

# INSECTES ORDINAIRES

## PROPRIÉTÉS EXTRAORDINAIRES



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*23 octobre 2018*

# BIOMIMICRY IN KEYWORDS

- interdisciplinarity *Distance*
    - one « biologist », one « engineer »
  - learning phase *Time*
    - reciprocal questioning & challenging (50%)
  - biological model (a species)
    - research object(s) *Project*
- Informed surface   Drilling engine   Biosyringe*



*Stomaphis quercus*



*Aphis nerii* © INRA, Bernard Chaubet



*Tuberculachnus salignus*



Paul Starosta



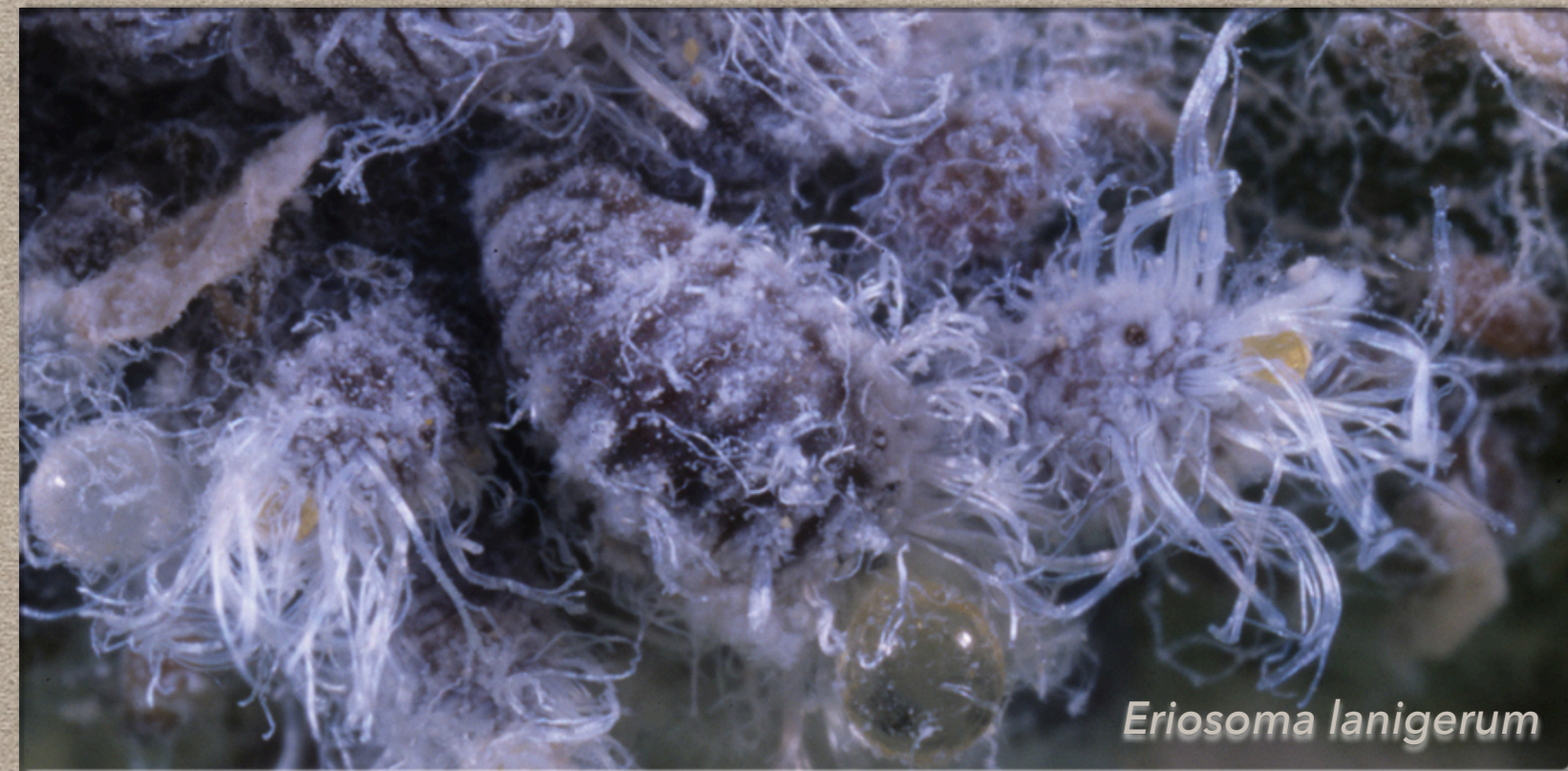
*Daktulosphaira vitifoliae*



© Influential points



*Baizongia pistaceae*



*Eriosoma lanigerum*



