

Food Microscopy

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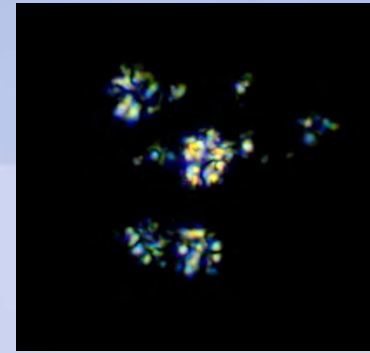
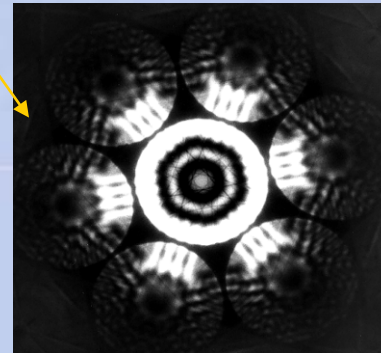
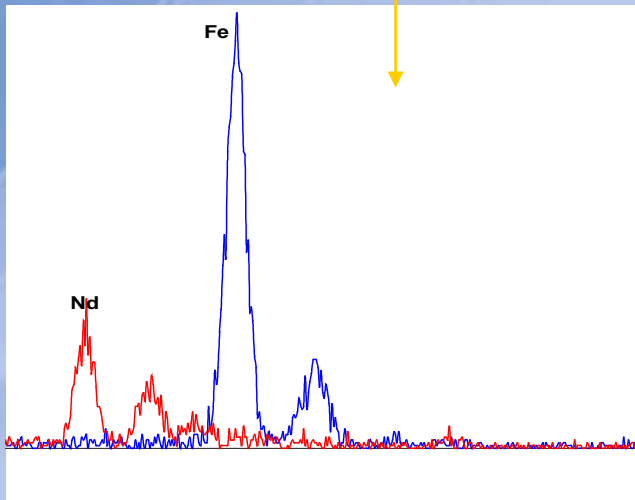
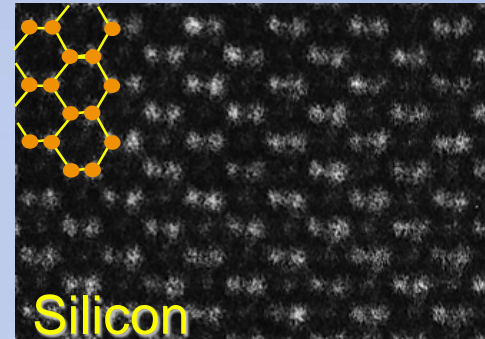
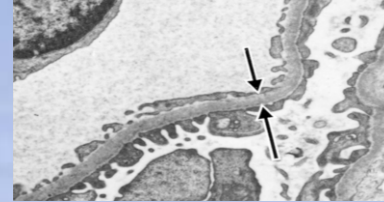


