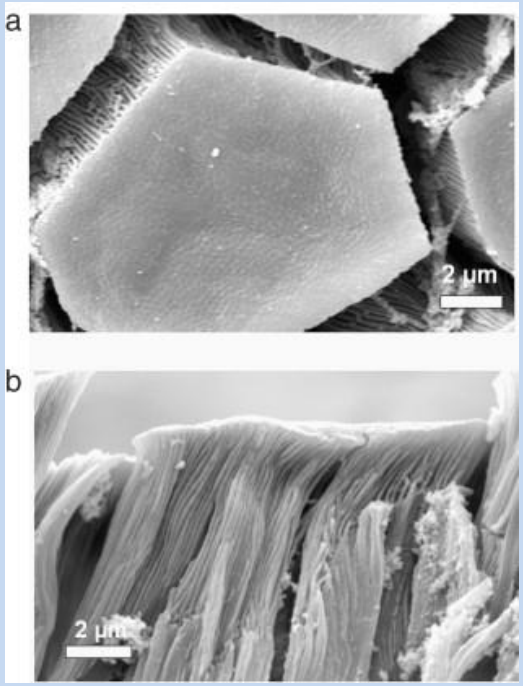


Tree frog

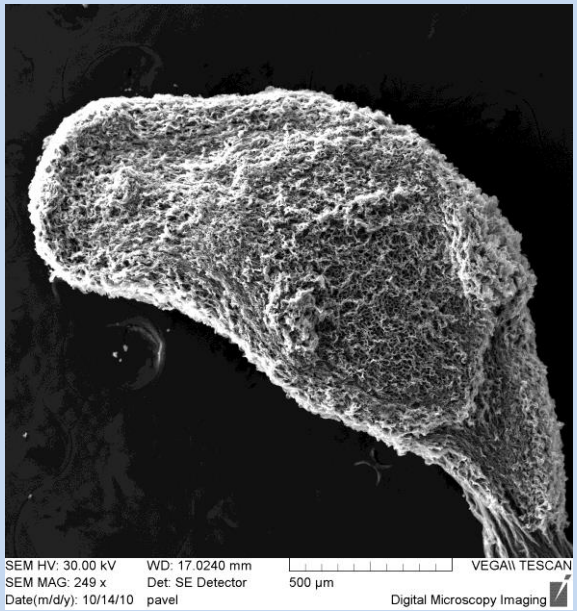


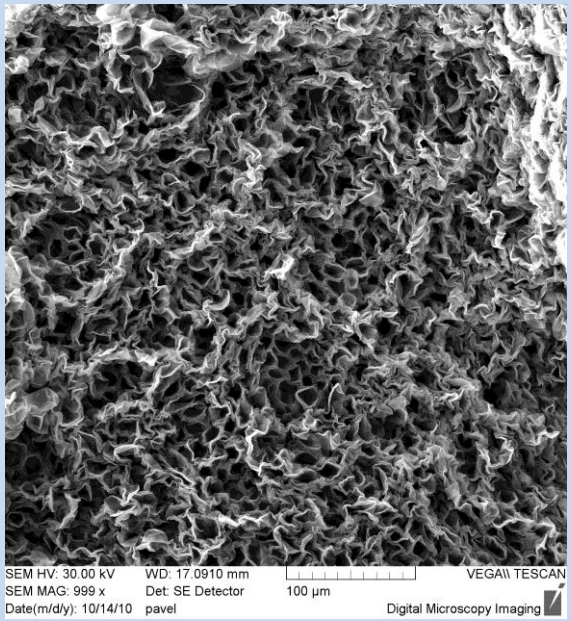


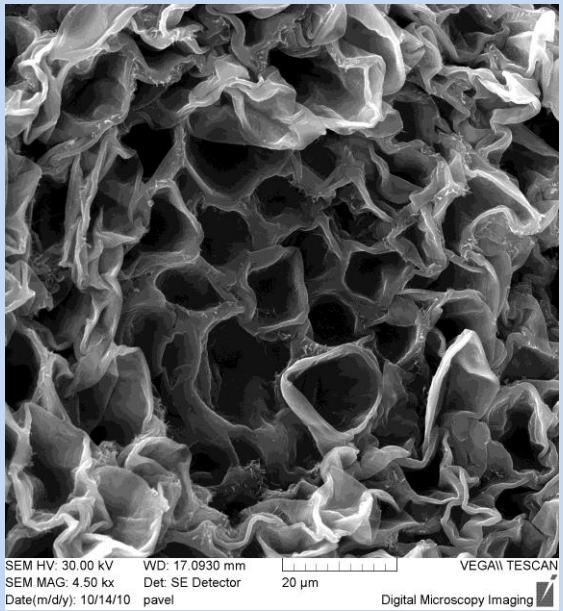




Přísavník pětilaločný

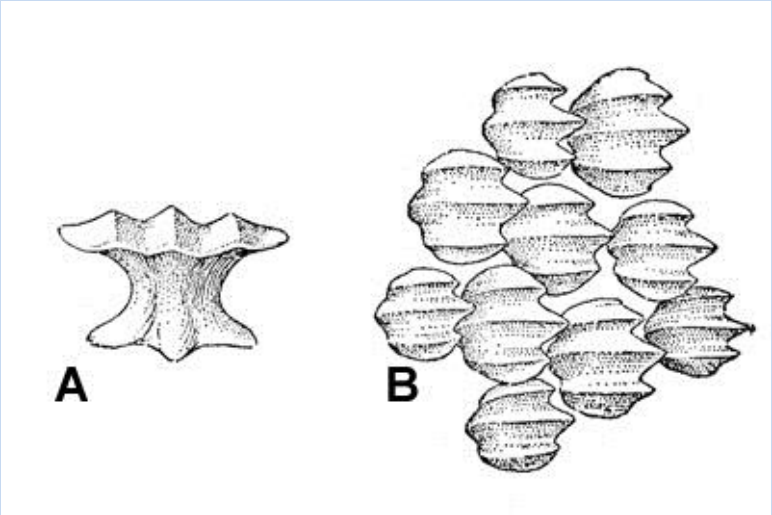


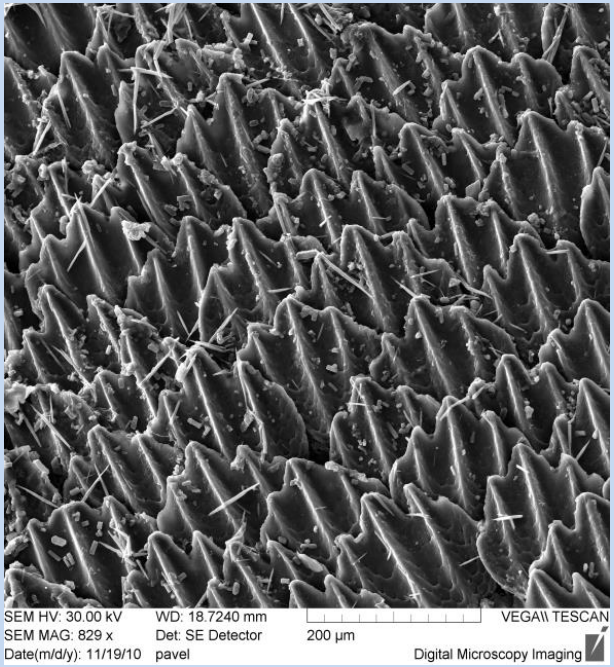


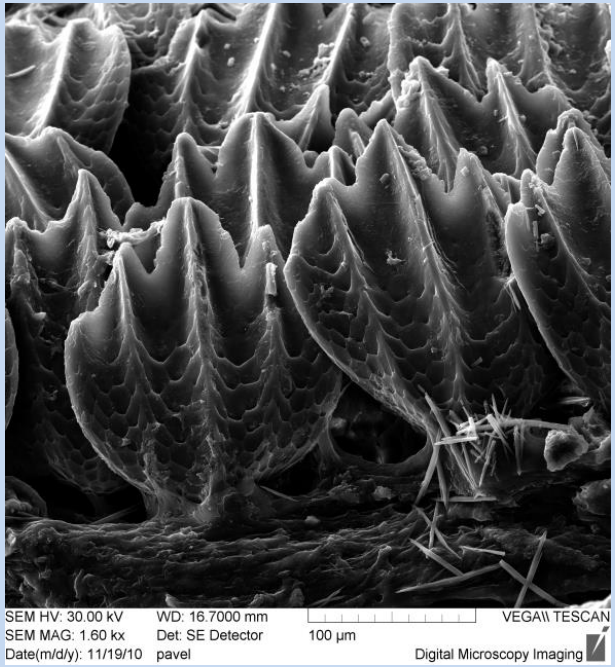


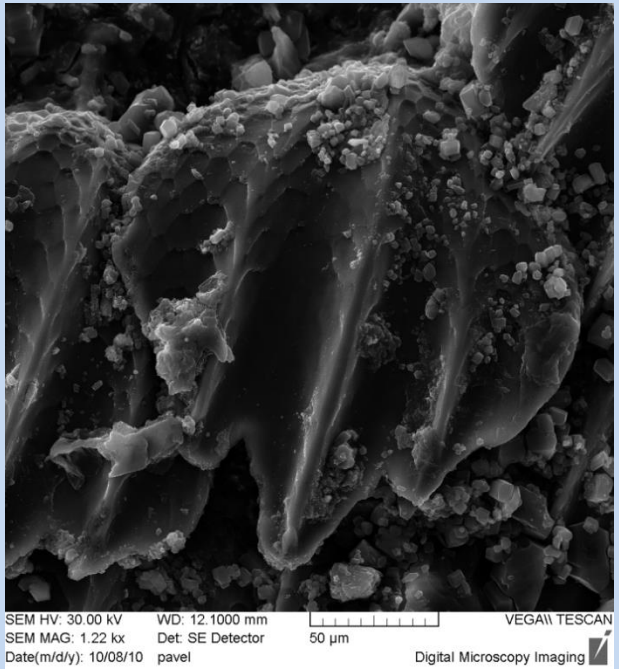
Proudění