© Influential points



*Acyrthosiphon pisum* © INRA, Bernard Chaubet

# PARTHENOGENESIS



*Acyrthosiphon pisum* © INRA, Bernard Chaubet

# PARTHENOGENESIS

## VECTOR



*Acyrthosiphon pisum* © INRA, Bernard Chaubet

**PARTHENOGENESIS**

**VECTOR**

**PHLOEM-FEEDER**



*Acyrthosiphon pisum* © INRA, Bernard Chaubet

**PARTHENOGENESIS**

**VECTOR**

**PHLOEM-FEEDER**

**PLASTIC**



*Acyrthosiphon pisum* © INRA, Bernard Chaubet



**PARTHENOGENESIS**

**VECTOR**

**PHLOEM-FEEDER**

**PLASTIC**

**TROPHIC POSITION**



*Acyrtosiphon pisum* © INRA, Bernard Chaubet

**PARTHENOGENESIS**

**VECTOR**

**PHLOEM-FEEDER**

**PLASTIC**

**TROPHIC POSITION**

**THANATOSIS**

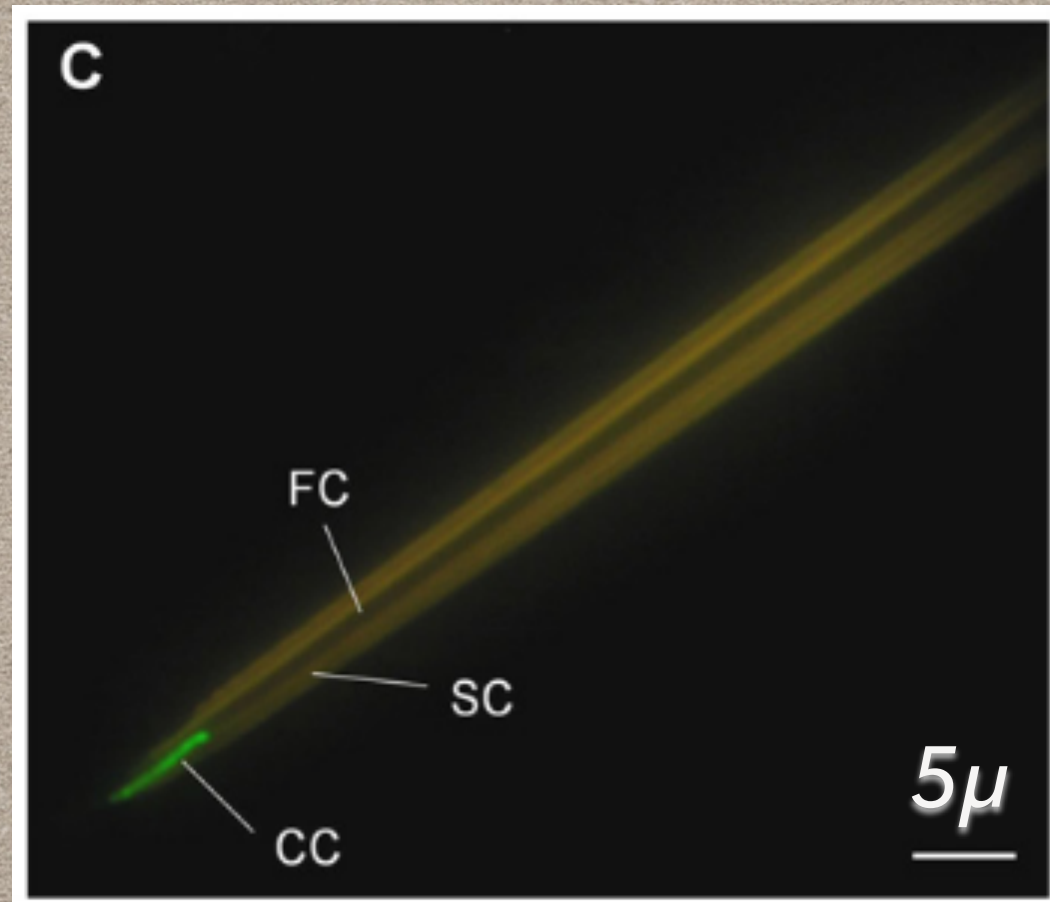