Part 1

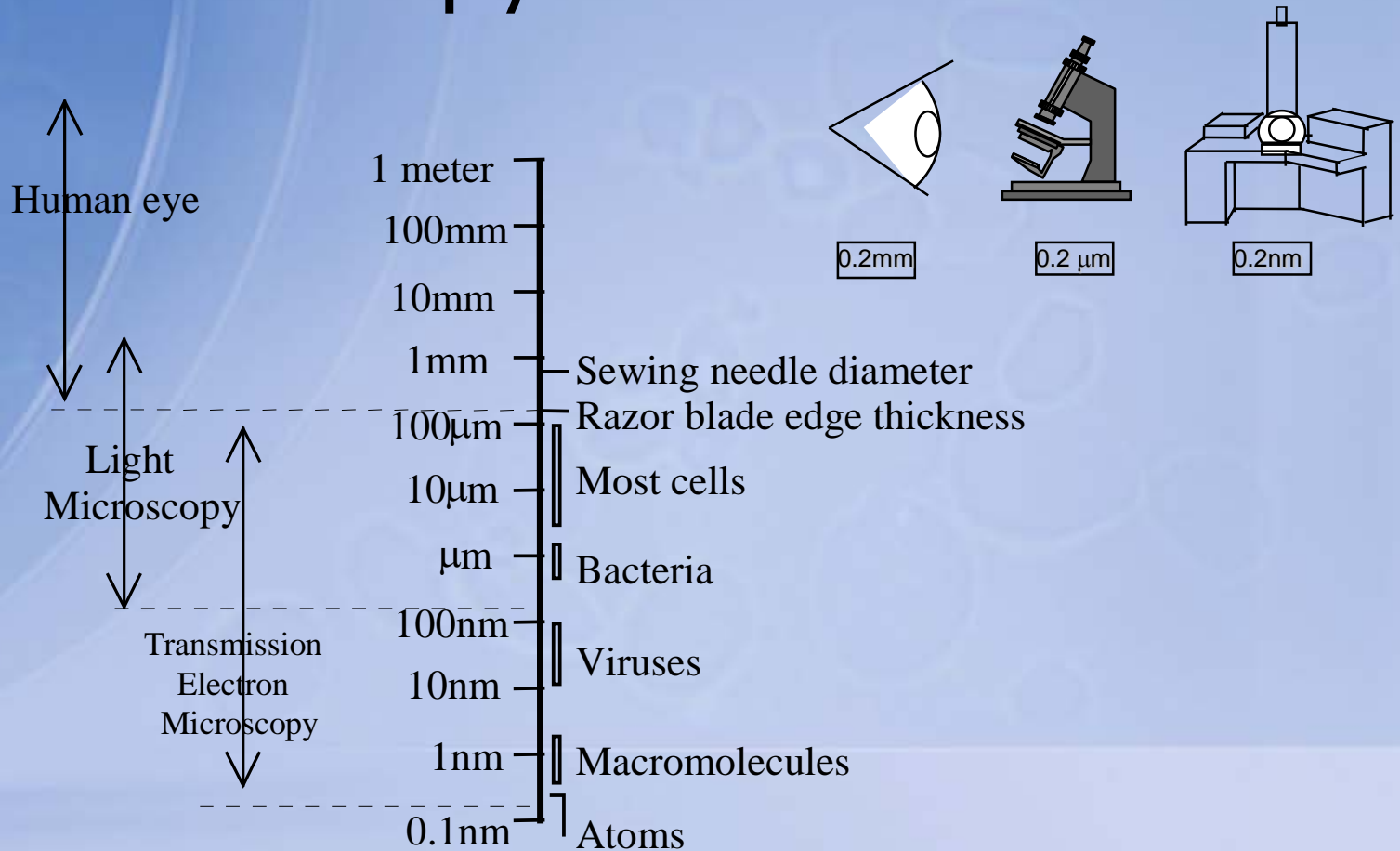
Introduction

Types of Information

- Image
- Structure
- Chemistry



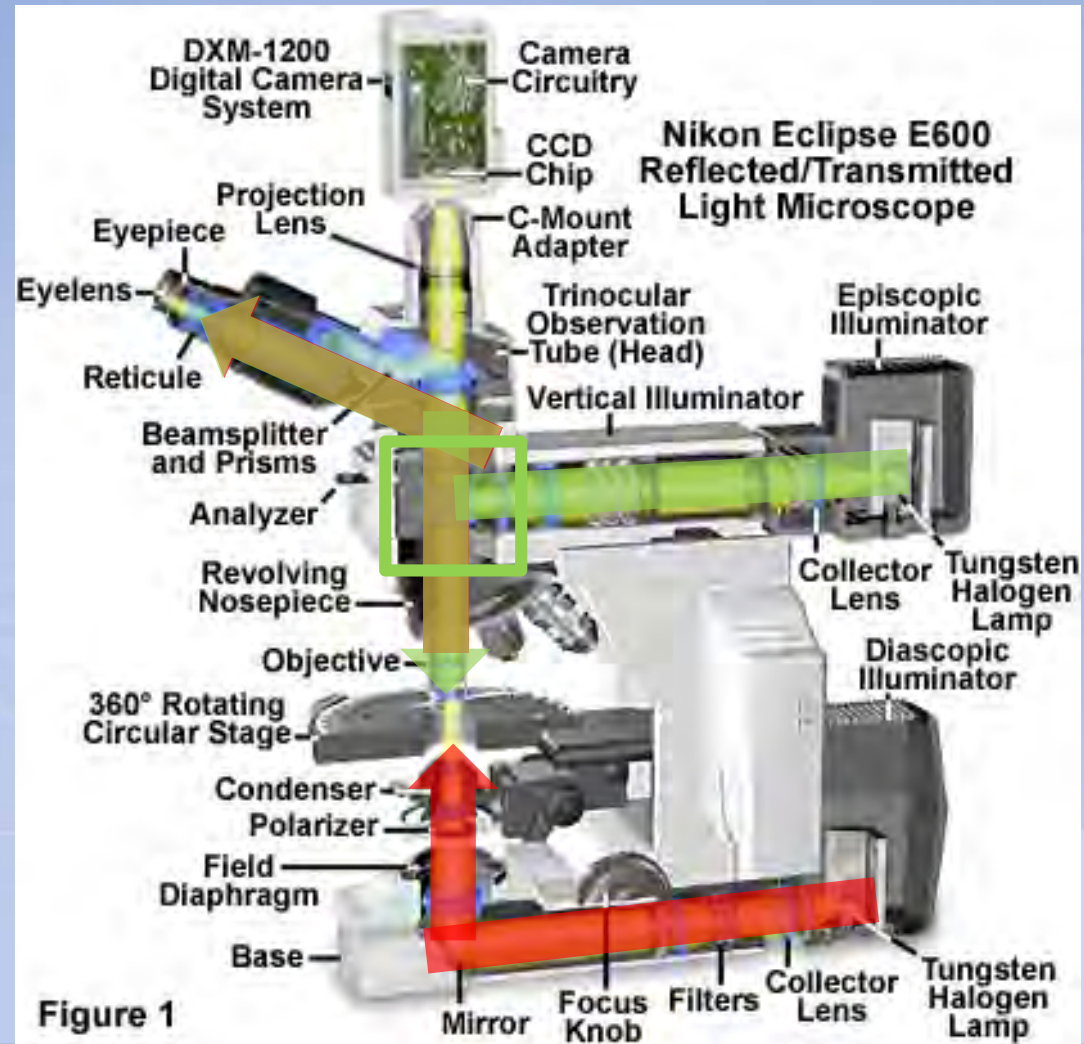
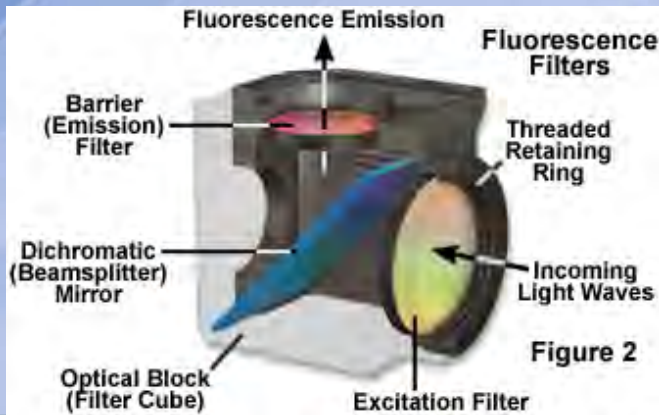
Microscopy and Resolution



Light microscopy

transmitted light

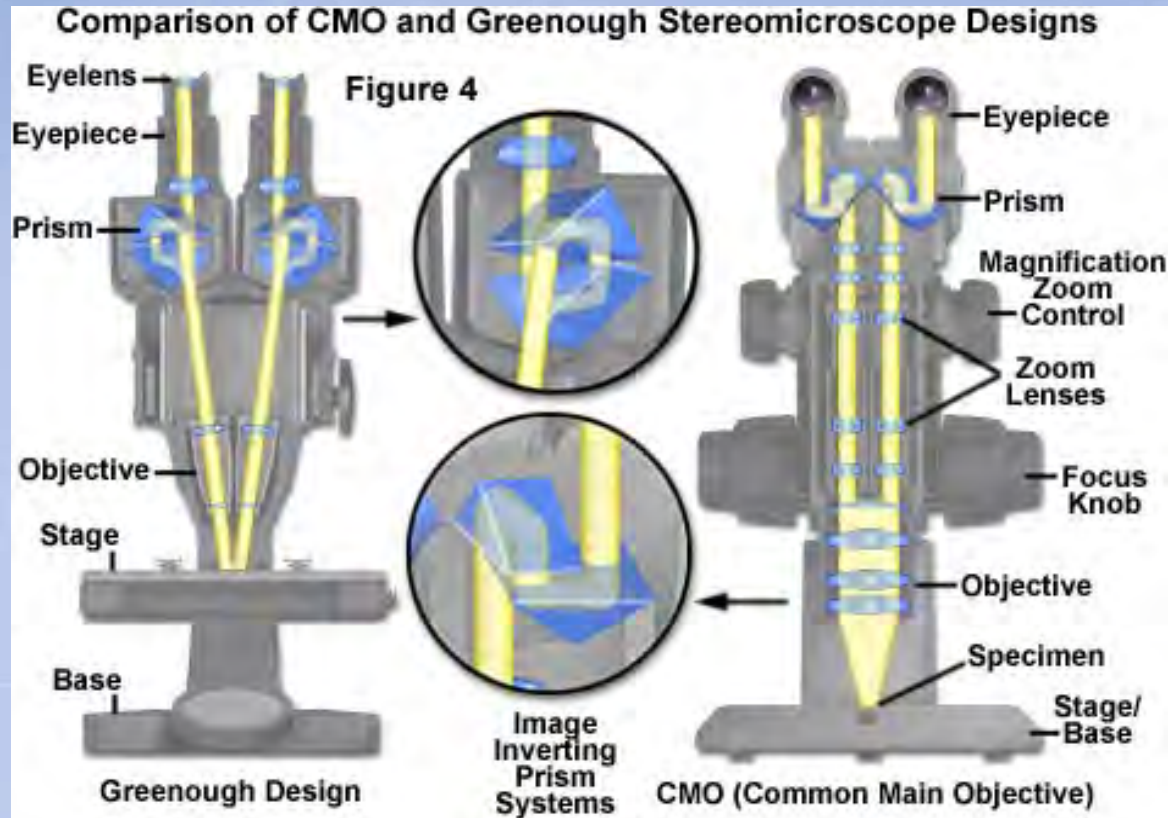
- light microscope
- fluorescence microscope



Light microscopy

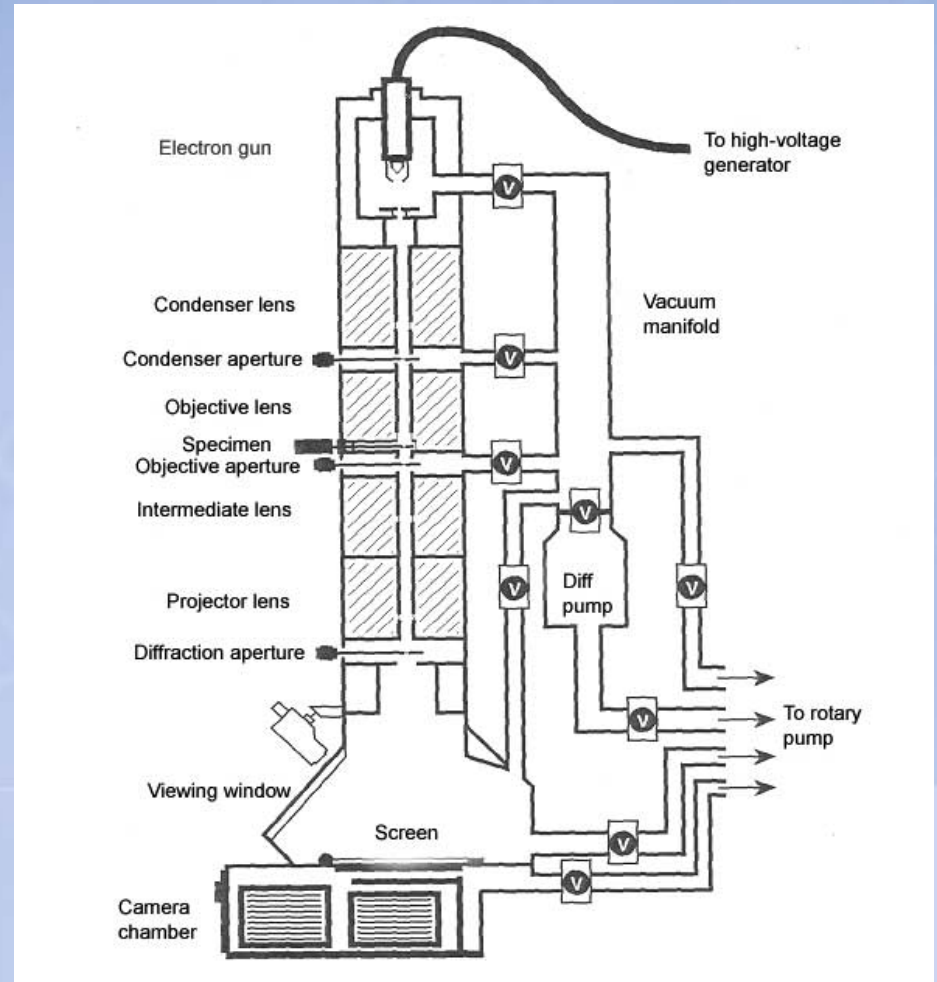
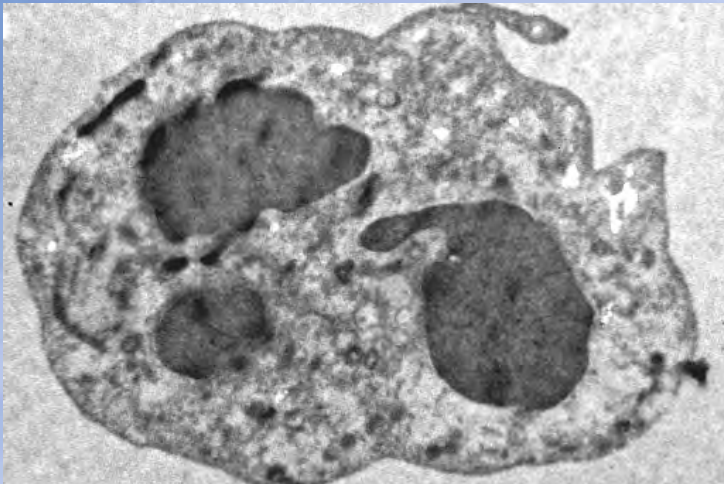
reflected light