„Neslyšní lovci“– snížení odporu proti proudění vody a struktura šupin

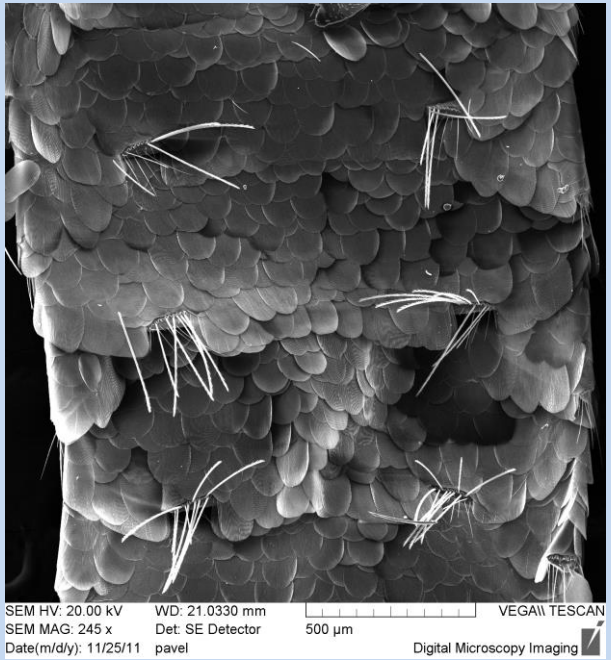


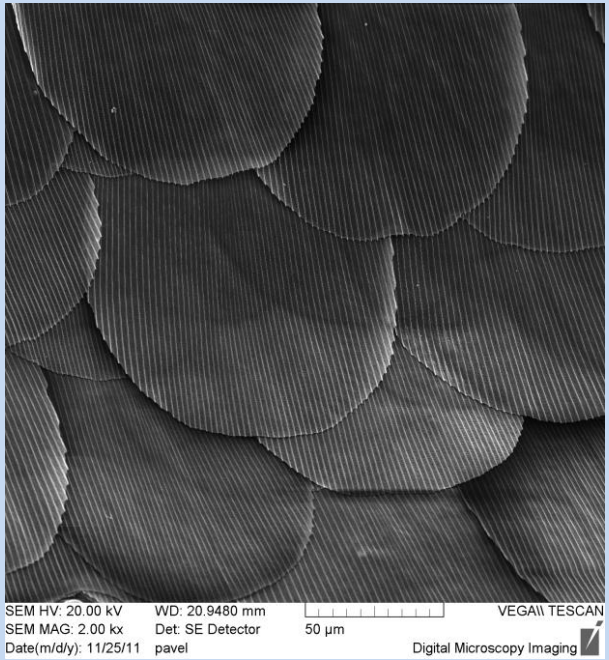


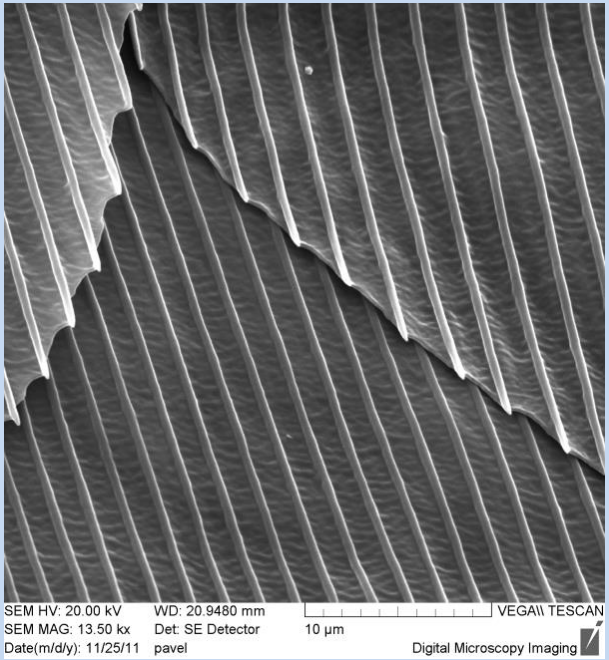




Rybenka domácí – „draci v koupelnách“

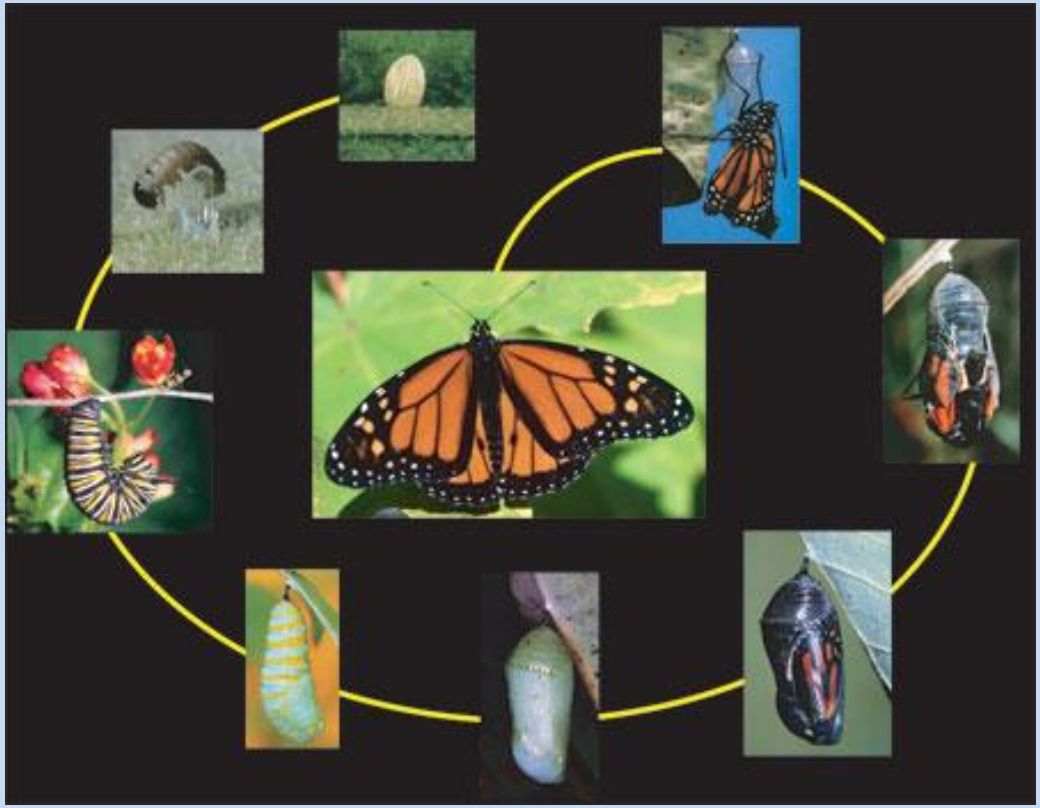


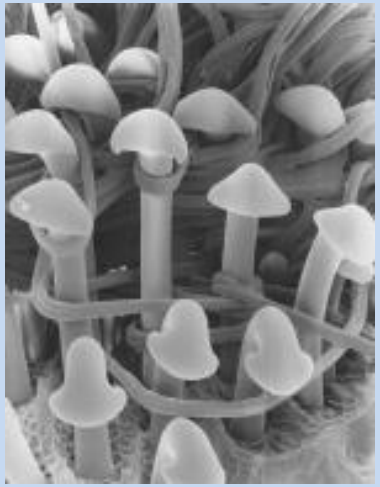


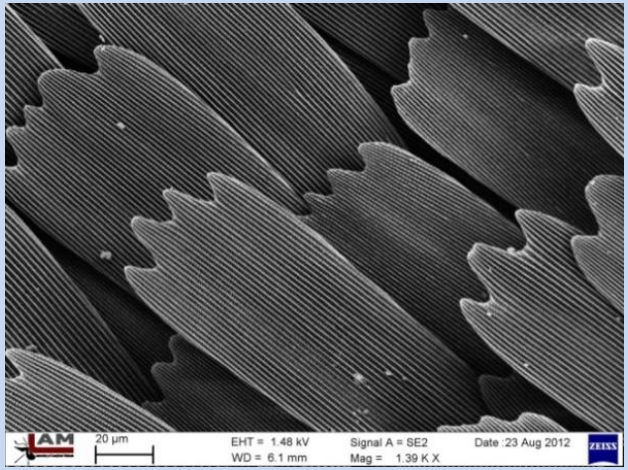


Nízko-hustotní materiály

„Zázrak“ motýlích křídel