*Acyrthosiphon pisum* © INRA, Bernard Chaubet

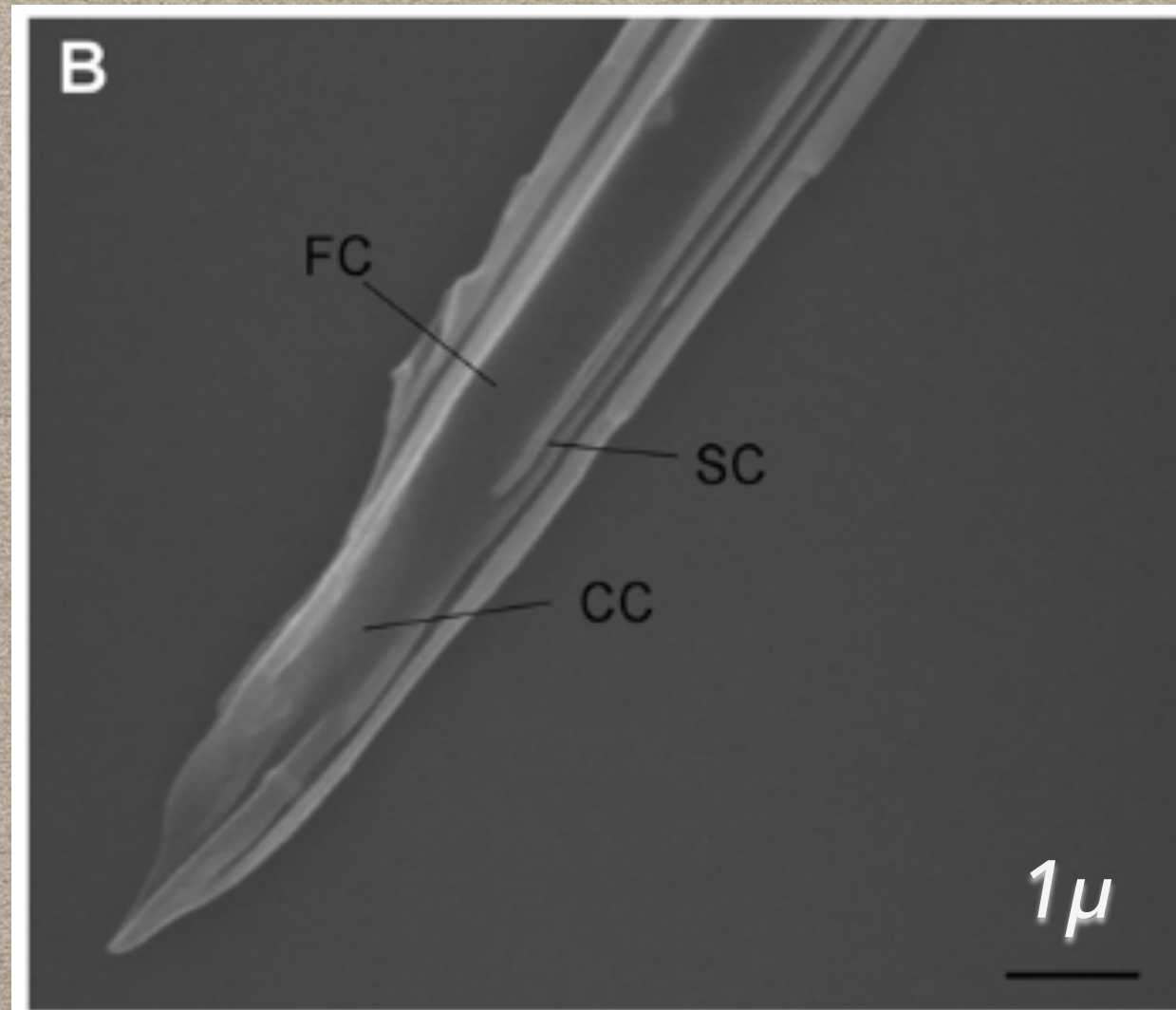
**VECTOR**

# VECTOR

## PLANT HEALTH



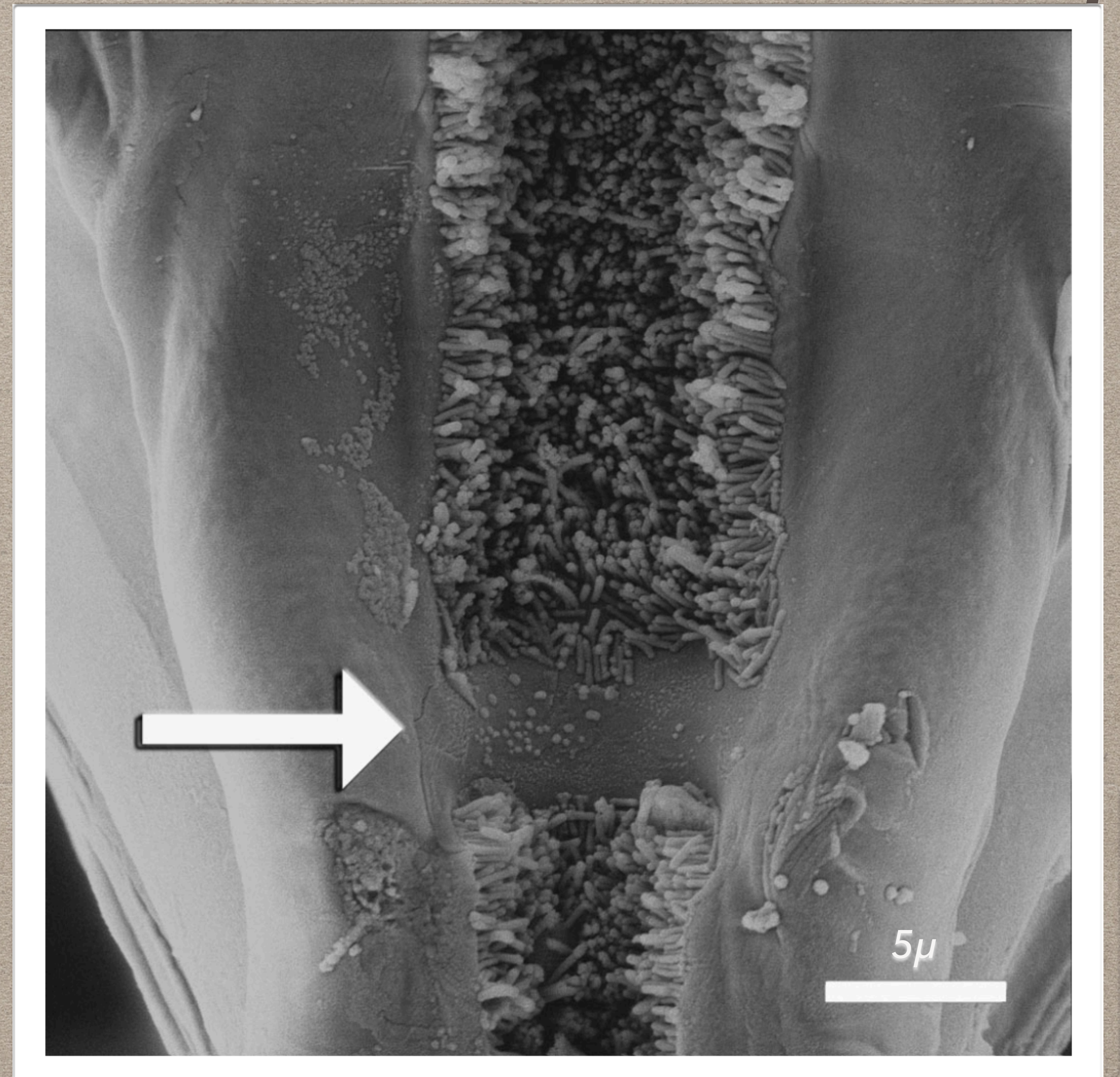
*aphid / virus*



*CaMV - cauliflower mosaic*

*sharpshooter / bacteria*

1



*Xylella fastidiosa - Pierce disease*

# VECTOR

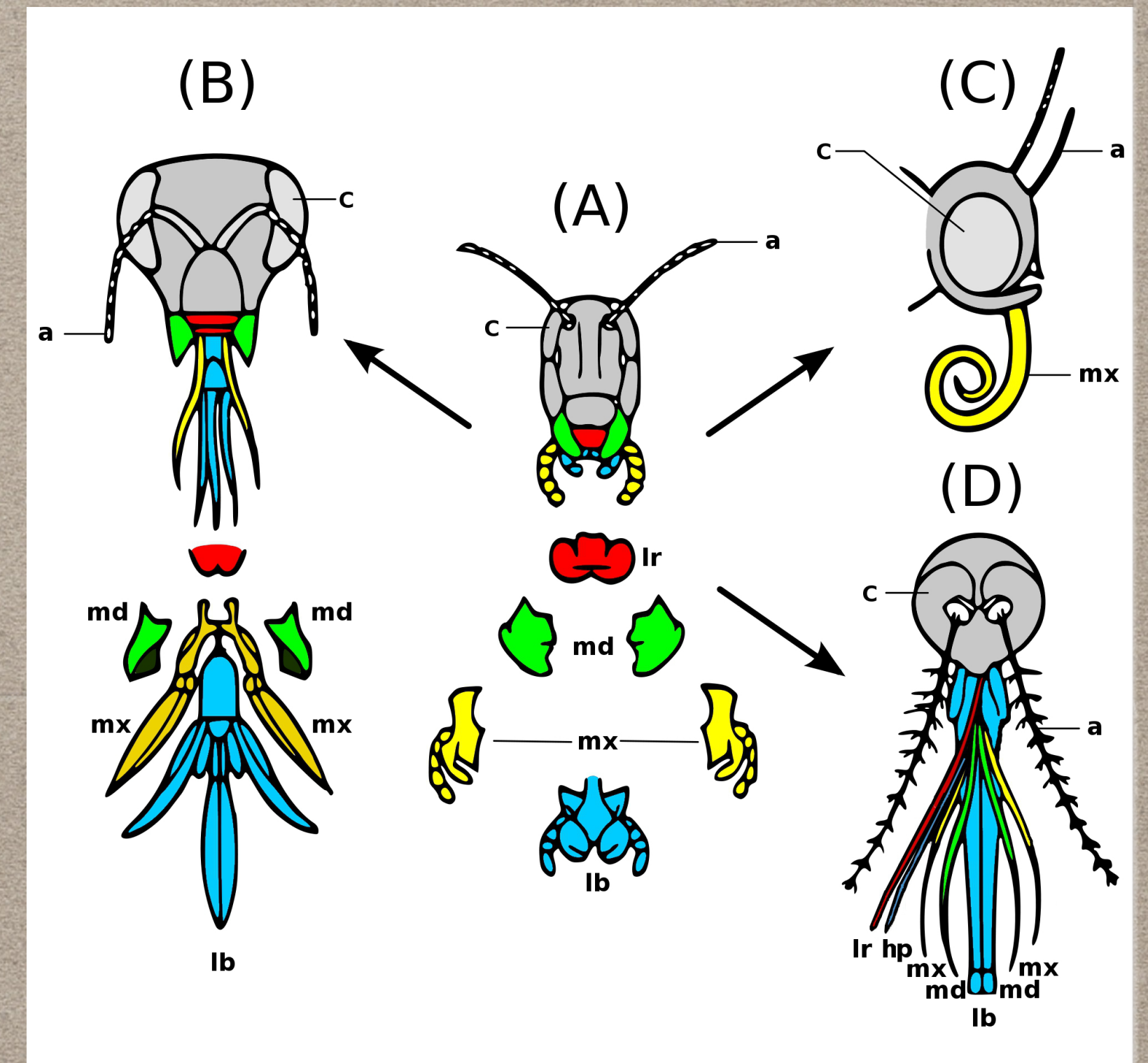
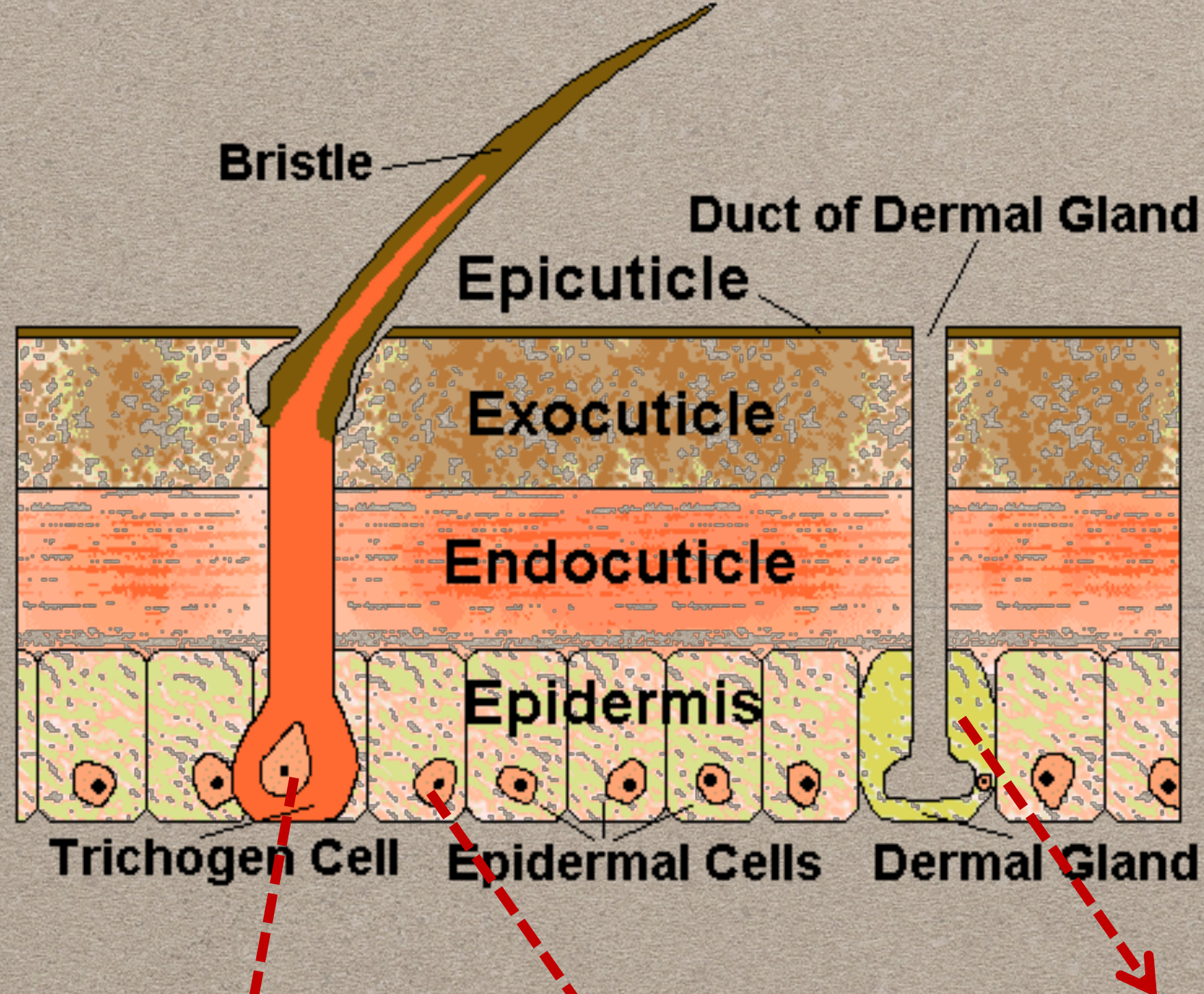
## INSECT CUTICLE

*Standard epidermal cuticle*

*Specialized mouthpart cuticle*

increased anatomical / morphological specialization

### The Insect Integument



secretory gland

accessory gland

# VECTOR

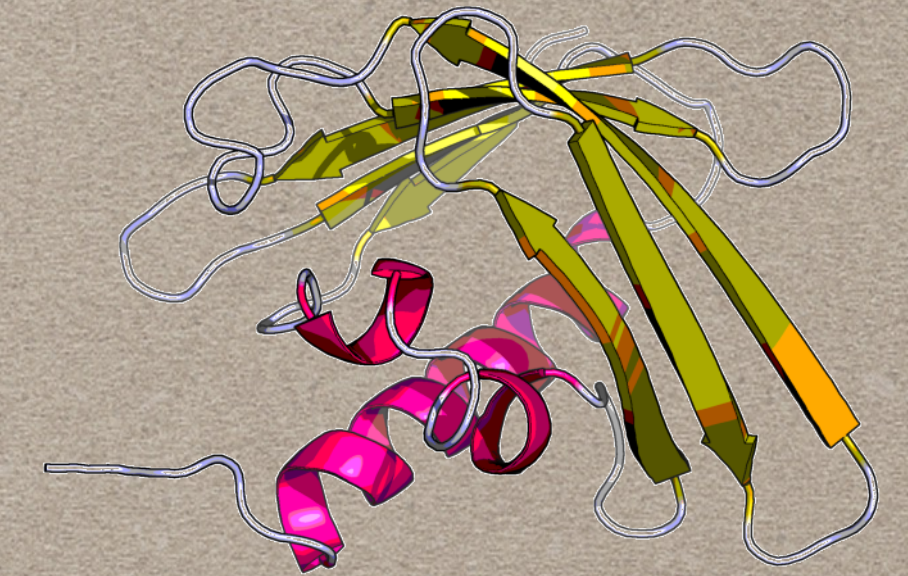
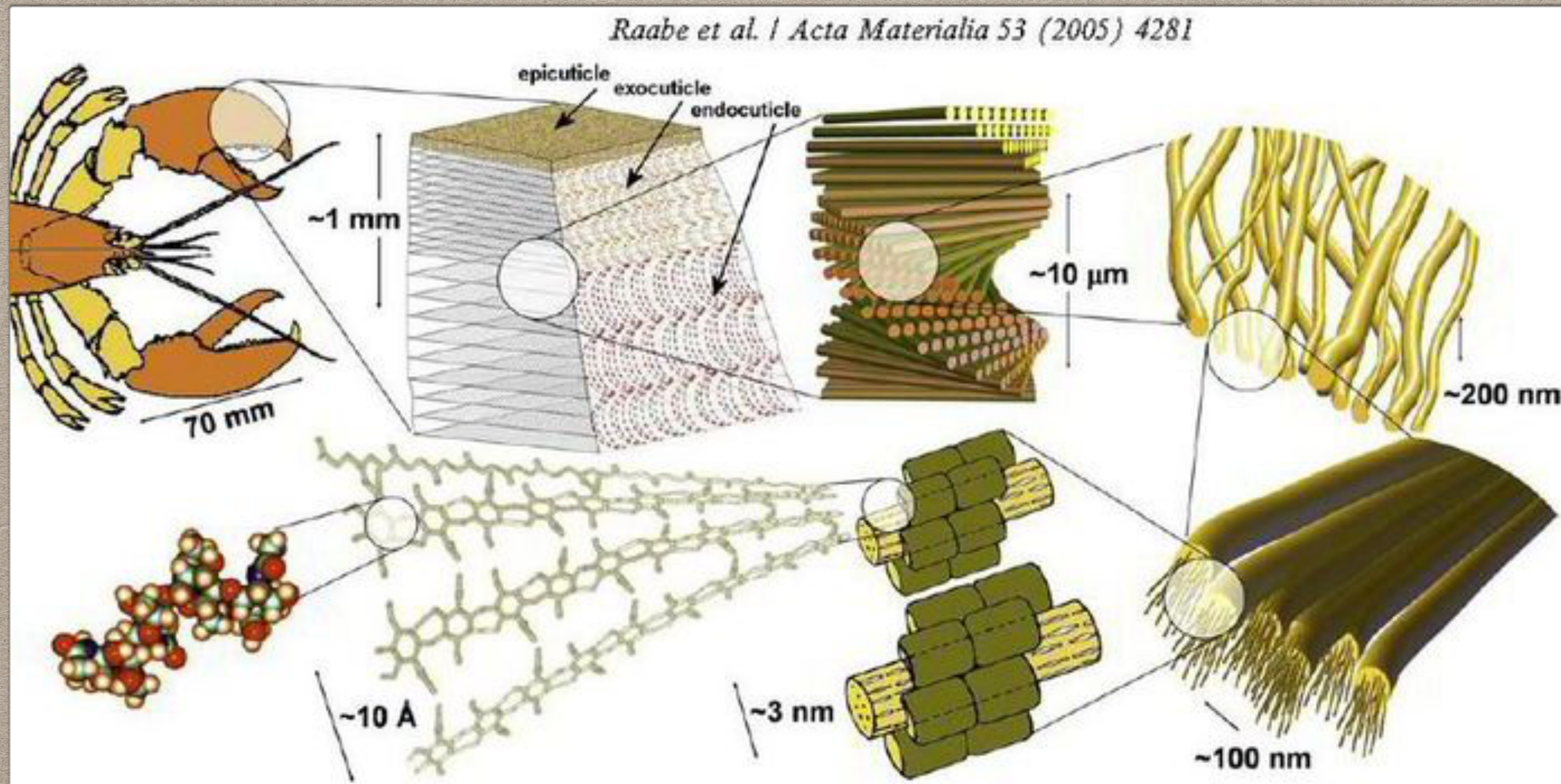
3