– stereomicroscope



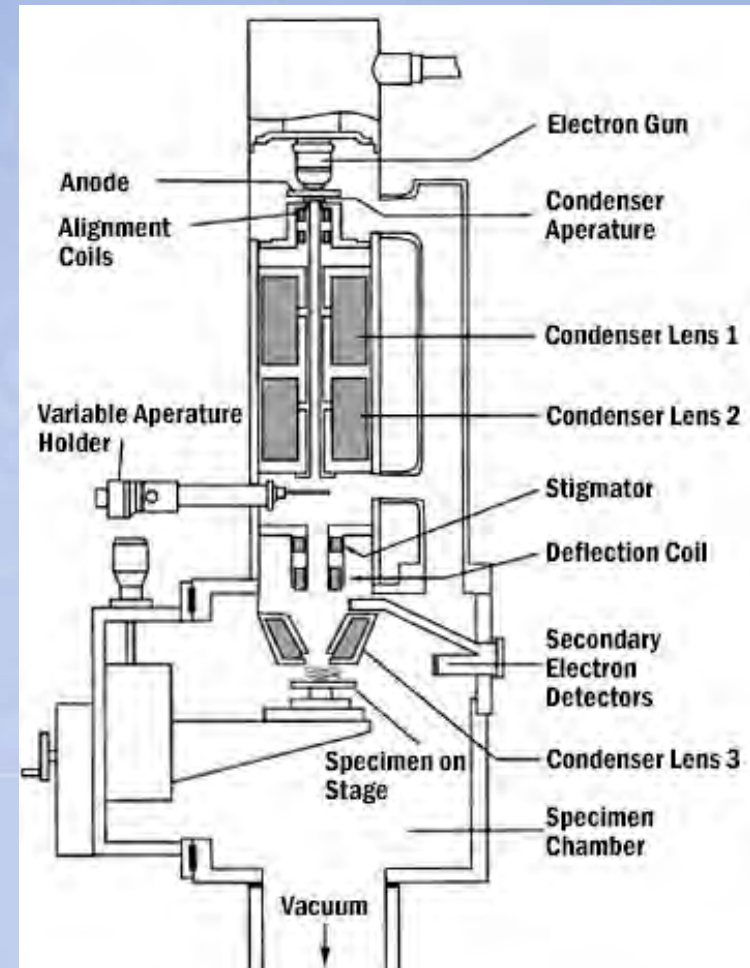
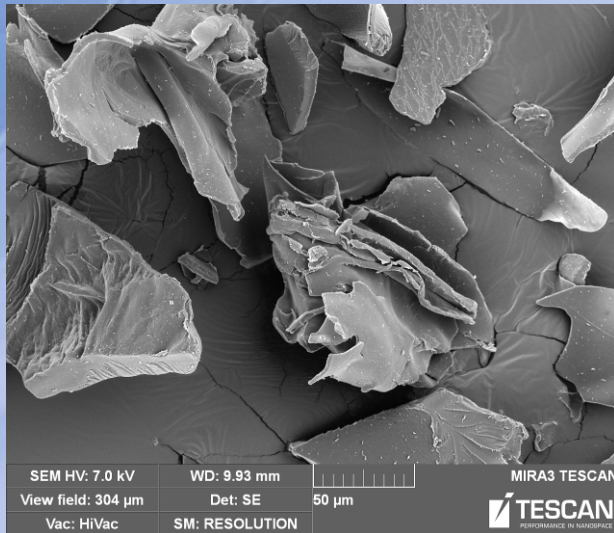
Electron microscopy

- TEM
transmission electron microscope



Electron microscopy

- SEM
scanning electron
microscope

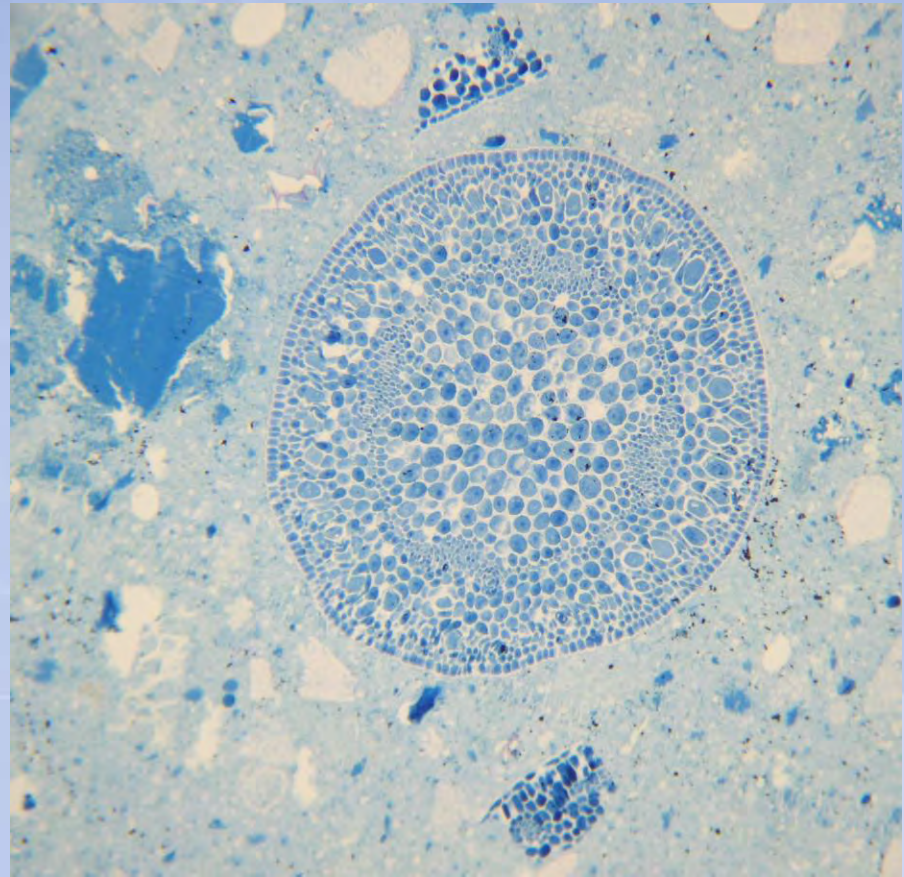


Comparison of Light and Electron Microscopy

	Light Microscopy	Electron Microscopy
Carrier	Light Rays	Electrons
Wavelength	400–800 nm (visible) 200 nm (ultra violet)	0.0037 nm (at 100kV) 0.0020 nm (at 300kV)
Medium	Air	Vacuum
Lenses	Glass	Electromagnets
Aperture Angle	<64°	0.2–0.7°
Observation	Direct	Via fluorescent screen
Contrast by	Absorption, Reflection and Phase Changes	Scattering, Phase Changes and Diffraction
Resolving Power	0.2 μm (visible) 0.1 μm (ultra violet)	0.2 nm (point) 0.1 nm (line)
Focusing and Alignment	Mechanically	Electronically
Depth of Focus	0.1 μm –0.1m (1-1k)	0.1–100,000m (1k–1000k)
Depth of Field	<0.1 μm	<1 μm
Information	Mass Density Distribution	Mass Density Distribution, Crystallographic and Chemical
Magnification	5 – 2000 times	30 000 – 100 000 times