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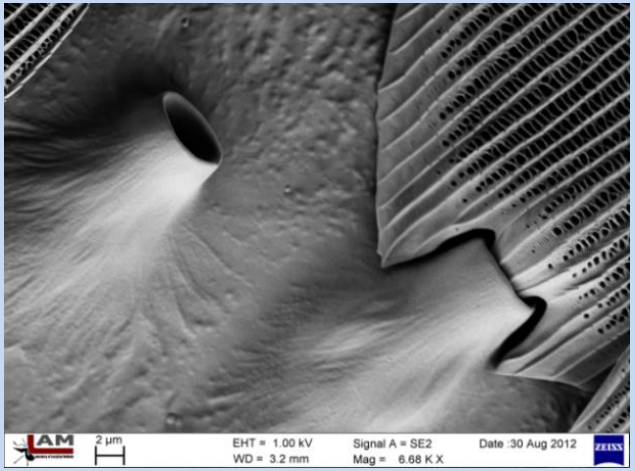
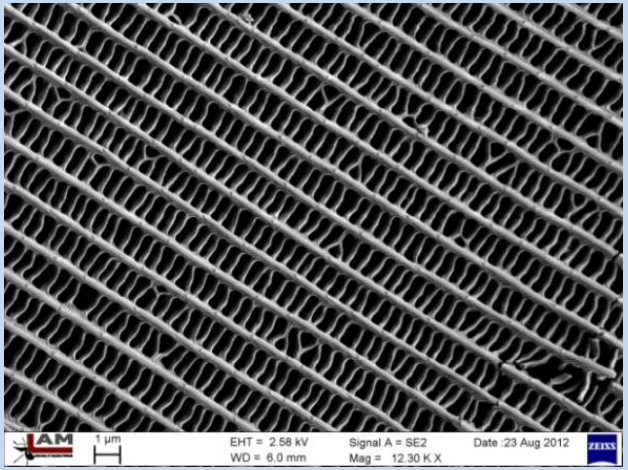
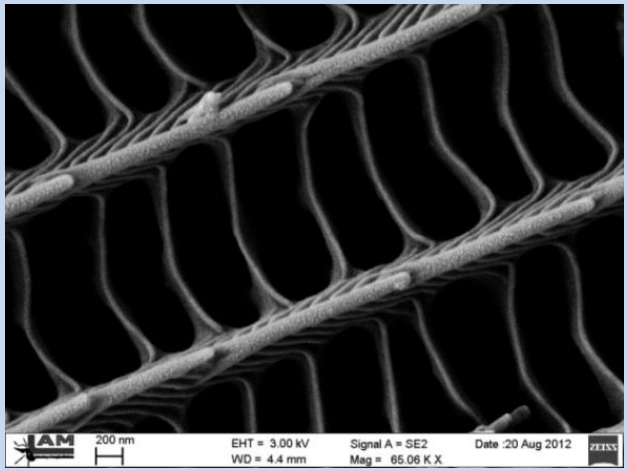
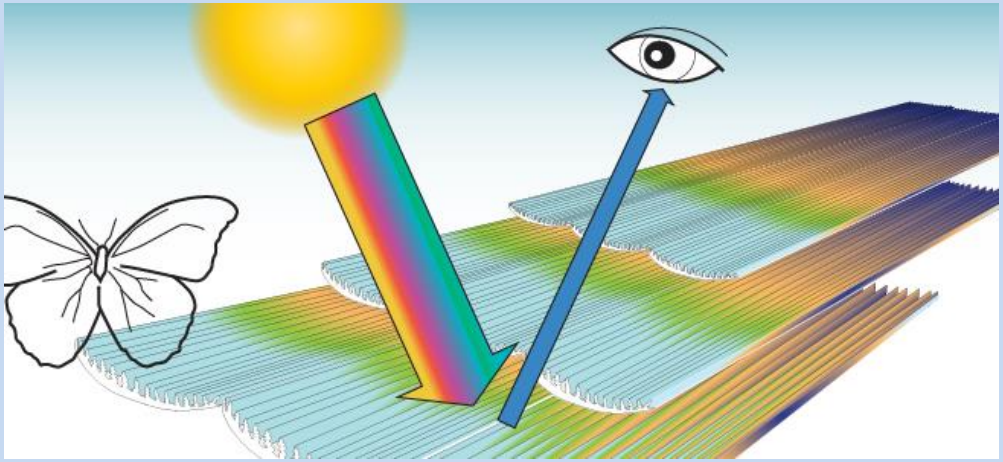
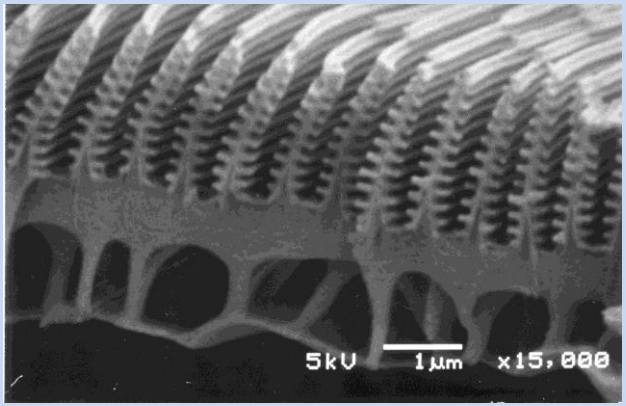
WD = 6.1 mm
Signal A = SE2
Mag = 1.39 K X
Date :23 Aug 2012
ZEISS

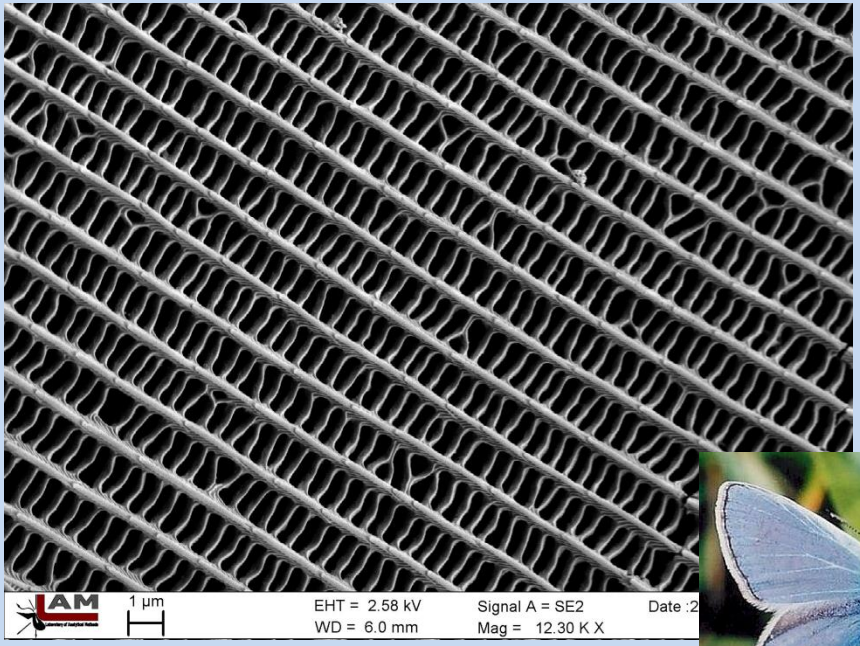

2 µm
EHT = 1.00 kV
WD = 3.2 mm
Signal A = SE2
Mag = 6.68 K X
Date :30 Aug 2012
ZEISS