« tanning » / « covalent »

POLYMER ALLOY

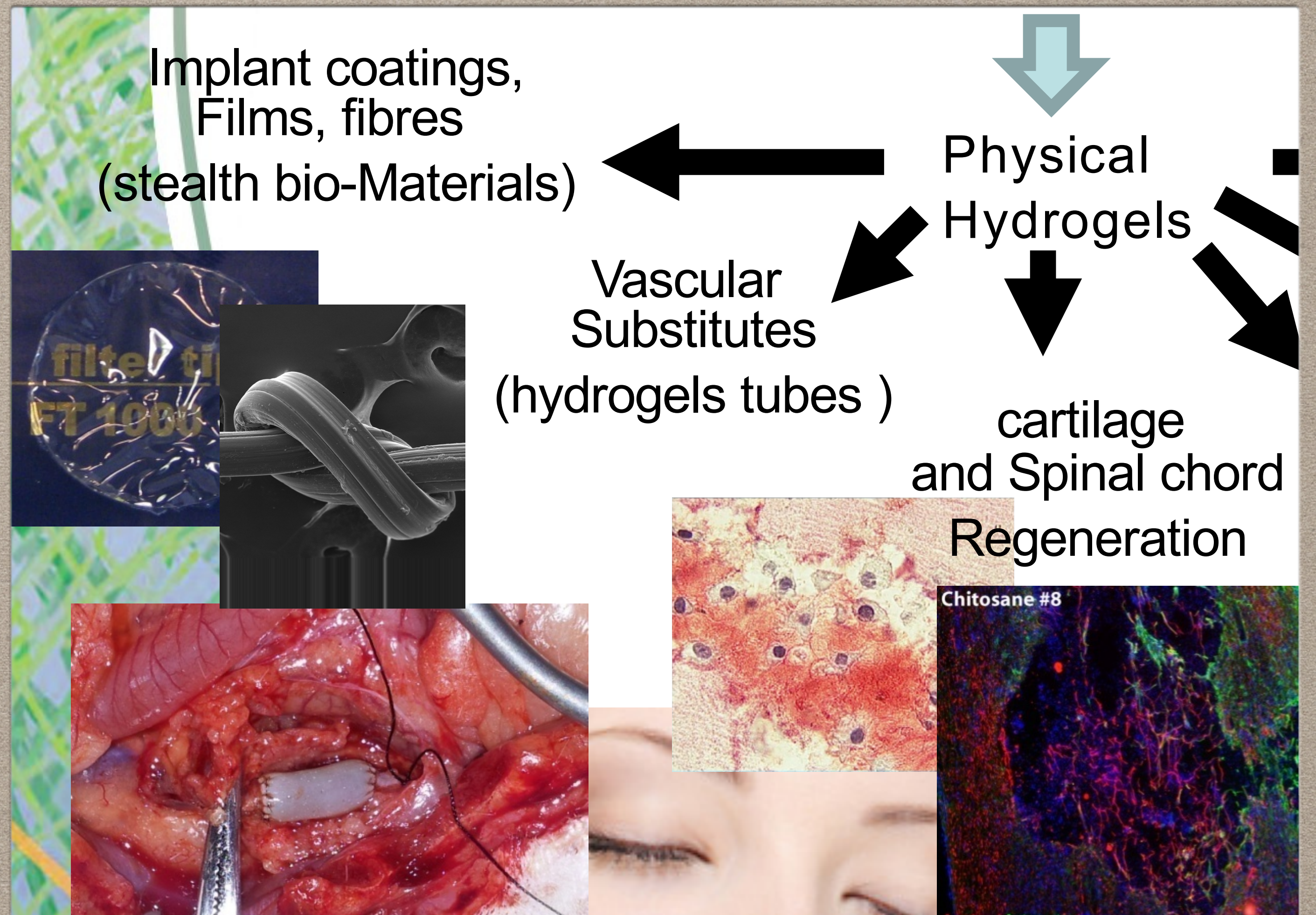
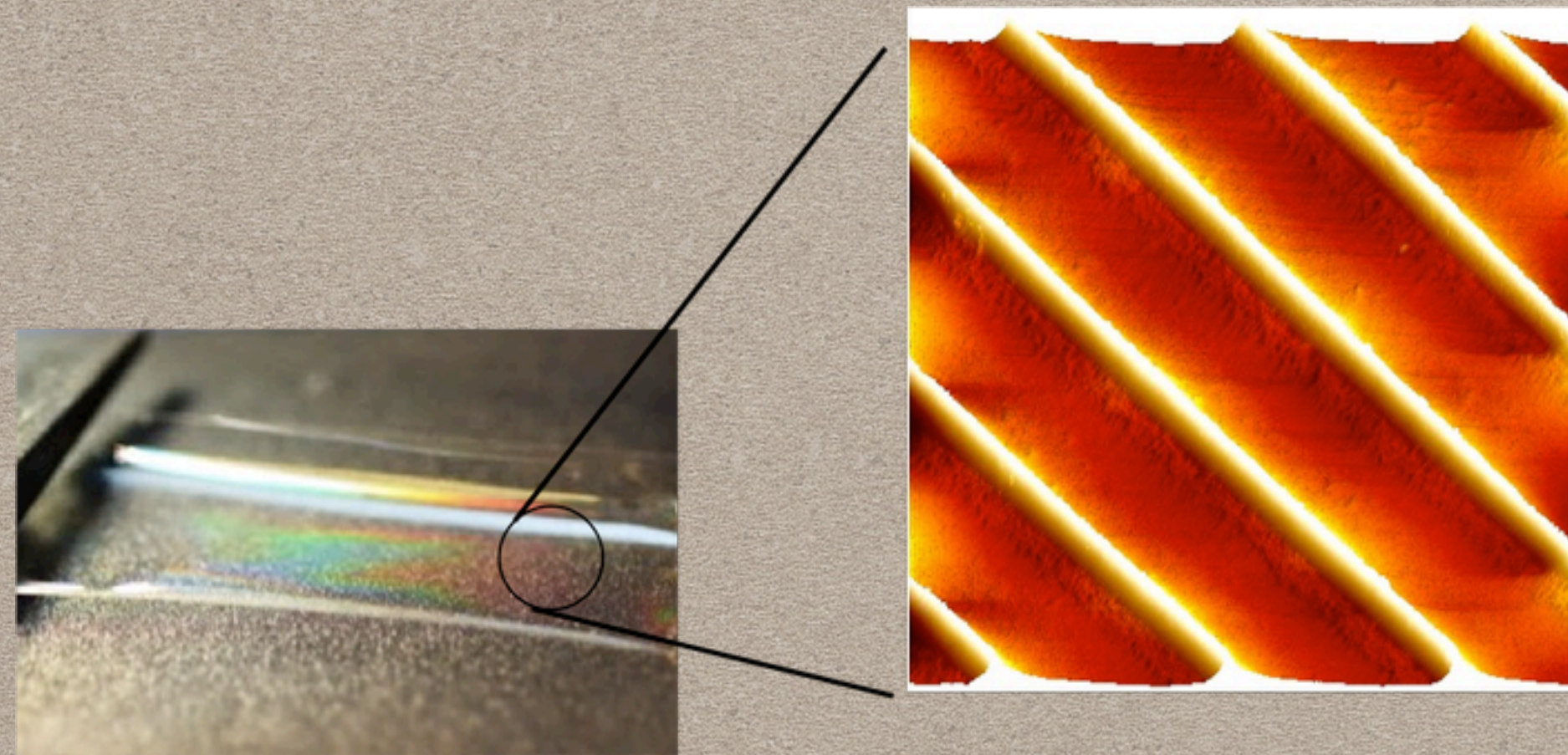
*Chitin + Proteins + Lipids + (aromatic sclerotization)*