Part 2

Foodstuff



Current options of food microscopy

1. The determination of the **composition** of food ingredients
2. The determination of the **quality** and **arrangement** of the components of foods
3. The detection of **adulteration and risk** components of foods
4. The **Quantitative** analysis of food ingredients

The determination of the composition of food ingredients

- **Common used methods**
 - **light (optical) microscopy**
 - for microstructure examination
 - **electron microscopy**
 - for ultrastructure examination

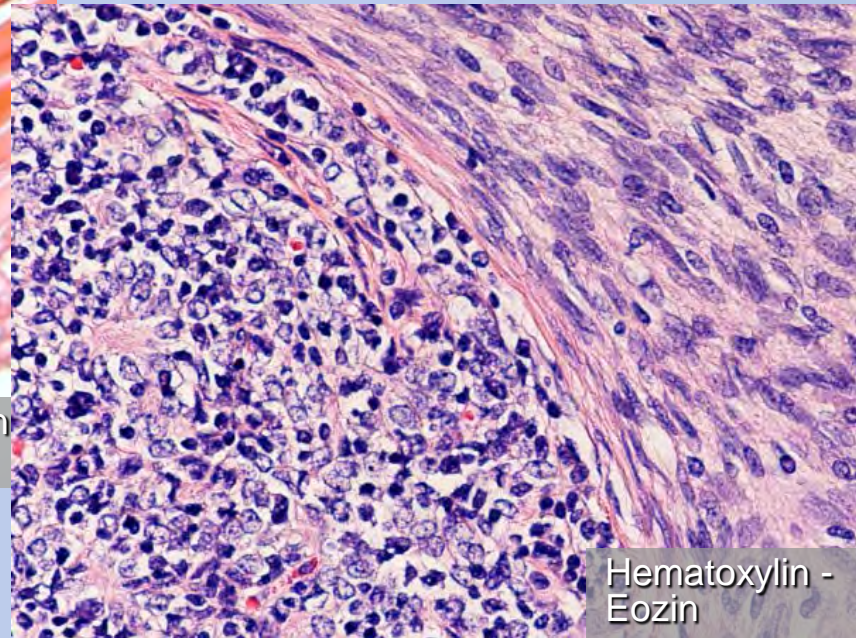
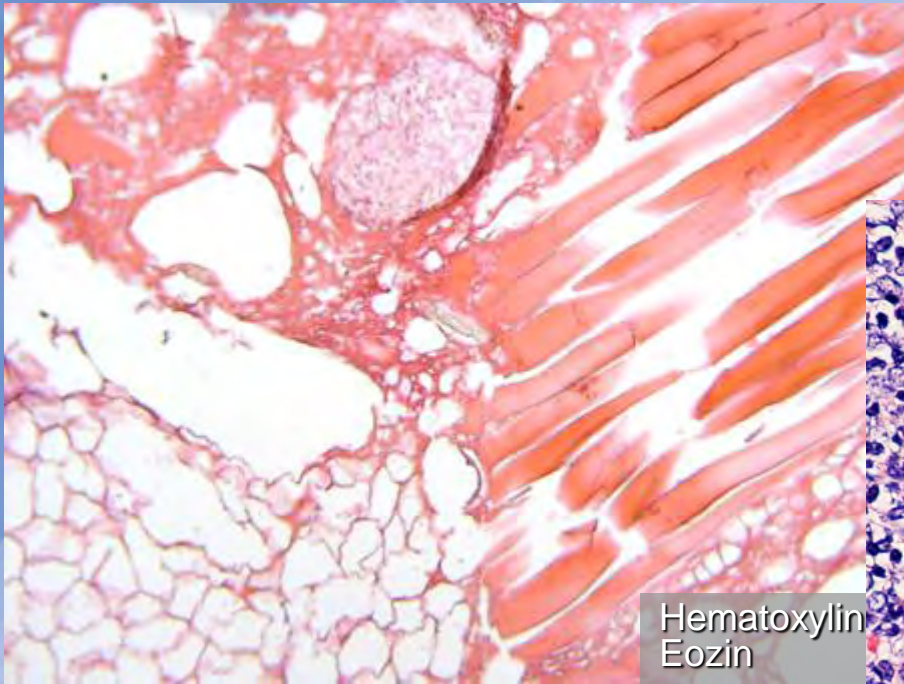


The determination of the composition of food ingredients

- general staining
 - rutin
 - short
- special staining
 - specific

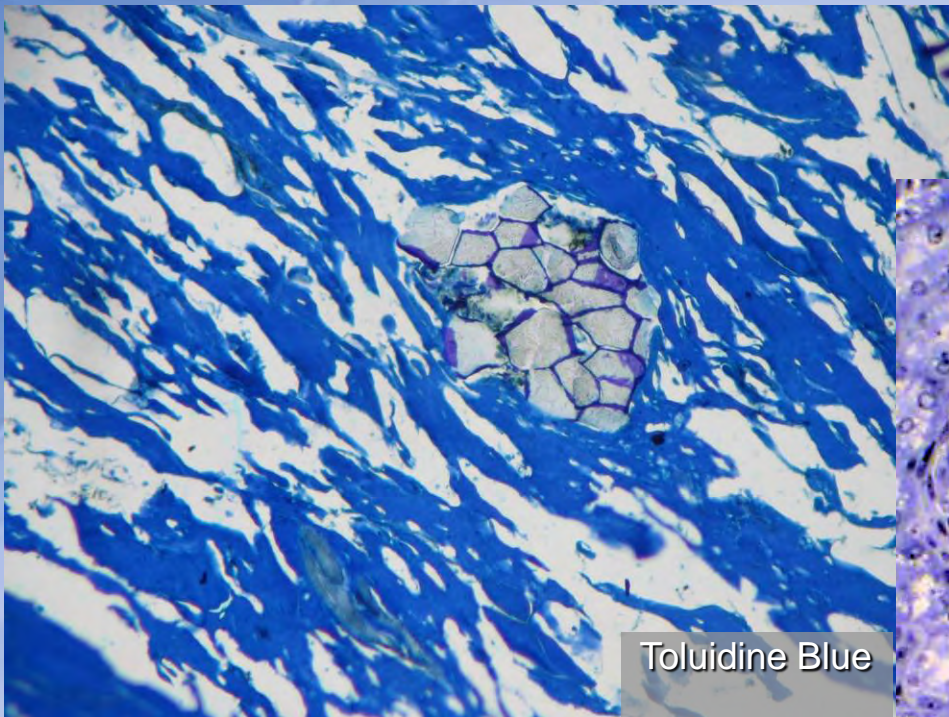
The determination of the composition of food ingredients