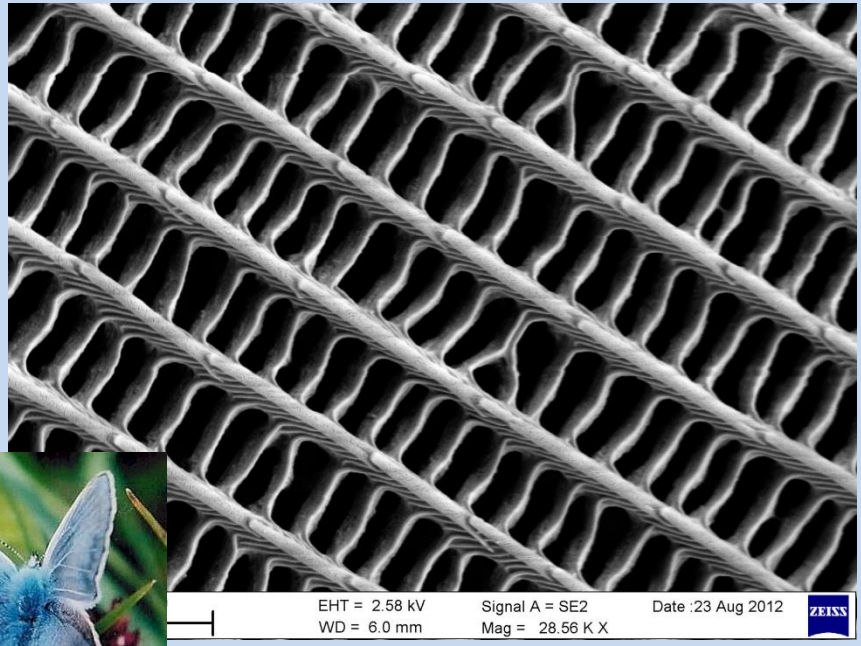

1 µm
EHT = 2.58 kV
WD = 6.0 mm
Signal A = SE2
Mag = 12.30 K X
Date :23 Aug 2012
ZEISS

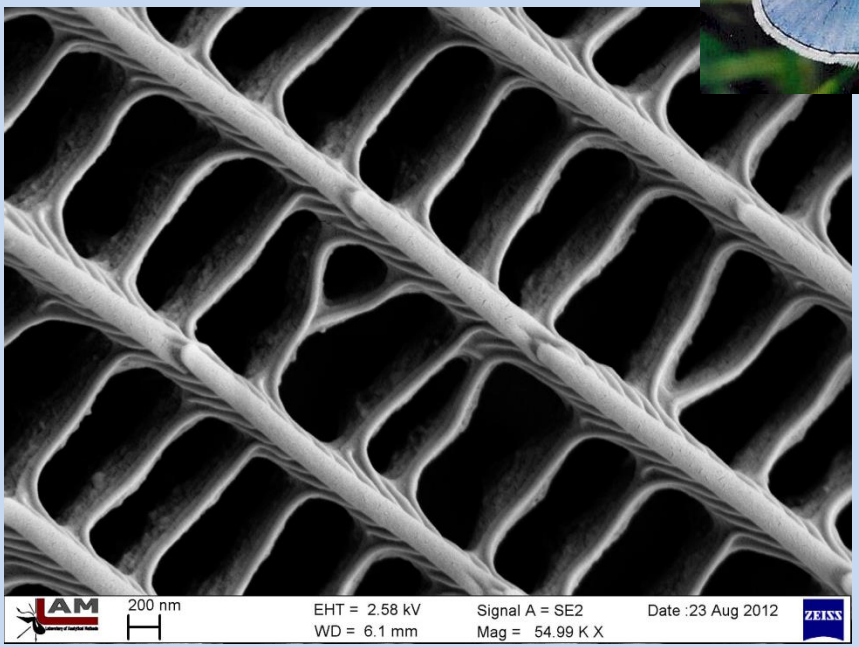

200 nm
EHT = 3.00 kV
WD = 4.4 mm
Signal A = SE2
Mag = 65.06 K X
Date :20 Aug 2012
ZEISS

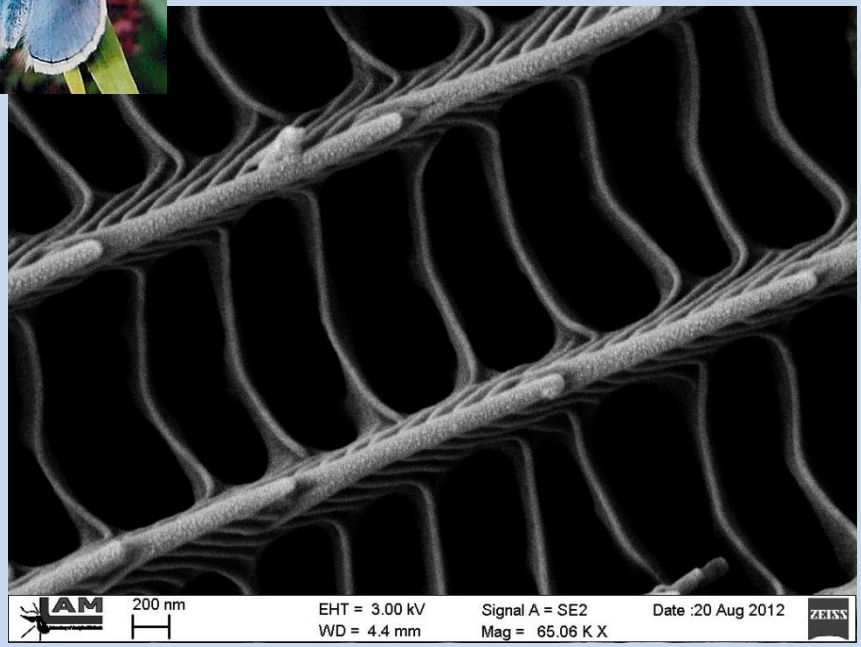



5kV 1µm x15,000


1 µm
EHT = 2.58 kV
WD = 6.0 mm
Signal A = SE2
Mag = 12.30 K X
Date :2


EHT = 2.58 kV
WD = 6.0 mm
Signal A = SE2
Mag = 28.56 K X
Date :23 Aug 2012
ZEISS

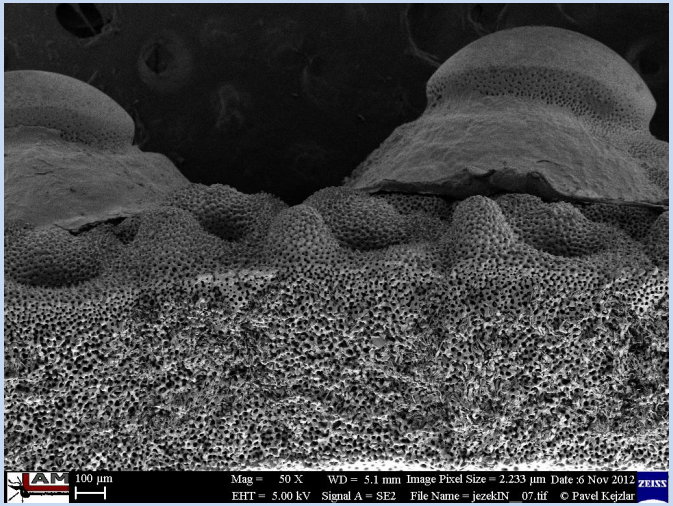

200 nm
EHT = 2.58 kV
WD = 6.1 mm
Signal A = SE2
Mag = 54.99 K X
Date :23 Aug 2012
ZEISS

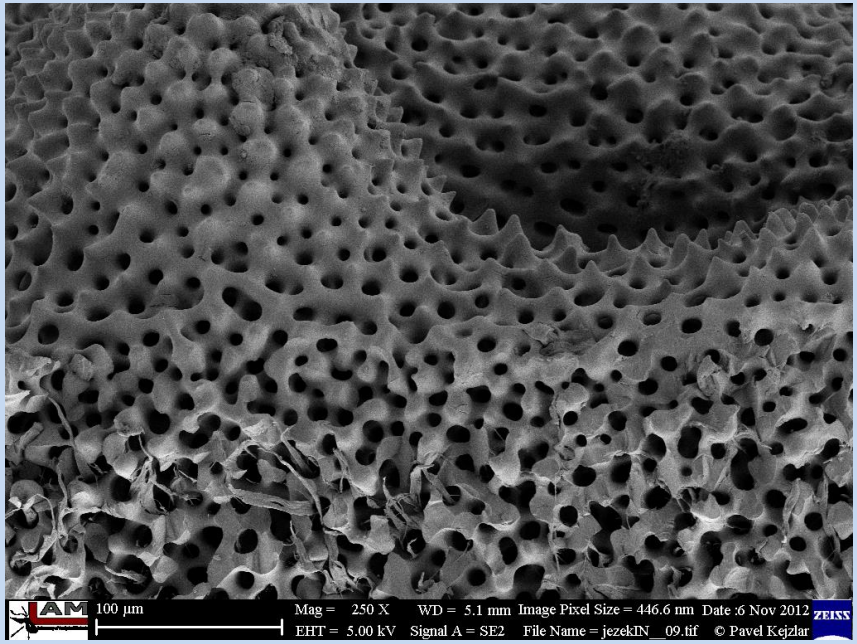

200 nm
EHT = 3.00 kV
WD = 4.4 mm
Signal A = SE2
Mag = 65.06 K X
Date :20 Aug 2012
ZEISS