*Raabe et al. / Acta Materialia 53 (2005) 4281*



# VECTOR

## BIOMIMICRY: ARTIFICIAL CUTICLES



*Add (cuticular) proteins  
To add Surface  
or Core  
Information*

**PHLOEM-FEEDER**



# PHLOEM-FEEDER

## PIERCING-SUCKING MOUTHPARTS

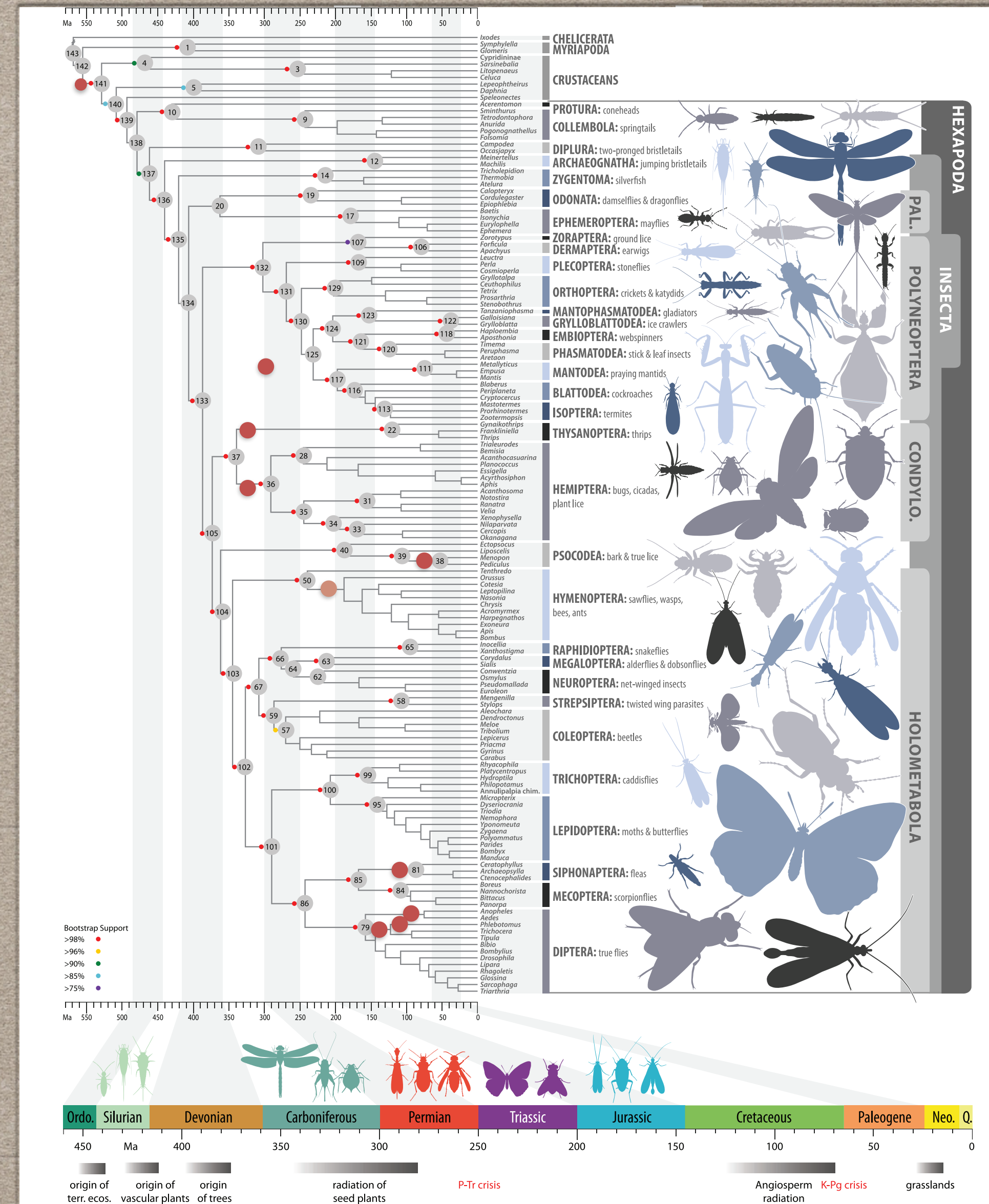