- general staining – Hematoxylin Eosin

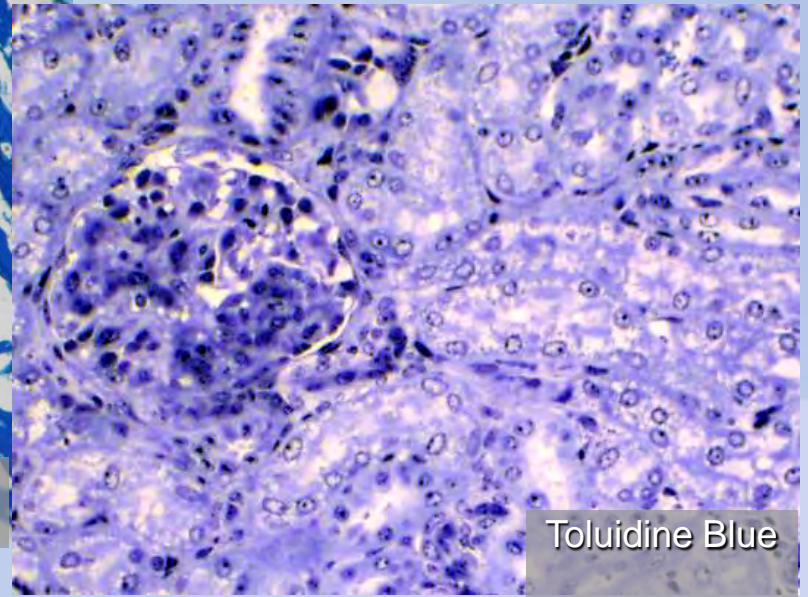


The determination of the composition of food ingredients

- general staining – Toluidine Blue



Toluidine Blue



Toluidine Blue

The determination of the composition of food ingredients

- special staining

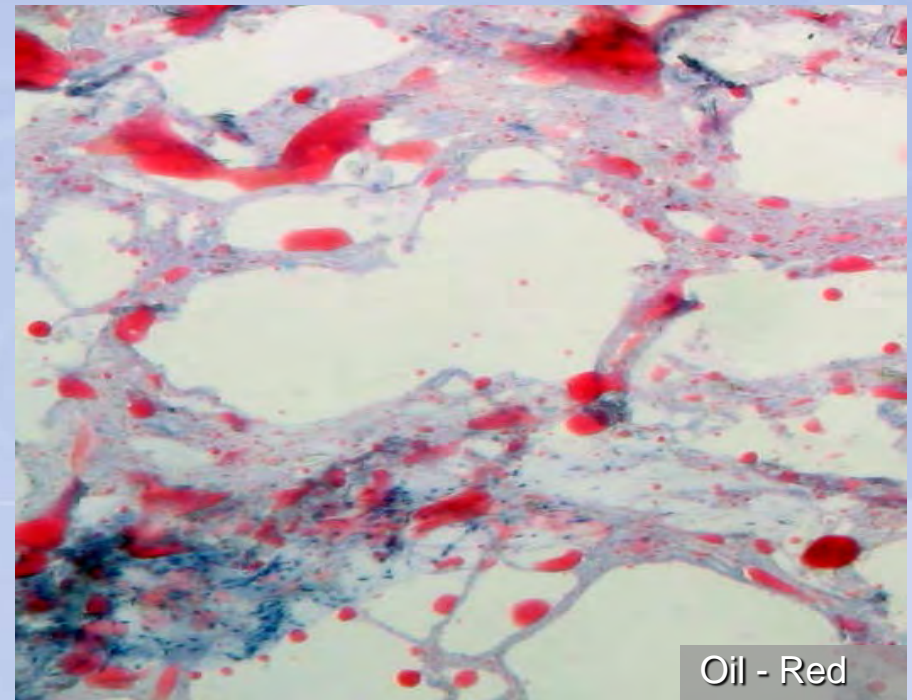
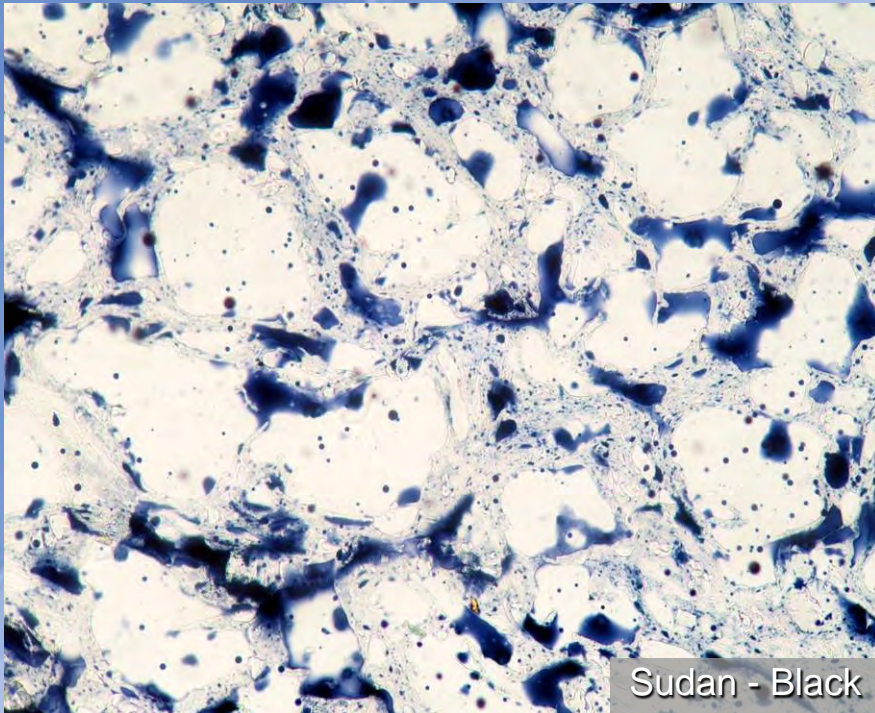
- Oil Red
- Sudan Stains
- Calleja
- Green, blue trichrome
- Von Kossa Stain
- Alizarin Red

The animal origine

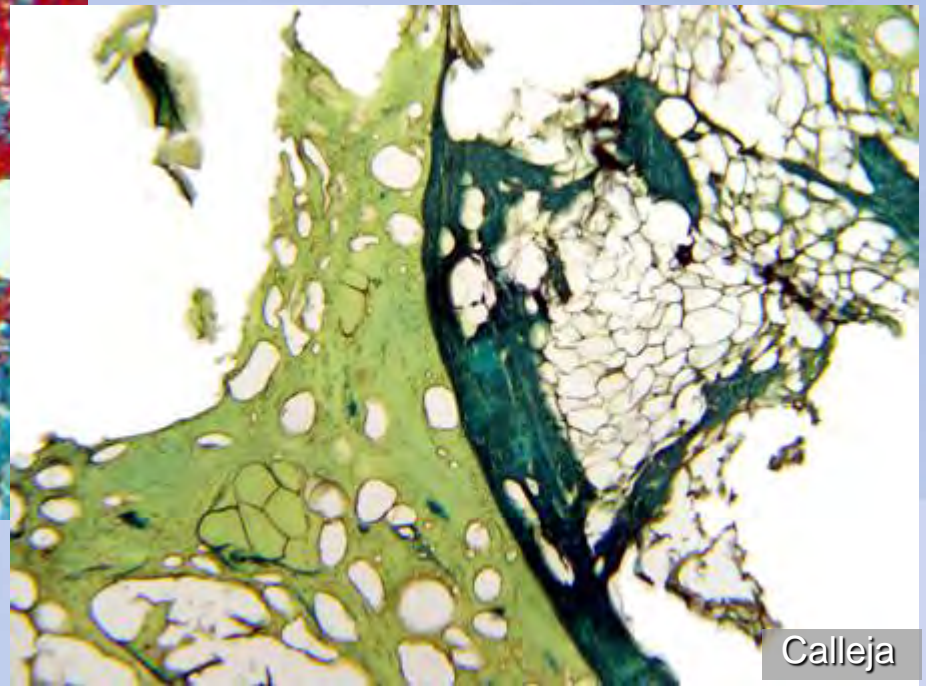
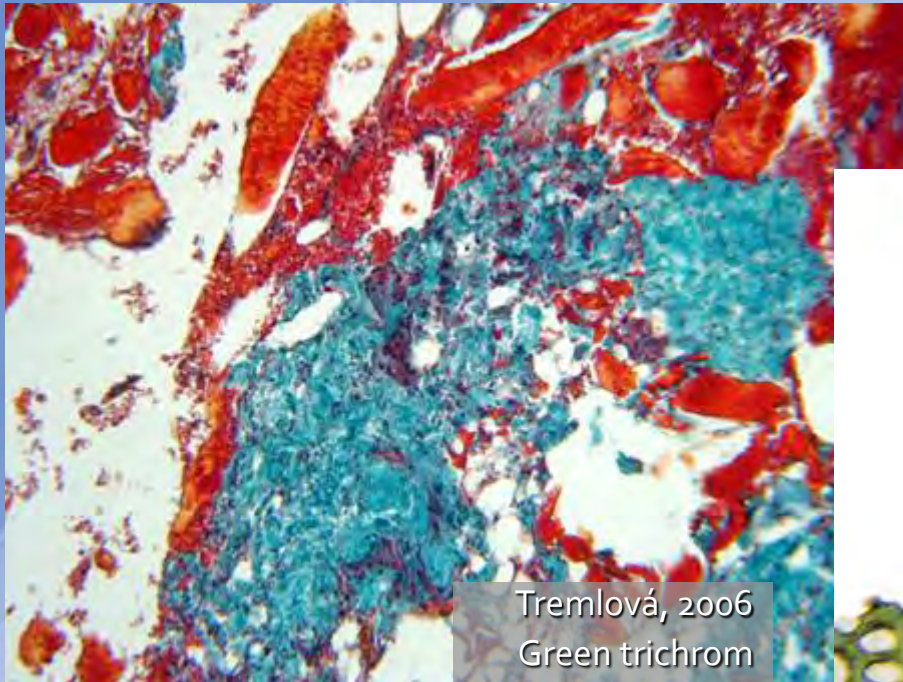
- Periodic Acid-Schiff (PAS)
- Lugol