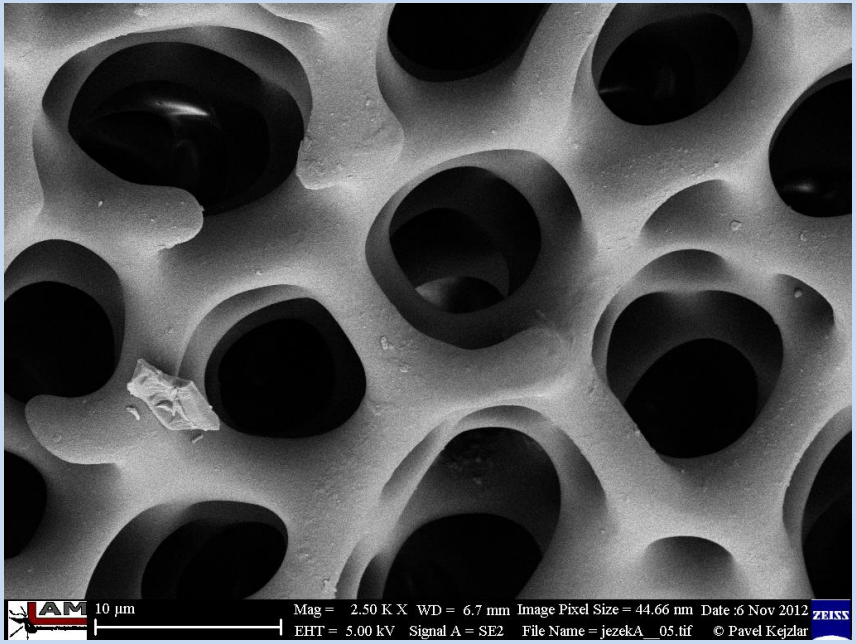
Mimikry

Porézní materiály

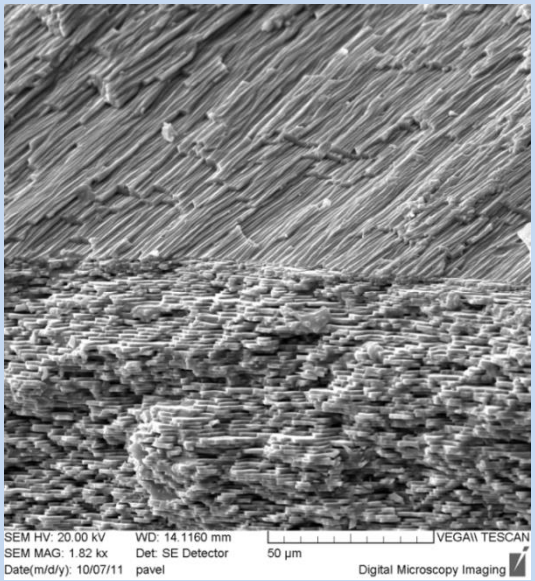
Mořský ježek - organicko-anorganické porézní systémy