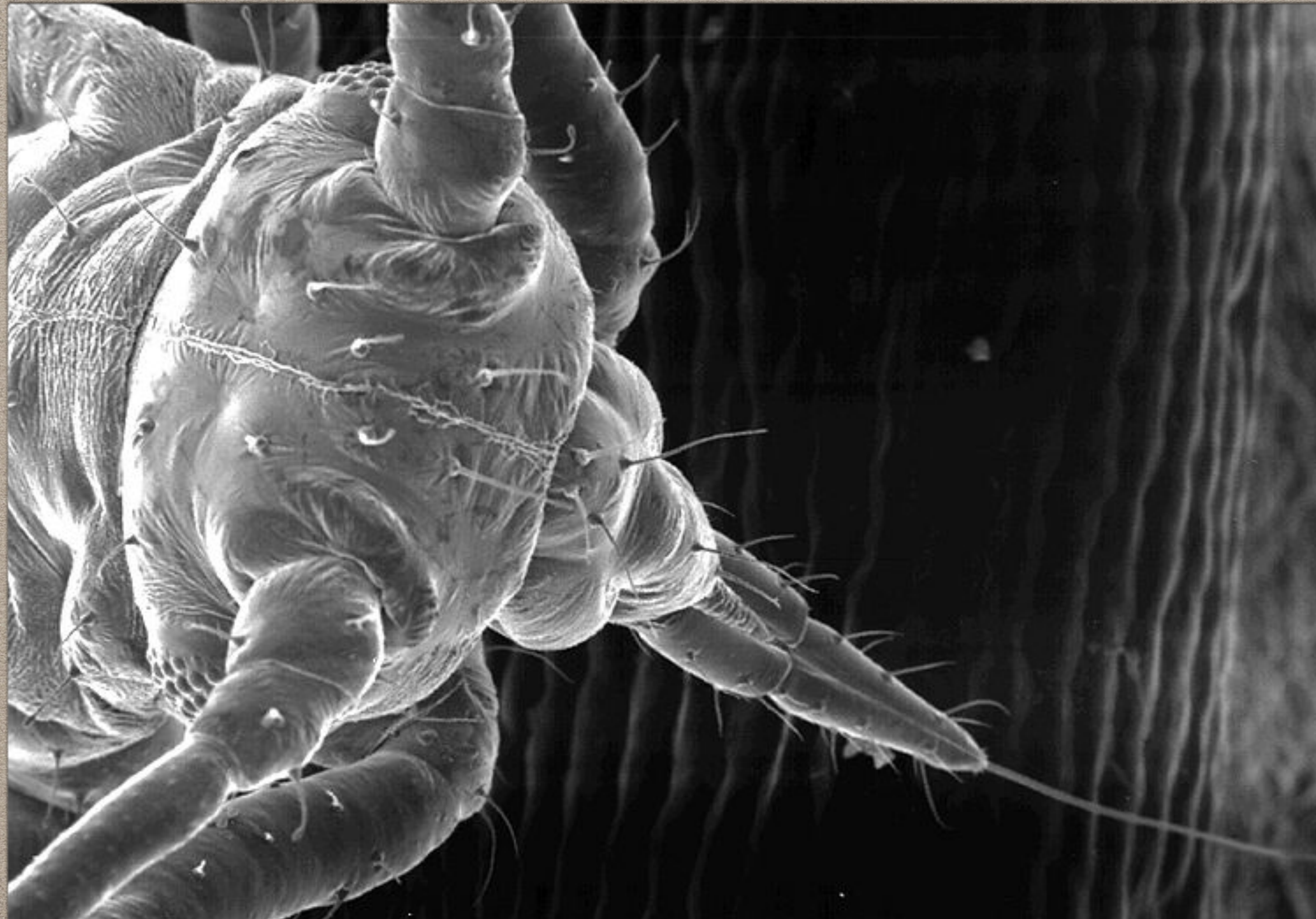
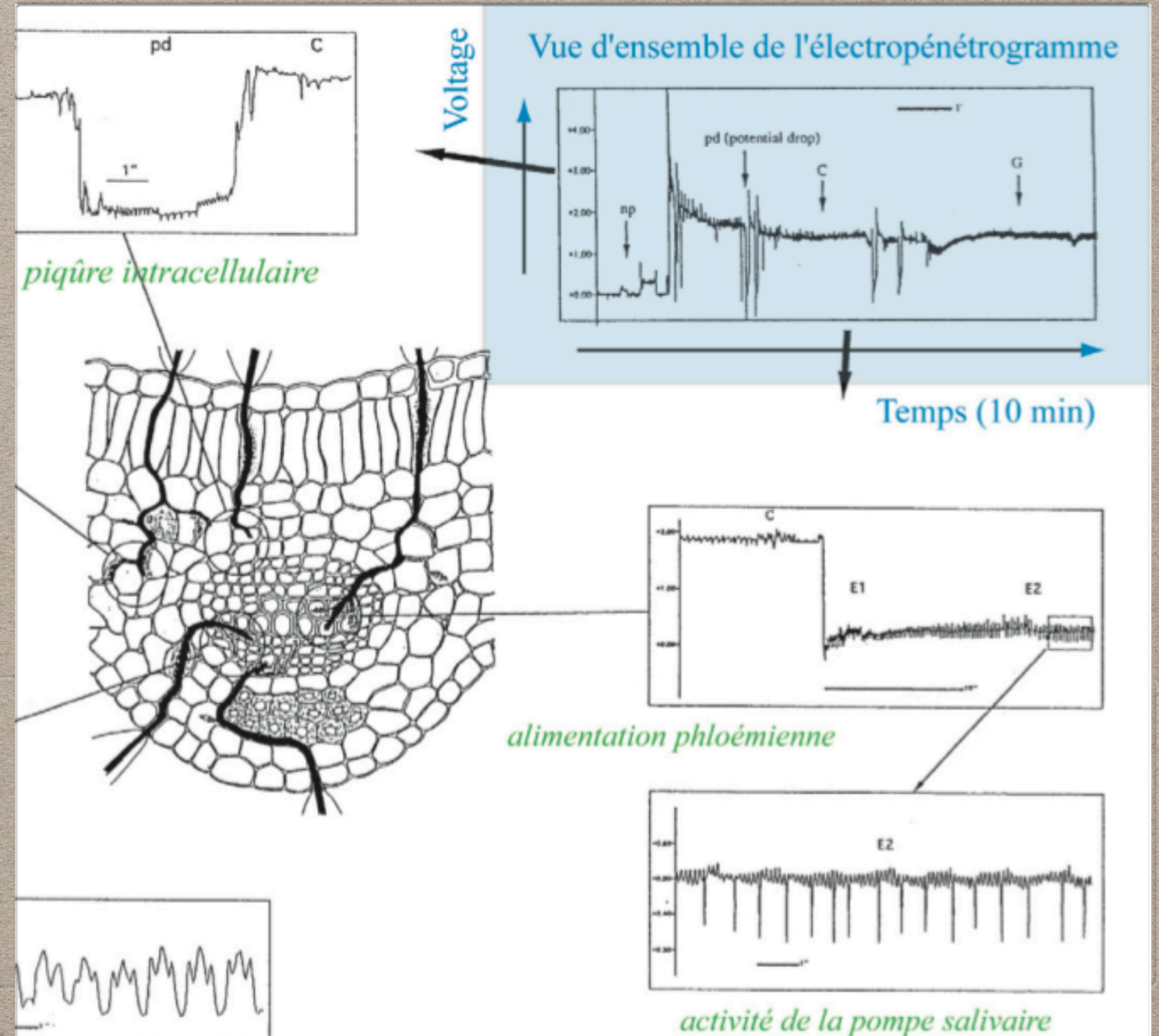
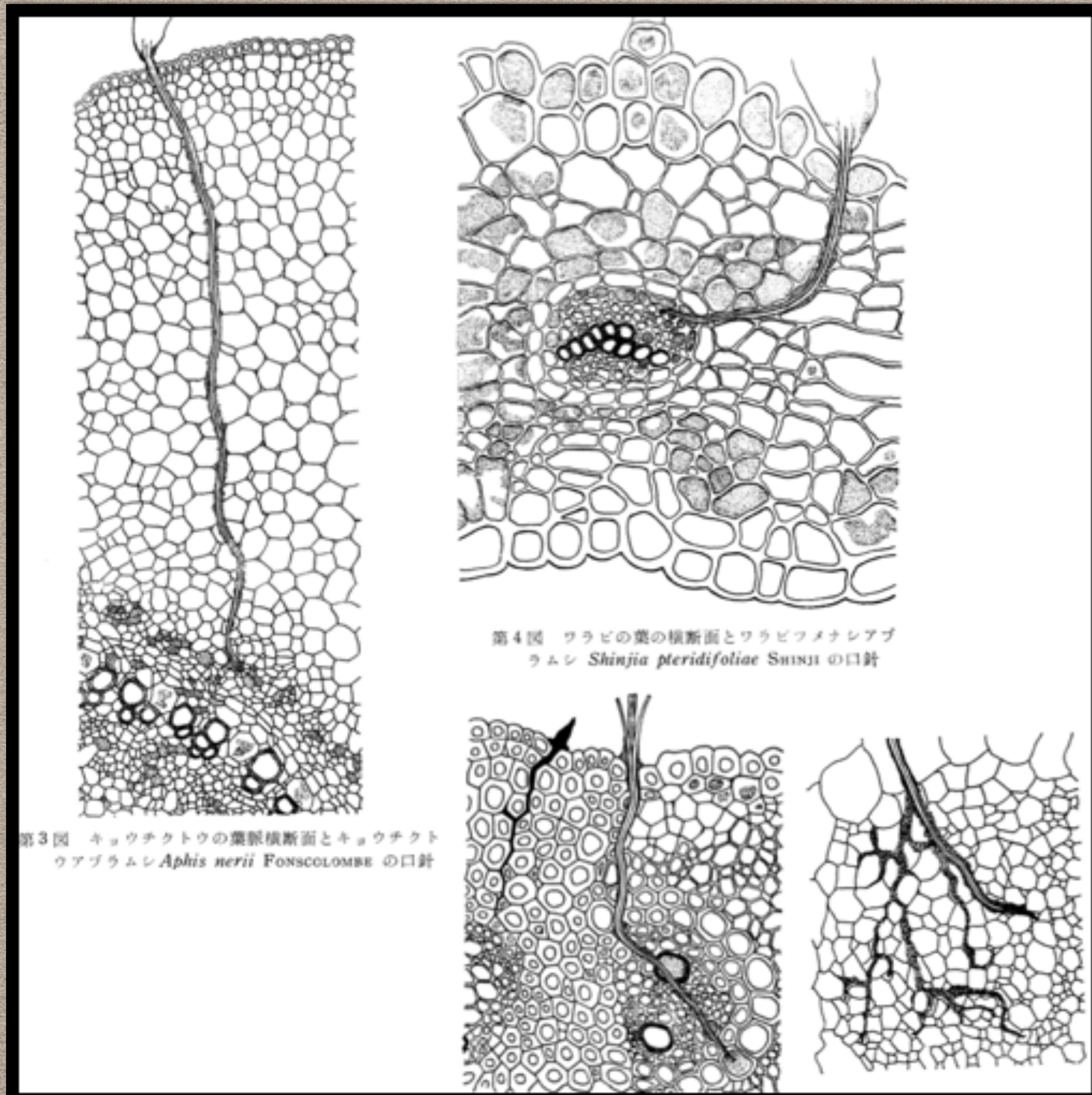


Fig. 1. Dated phylogenetic tree of insect relationships. The tree was inferred through a maximum-likelihood analysis of 413,459 amino acid sites divided into