The Plant origine

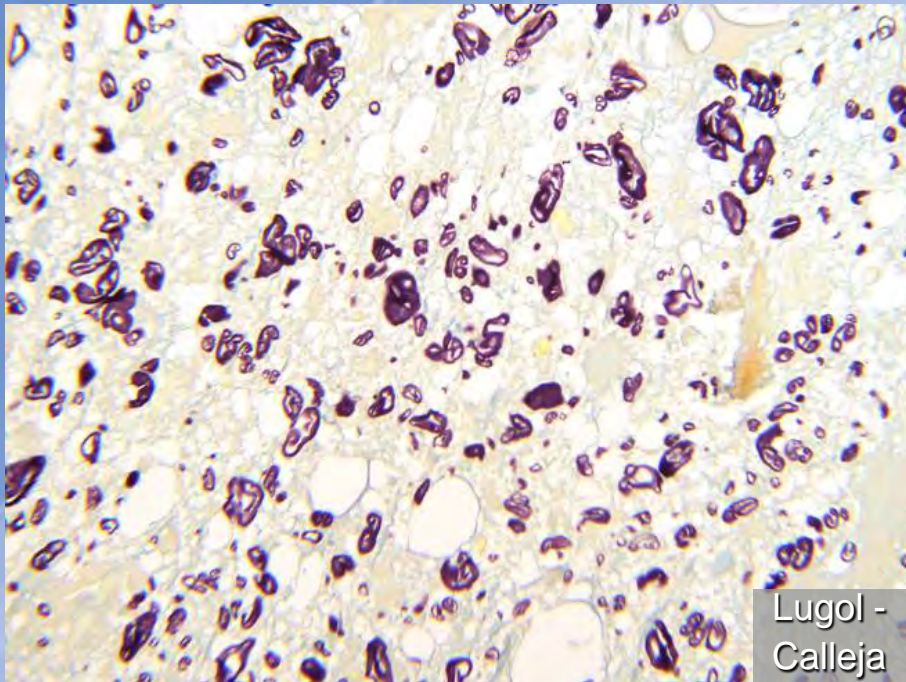
The determination of the composition of food ingredients - lipids



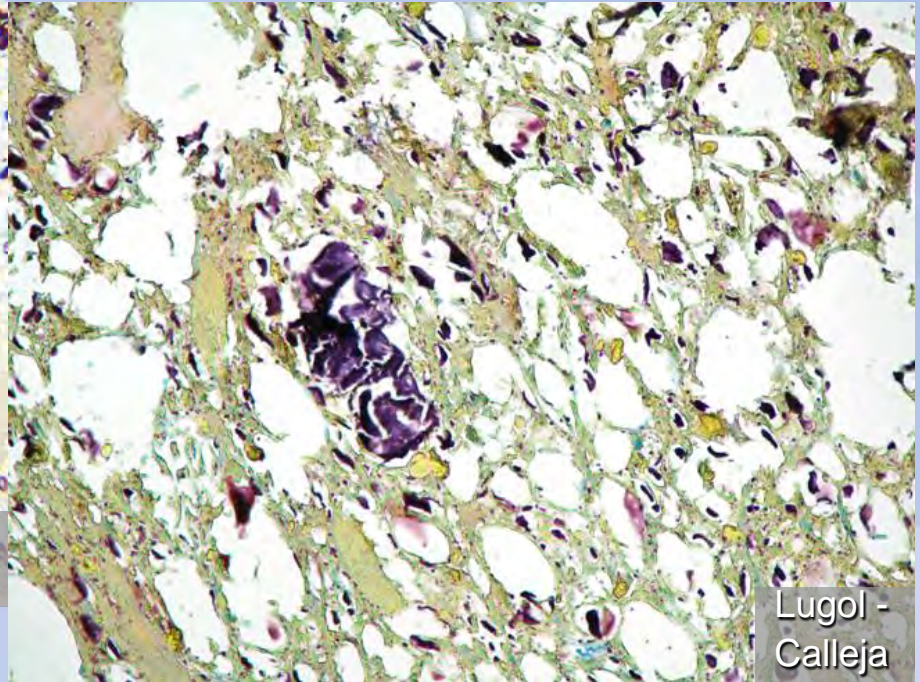
The determination of the composition of food ingredients - collagen



The determination of the composition of food ingredients - starch

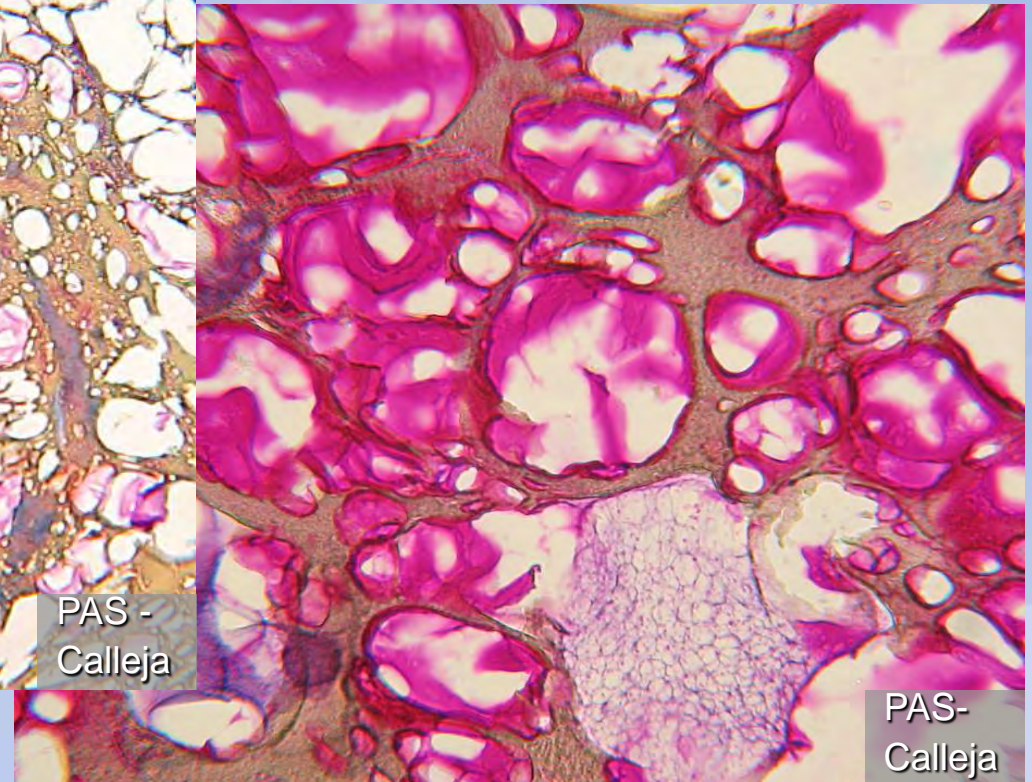
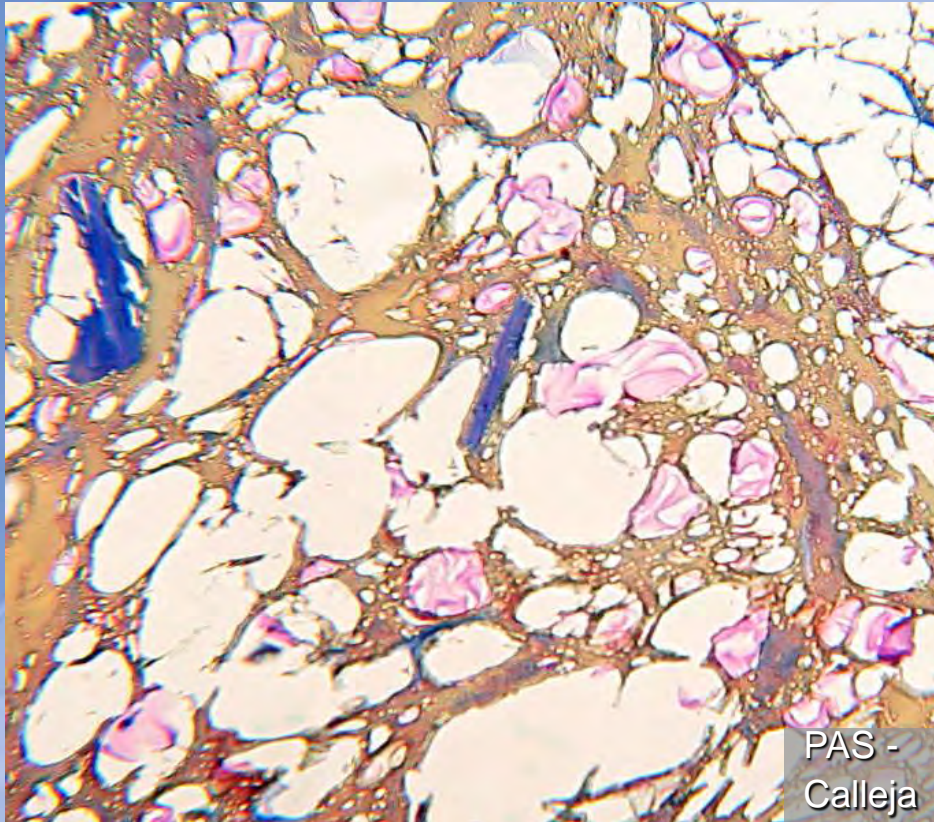