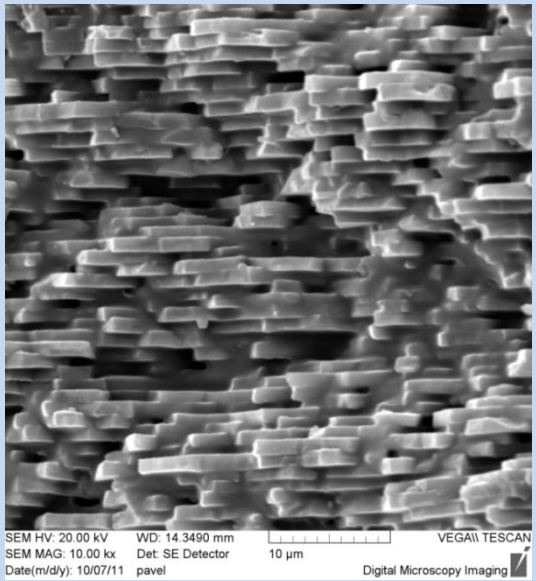


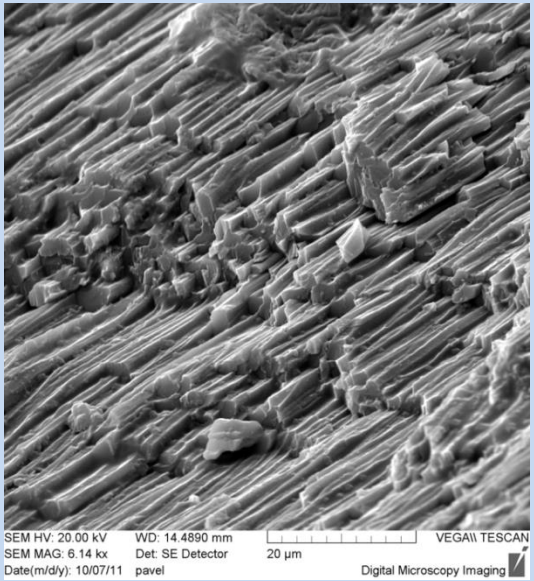


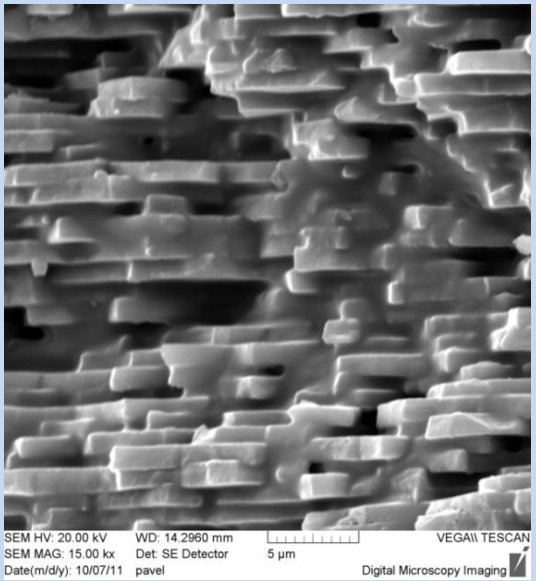


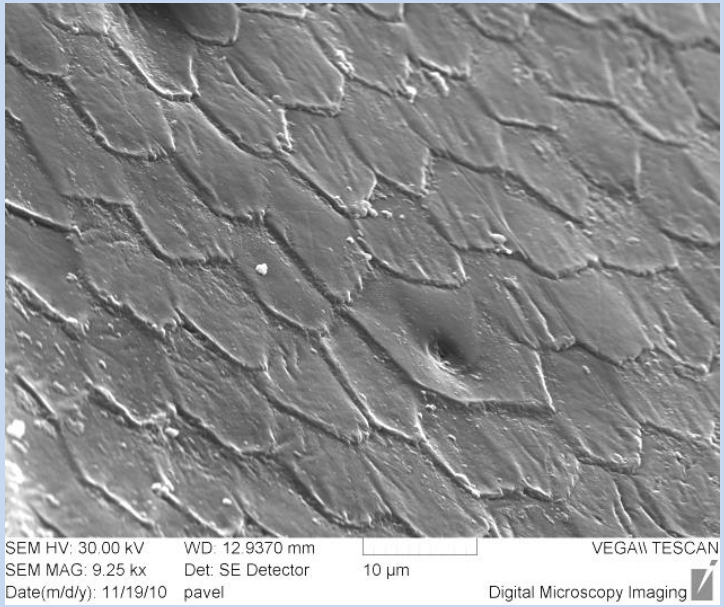
Kompozitní materiály

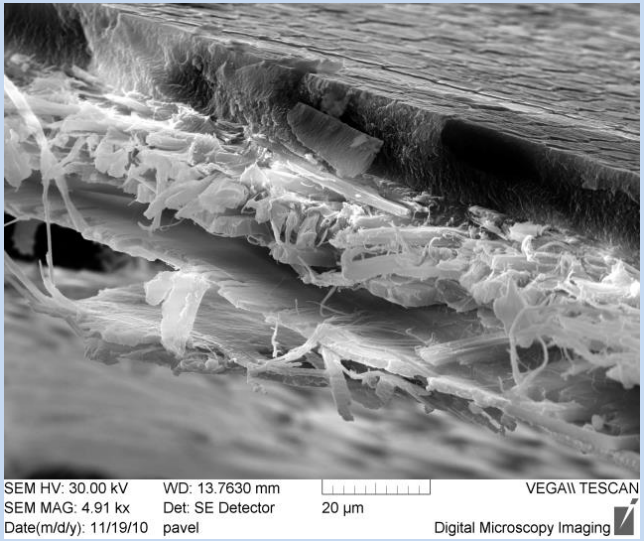


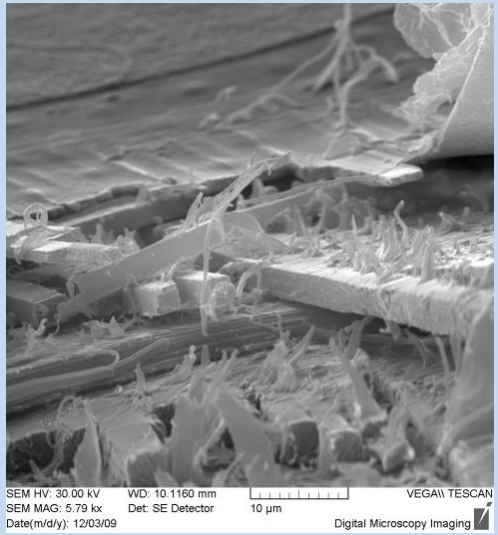


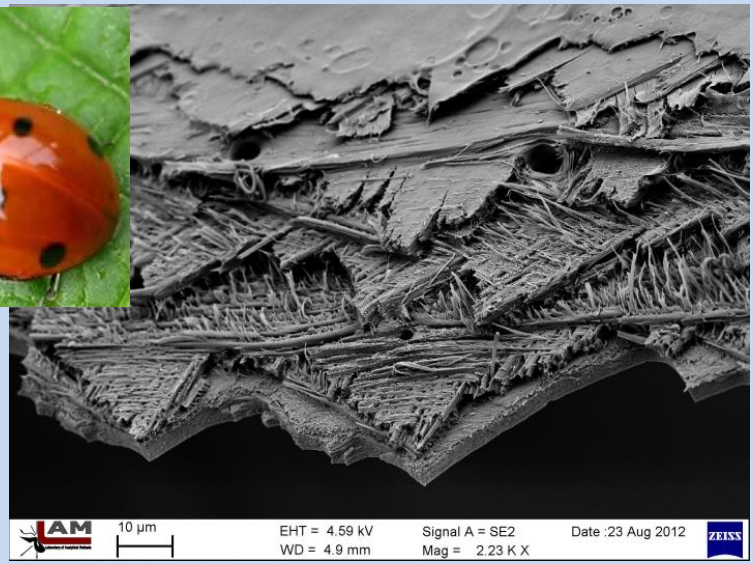


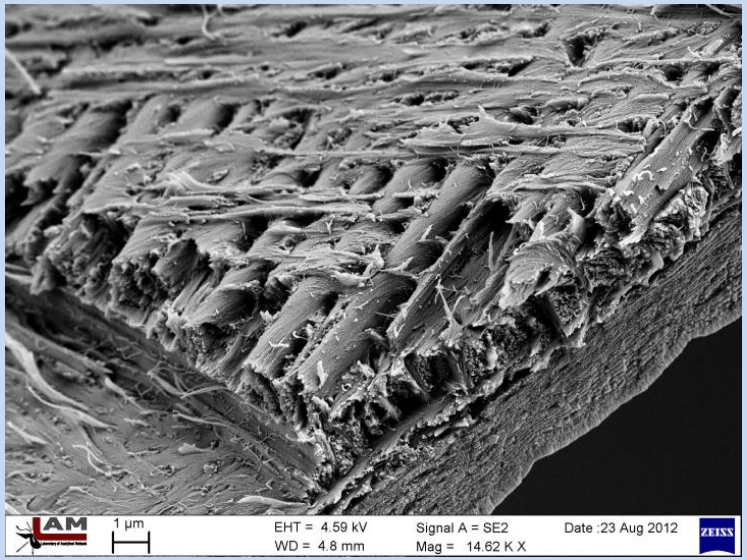


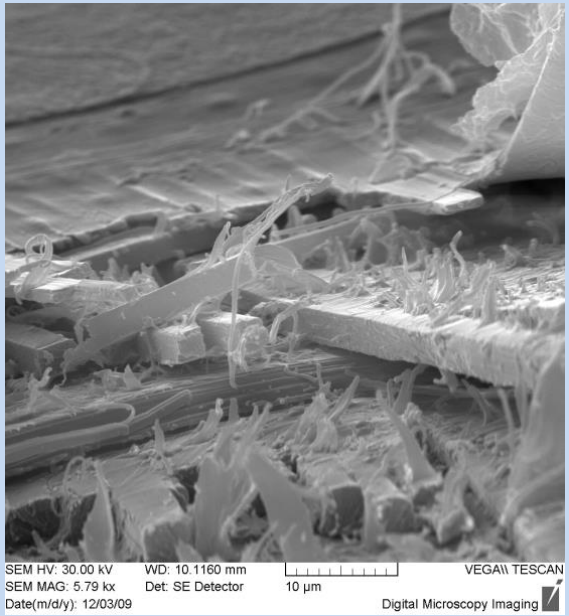

SEM HV: 30.00 kV
WD: 12.9370 mm
VEGA\\ TESCAN
SEM MAG: 9.25 kx
Det: SE Detector
10 µm
Date(m/d/y): 11/19/10
pavel
Digital Microscopy Imaging

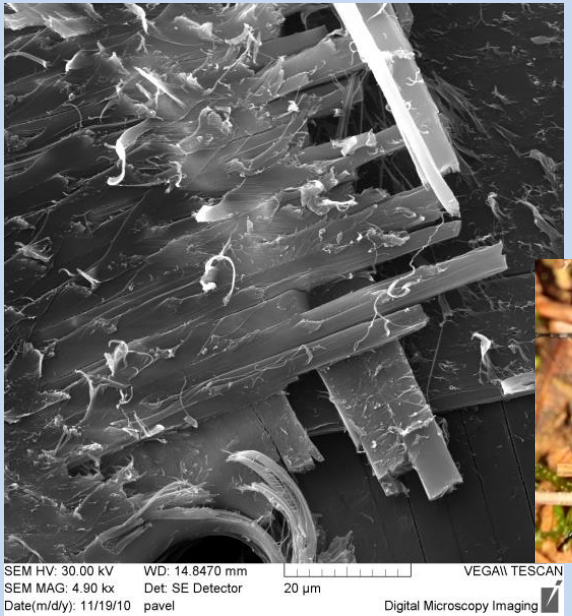

SEM HV: 30.00 kV
WD: 13.7630 mm
VEGA\\ TESCAN
SEM MAG: 4.91 kx
Det: SE Detector
20 µm
Date(m/d/y): 11/19/10
pavel
Digital Microscopy Imaging


SEM HV: 30.00 kV
WD: 10.1160 mm
VEGA\\ TESCAN
SEM MAG: 5.79 kx
Det: SE Detector
10 µm
Date(m/d/y): 12/03/09
Digital Microscopy Imaging

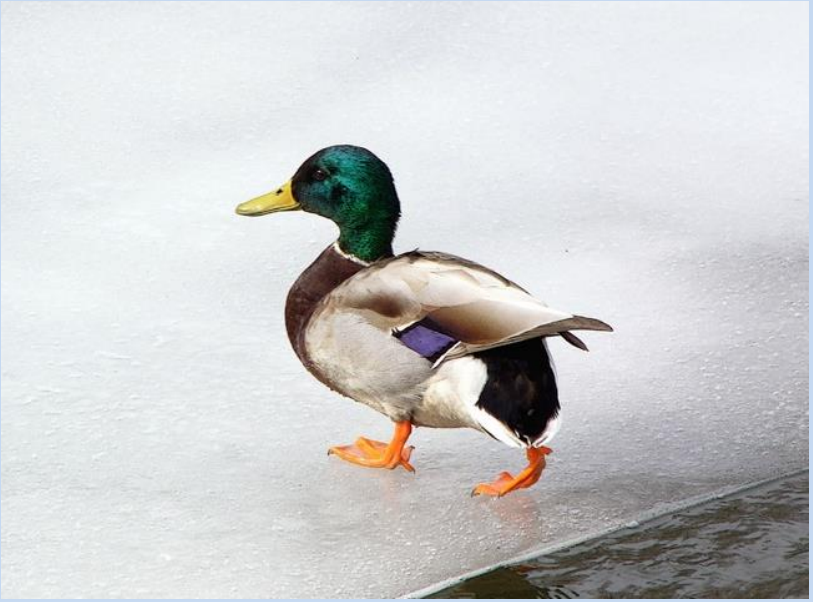

10 µm
EHT = 4.59 kV
WD = 4.9 mm
Signal A = SE2
Mag = 2.23 K X
Date :23 Aug 2012
ZEISS

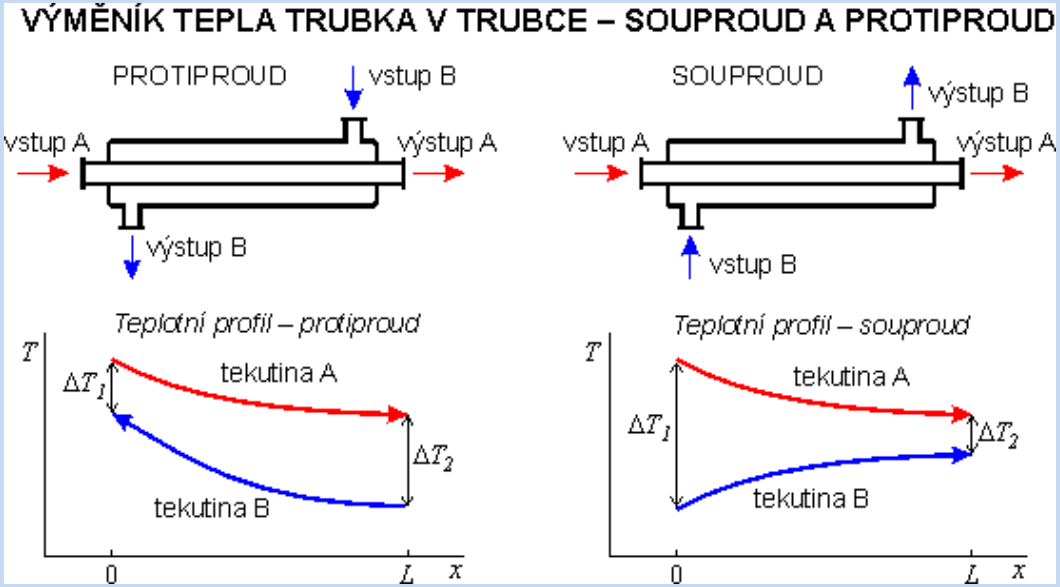

1 µm
EHT = 4.59 kV
WD = 4.8 mm
Signal A = SE2
Mag = 14.62 K X
Date :23 Aug 2012
ZEISS