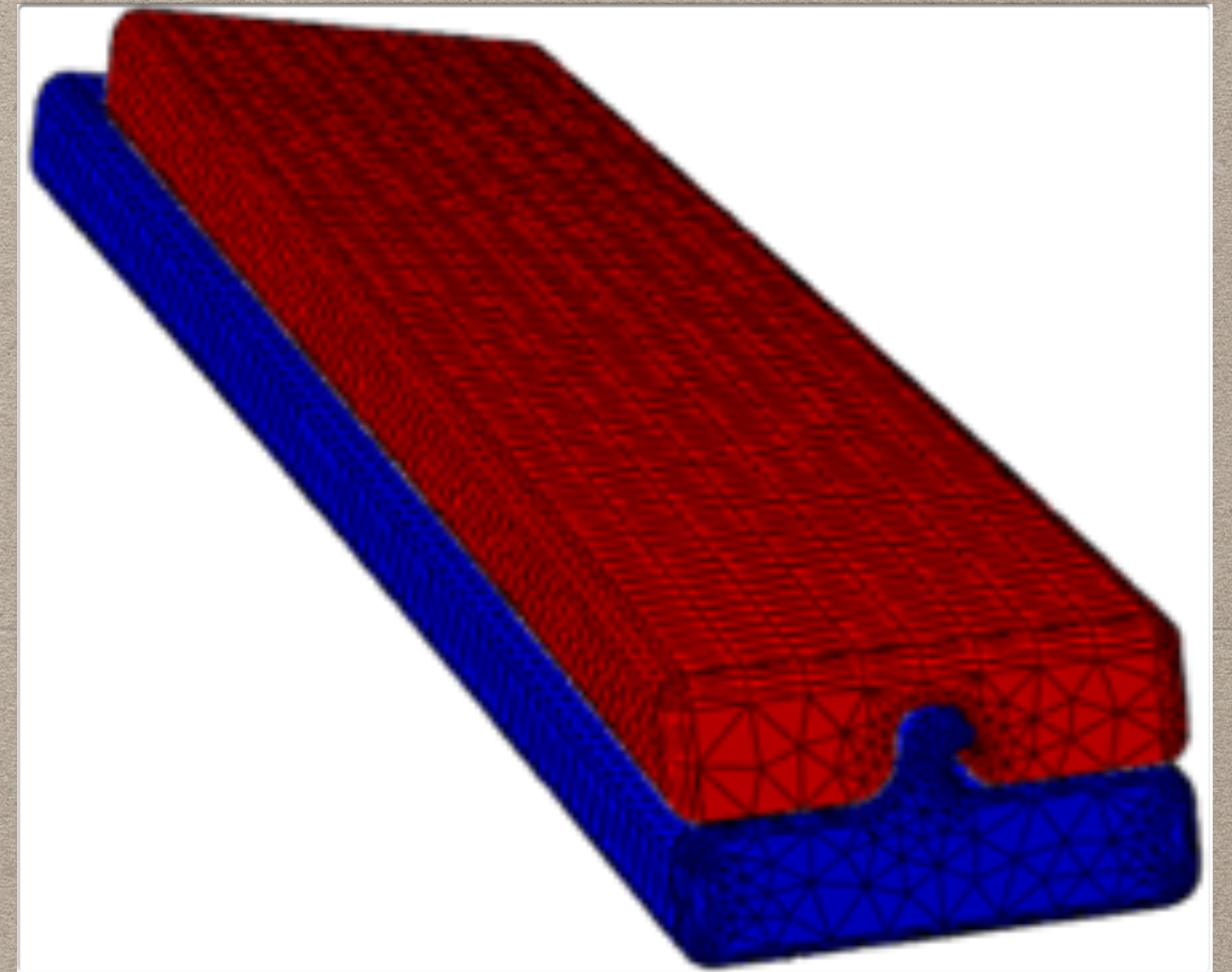
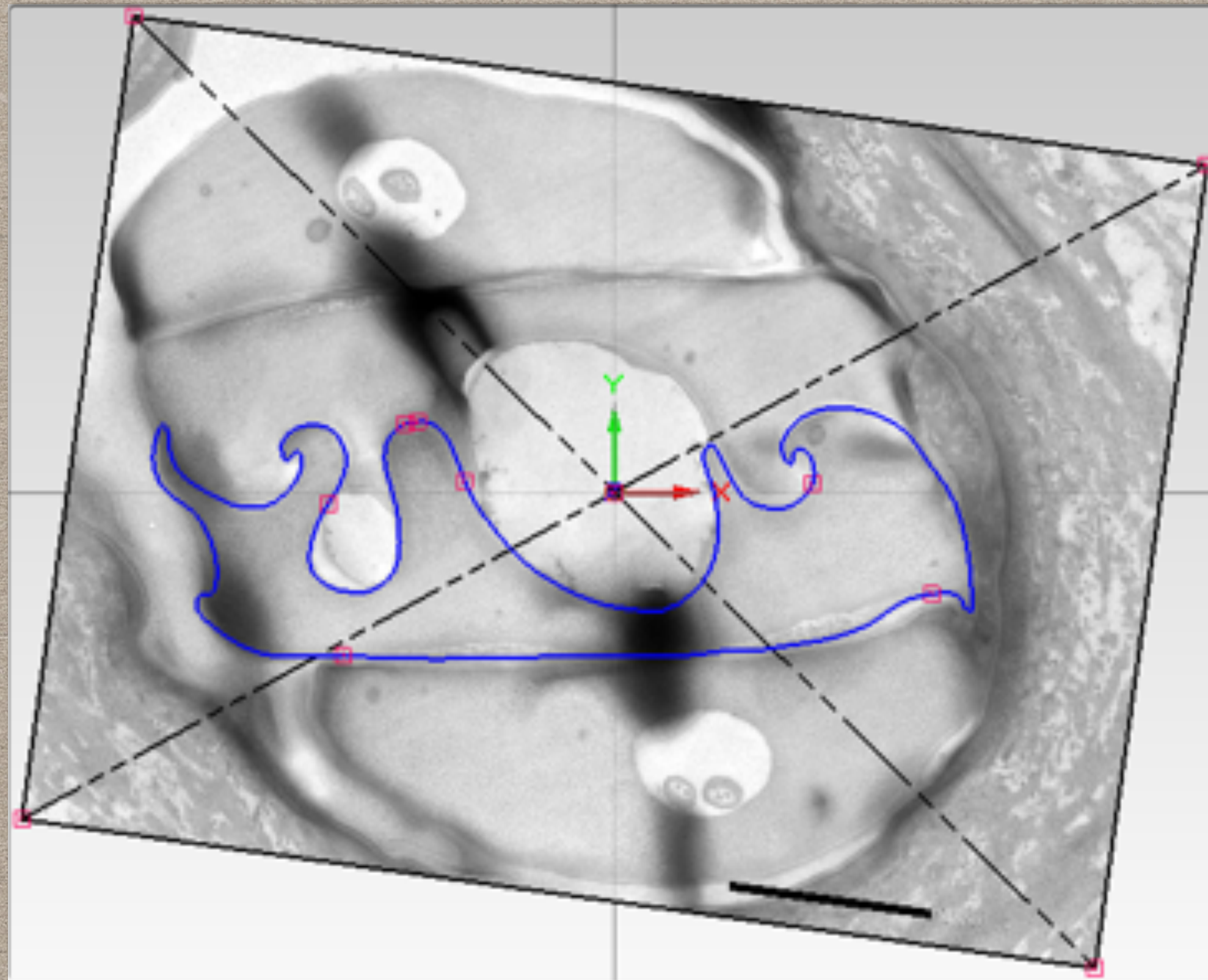
# PHLOEM-FEEDER