Lugol -
Calleja



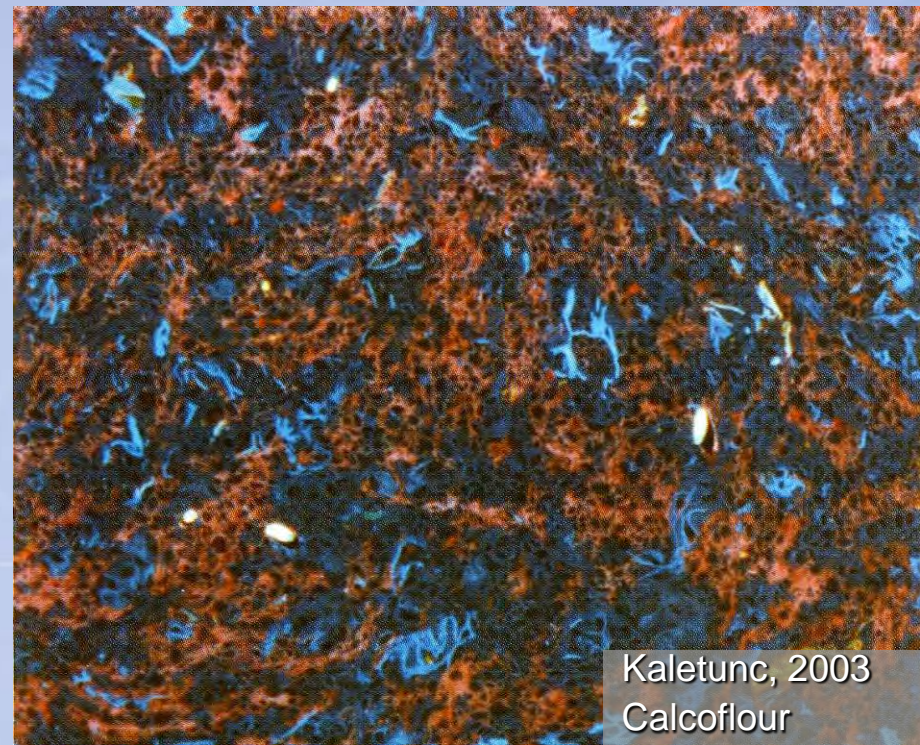
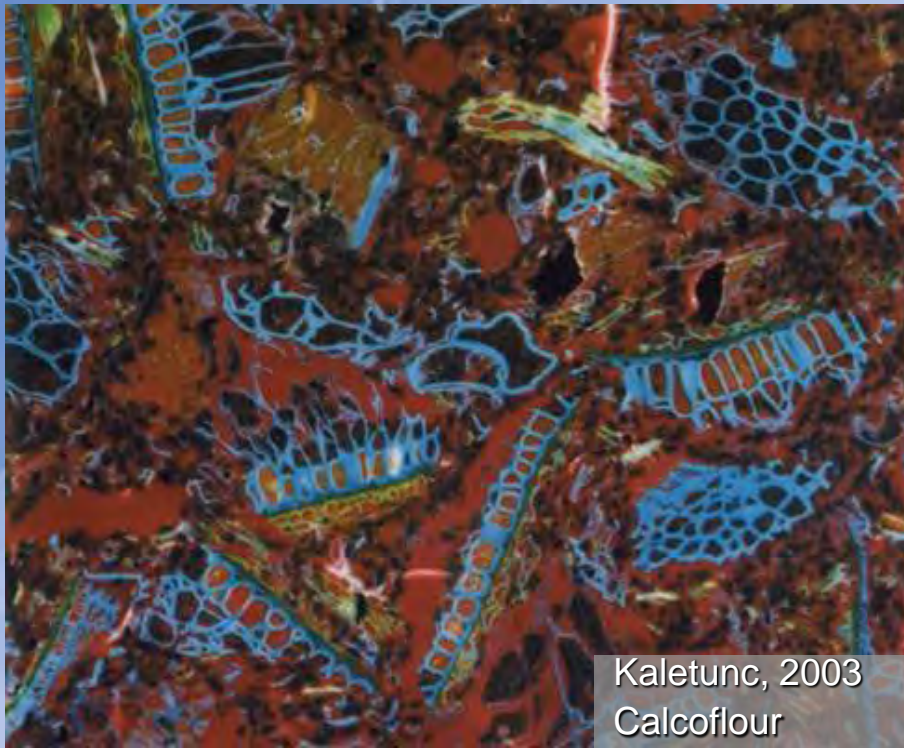
Lugol -
Calleja

The determination of the composition of food ingredients - carbohydrates



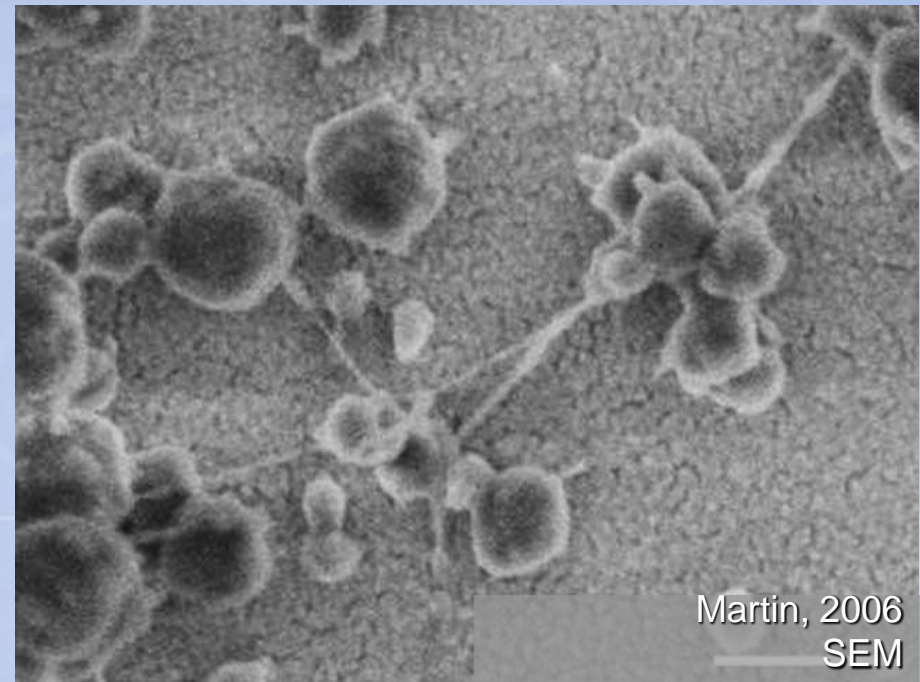
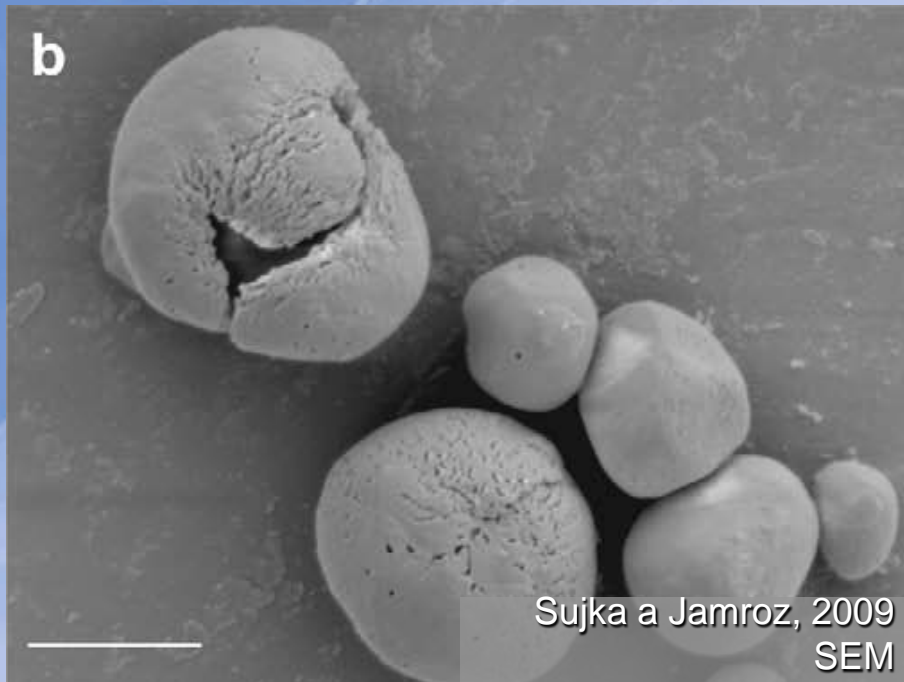
The determination of the composition of food ingredients - carbohydrates