SEM HV: 30.00 kV
WD: 10.1160 mm
VEGA\\ TESCAN
SEM MAG: 5.79 kx
Det: SE Detector
10 µm
Date(m/d/y): 12/03/09
Digital Microscopy Imaging

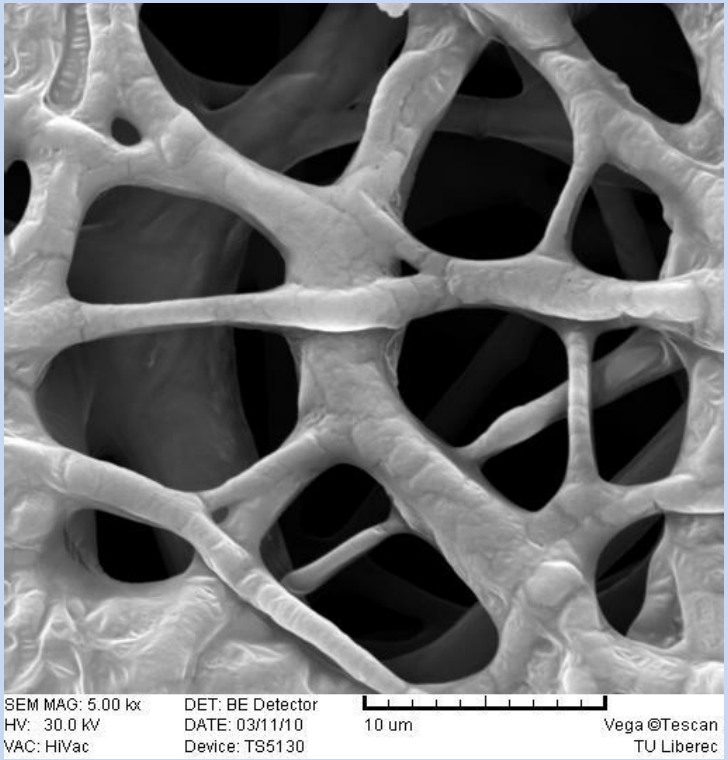

SEM HV: 30.00 kV
WD: 14.8470 mm
VEGA\\ TESCAN
SEM MAG: 4.90 kx
Det: SE Detector
20 µm
Date(m/d/y): 11/19/10
pavel
Digital Microscopy Imaging

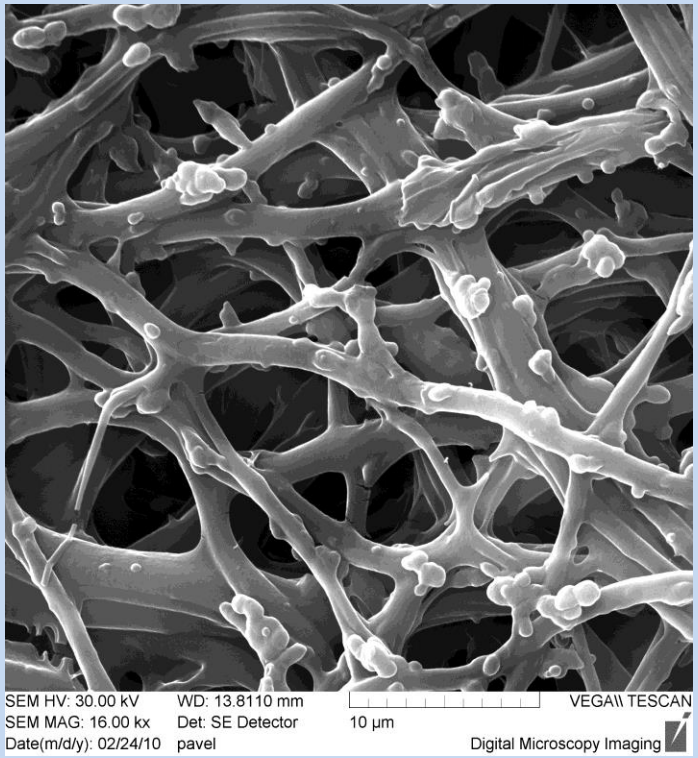
Vedení tepla

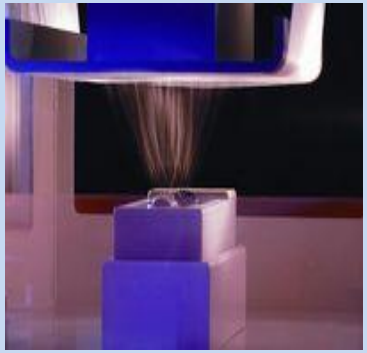




?

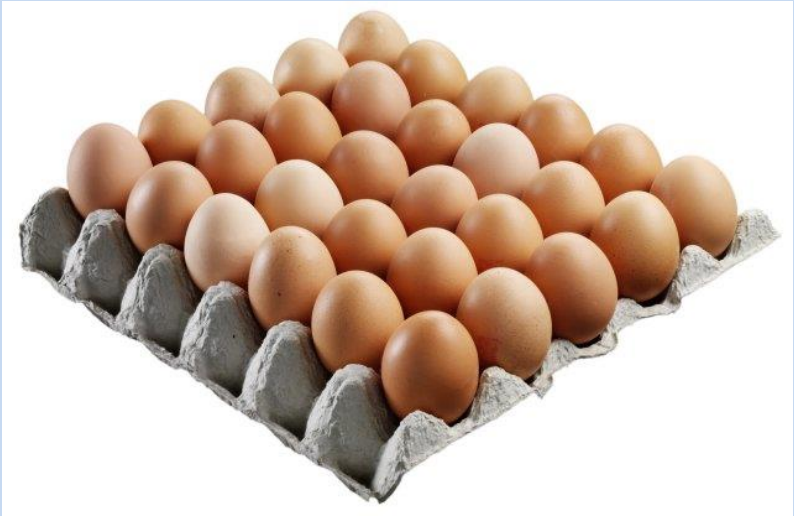

SEM MAG: 5.00 kx
HV: 30.0 kV
VAC: HiVac
DET: BE Detector
DATE: 03/11/10
Device: TS5130
10 um
Vega ©Tescan
TU Liberec

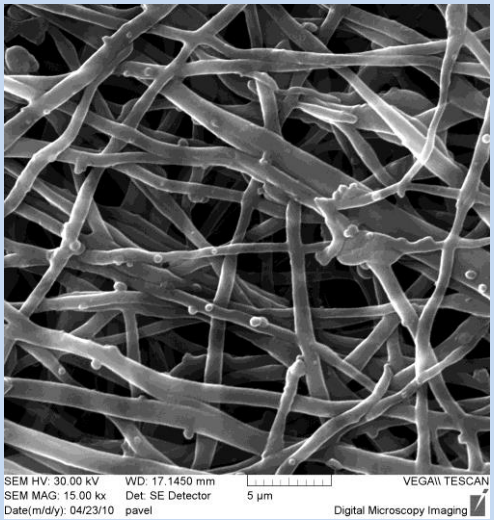

SEM HV: 30.00 kV
SEM MAG: 16.00 kx
Date(m/d/y): 02/24/10
WD: 13.8110 mm
Det: SE Detector
pavel
10 µm
VEGA\\ TESCAN
Digital Microscopy Imaging