## STEALTH FEEDING STRATEGY



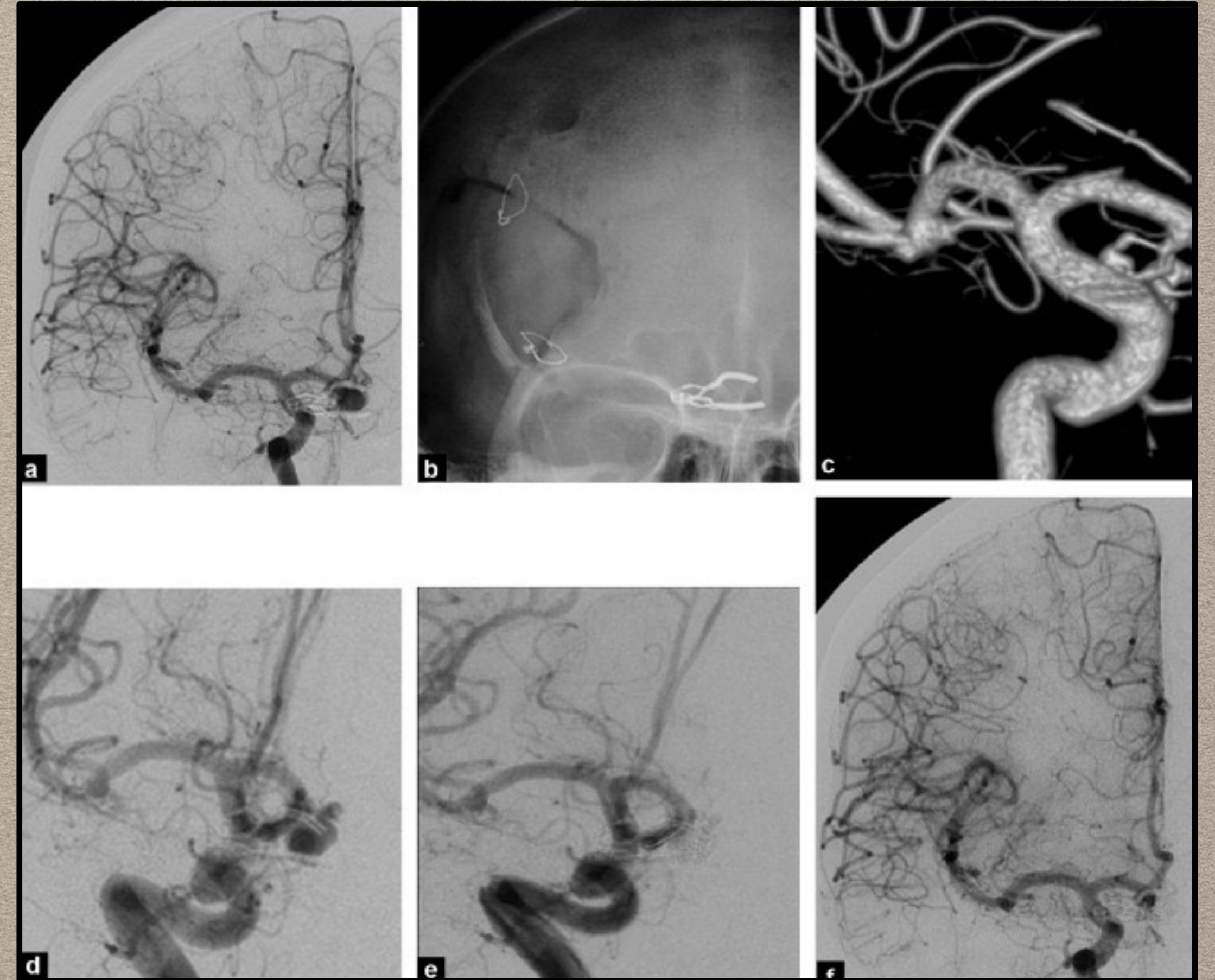
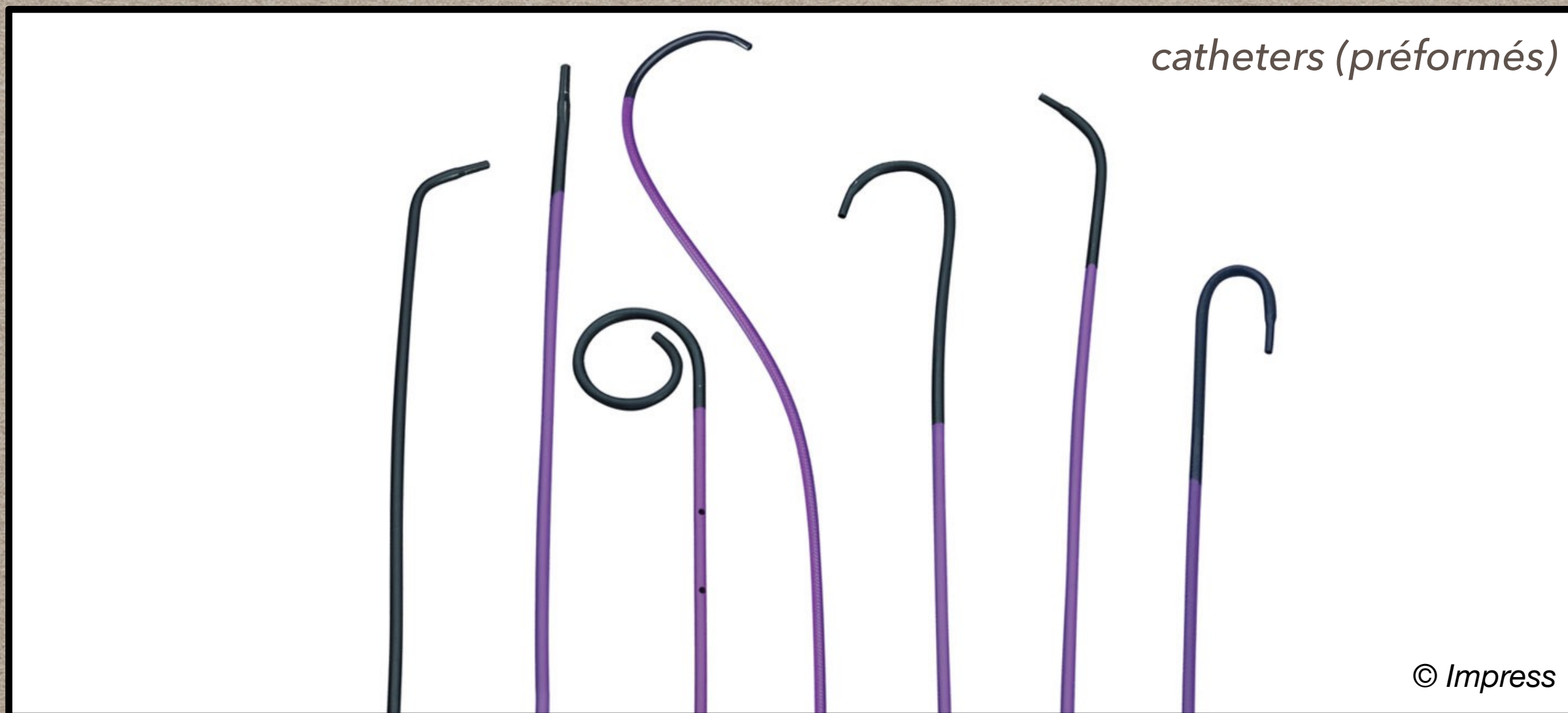
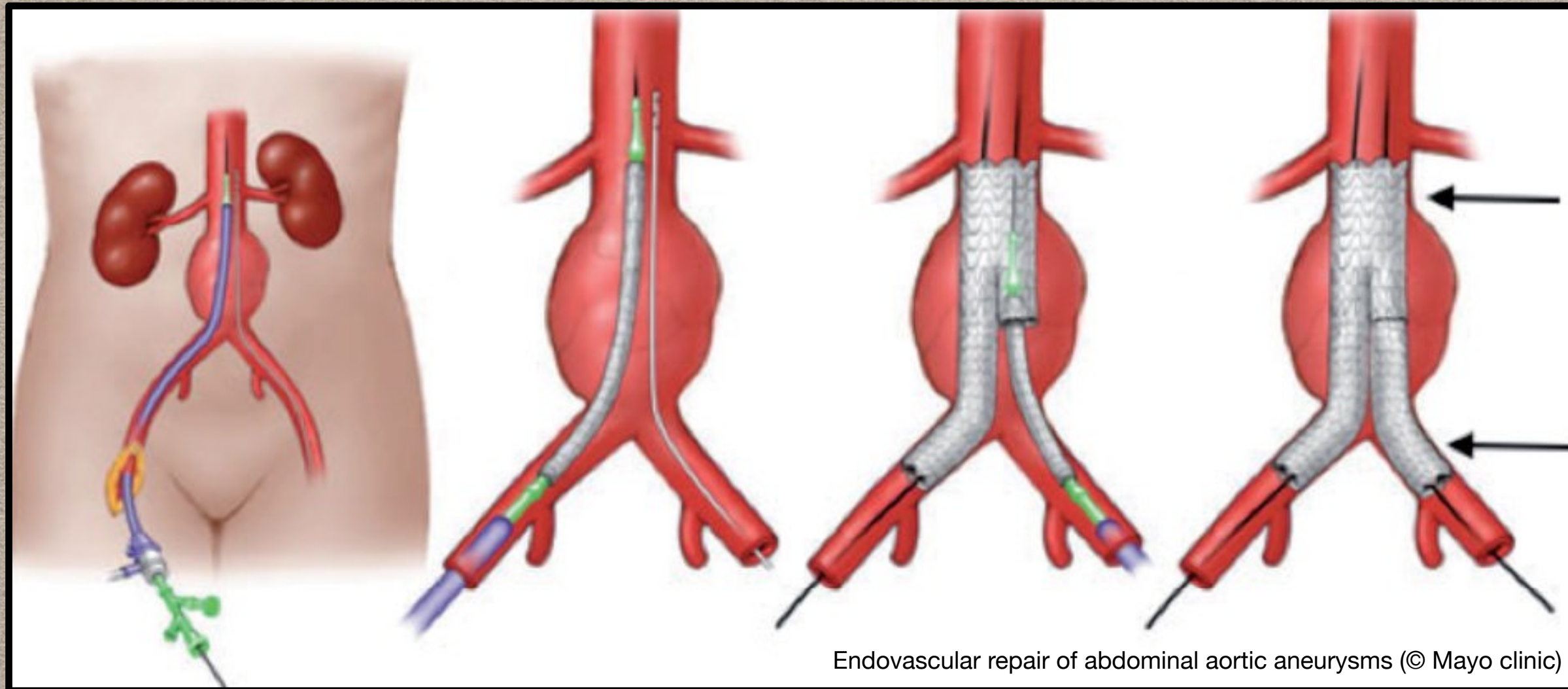
# PHLOEM-FEEDER

BIOMIMICRY: MECHANICAL MODELLING OF THE (4-)STYLET MICRO-DRILLING MACHINE



# PHLOEM-FEEDER

## BIOMIMICRY: ENDOVASCULAR SURGERY MECHANICS



*Biomimetic functions  
(Ontology)*

*asknature.com*

*insectsdiditfirst.com*

# ORDINARY INSECTS

EXTRAORDINARY PROPERTIES

*BiG: Bio-inspiration Group*



*yvan.rahbe@inra.fr*

Biomimetic functions  
(Ontology)

[asknature.com](http://asknature.com)

[insectsdiditfirst.com](http://insectsdiditfirst.com)

# ORDINARY INSECTS EXTRAORDINARY PROPERTIES



BiG: Bio-inspiration Group



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