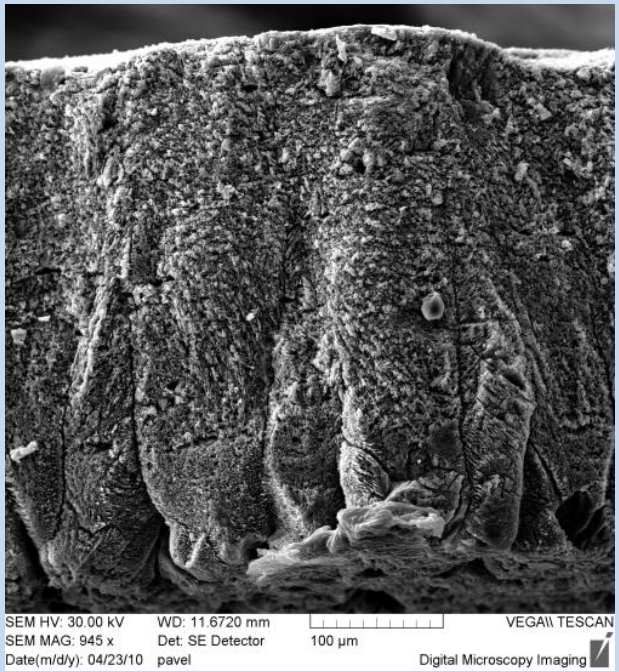


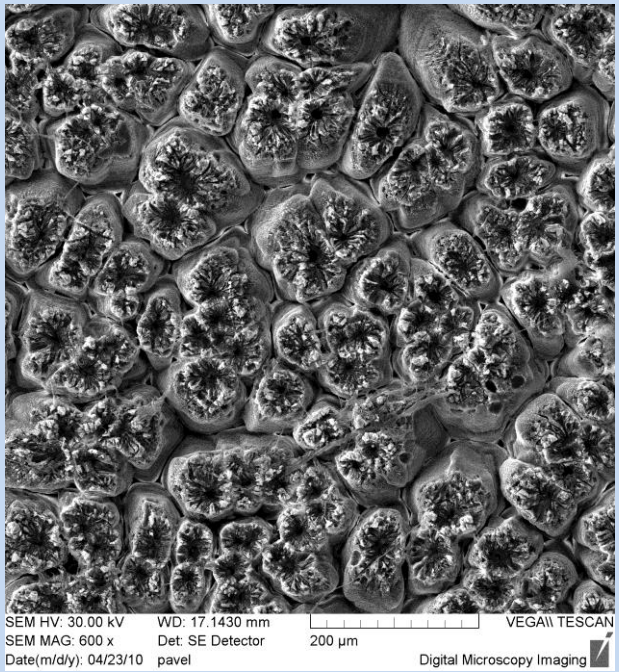
Obalové materiály

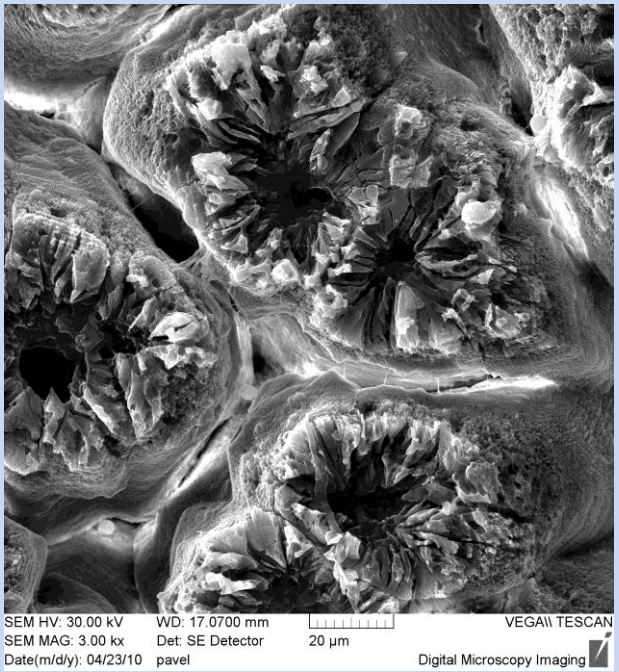
Vaječná skořápka – dokonalý obalový materiál



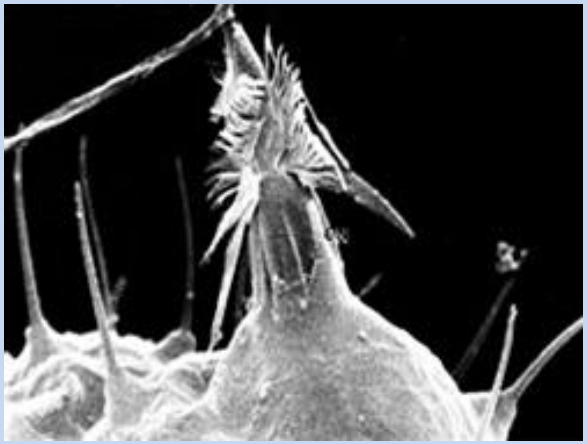




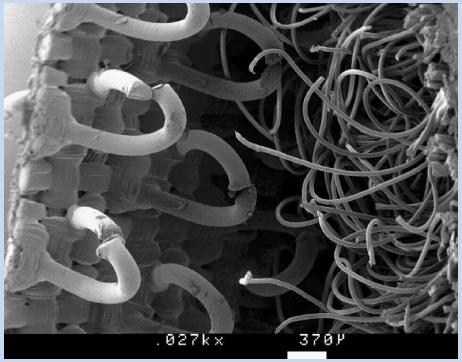


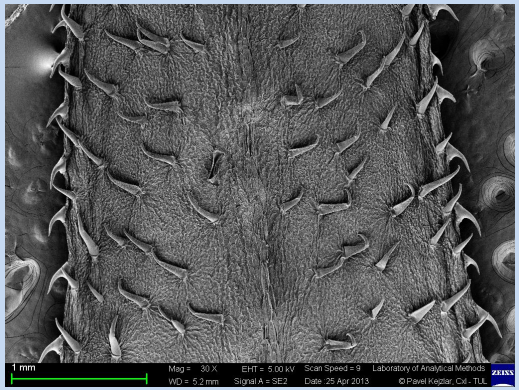


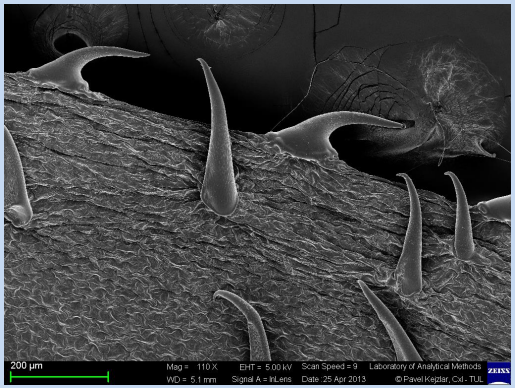
Nástroje

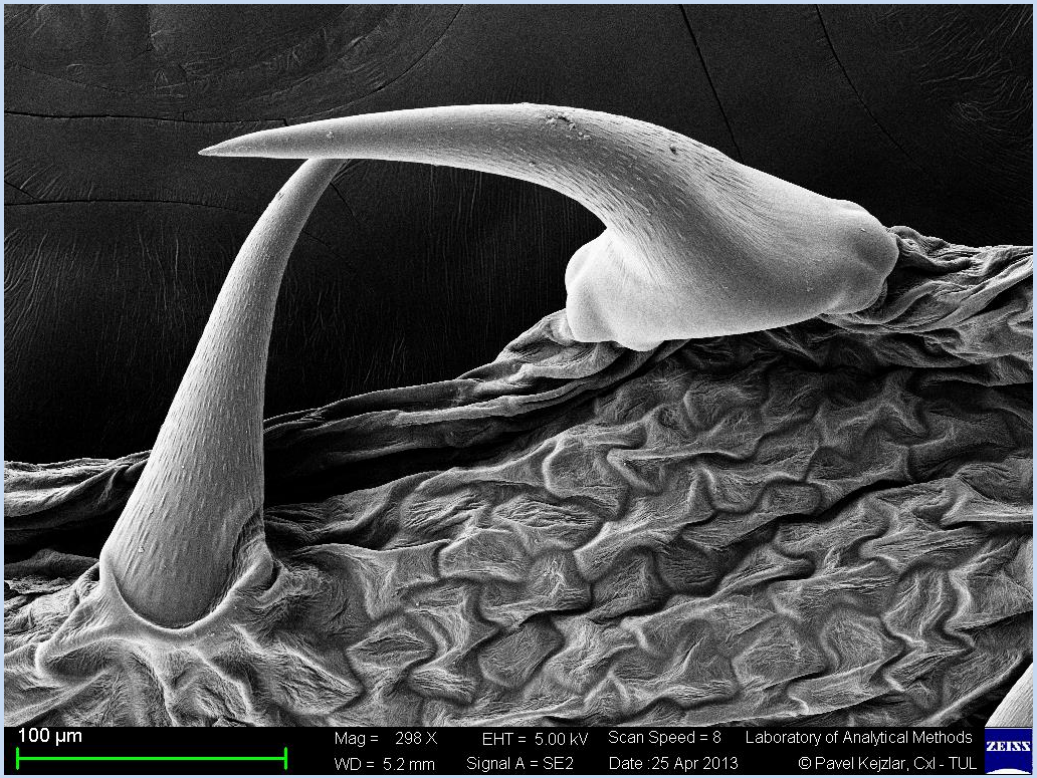


Přírodní nástroje jako inspirace









Děkuji za pozornost.

Poděkování za snímky z elektronového mikroskopu náleží
Ing. Pavlu Kejzlarovi.