- fluorescence microscopy



The determination of the composition of food ingredients - carbohydrates

- electron microscopy



The determination of quality

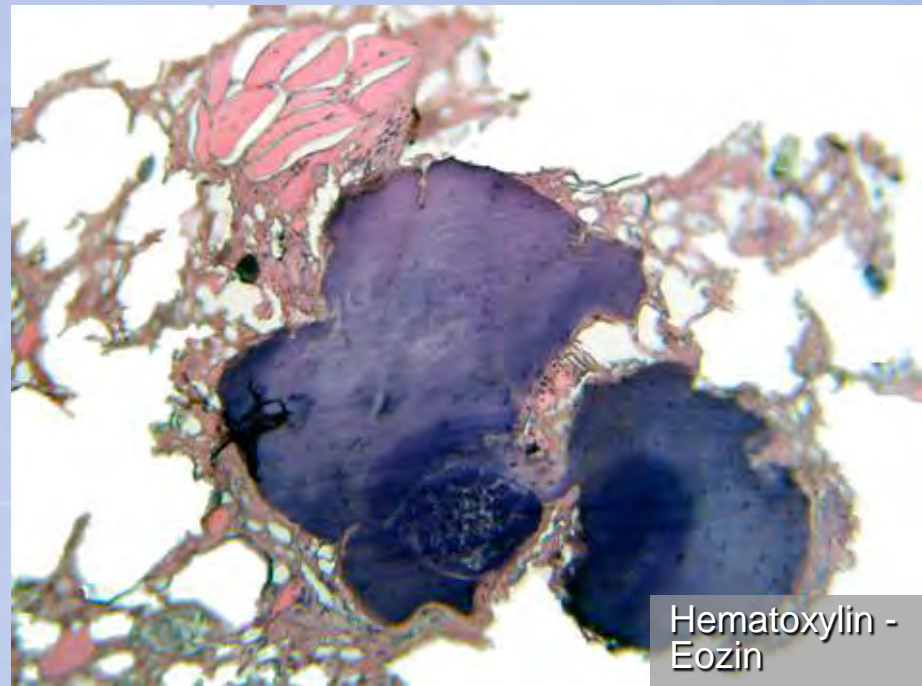
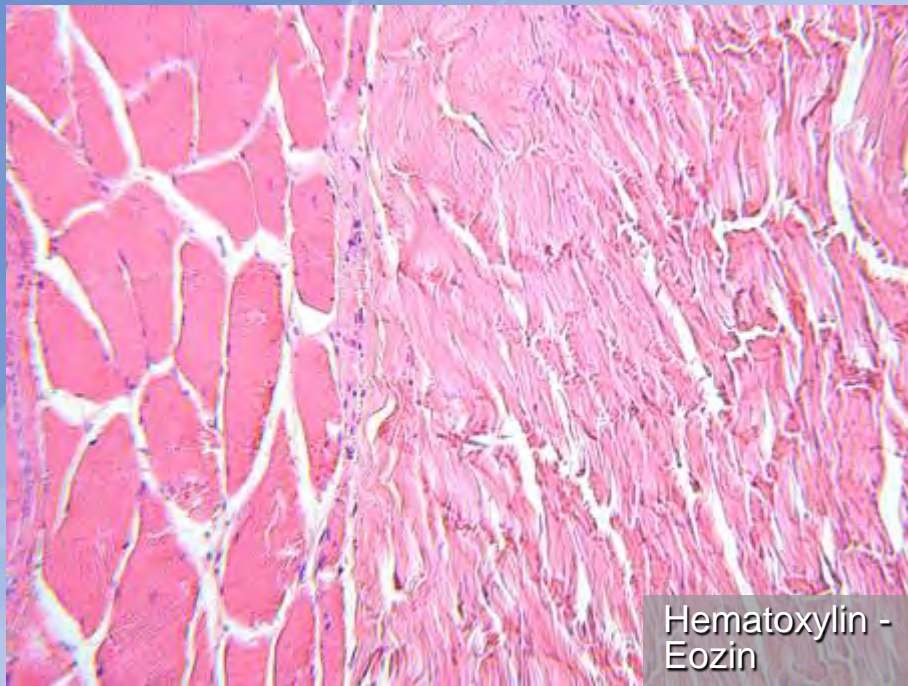
- The assessment of raw materials used in the food product
- The assessment of adequacy of technology working

The determination of quality

- **selected parameters**
 - presence of the less valuable components (raw materials)
 - presence of rework products
 - detection of inappropriate storage
 - thermal changes as an indicator of the used heat treatment
- if there are some parameters in contradiction to the legislation - we are talking about adulteration

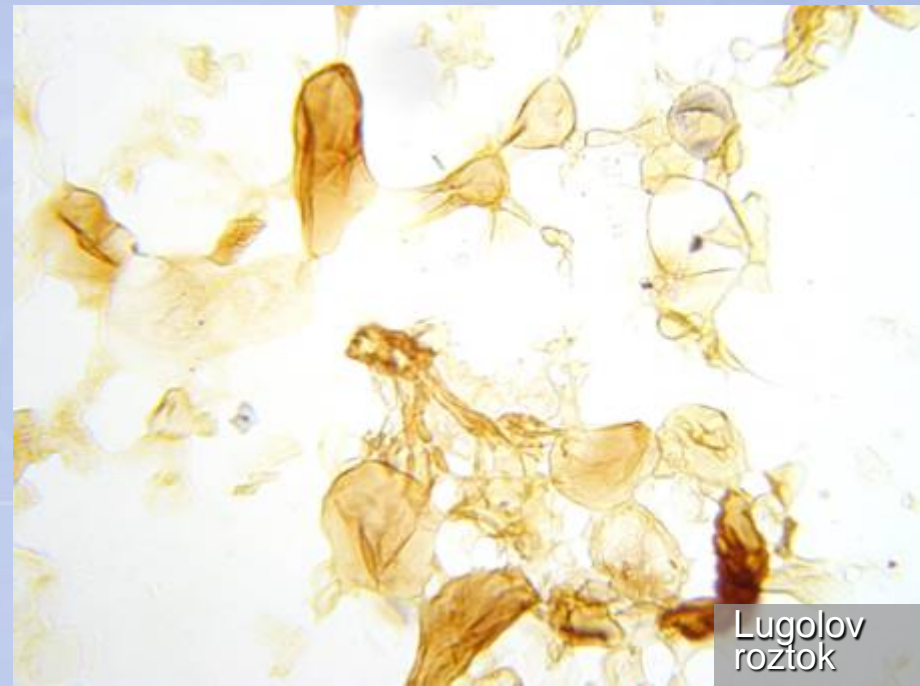
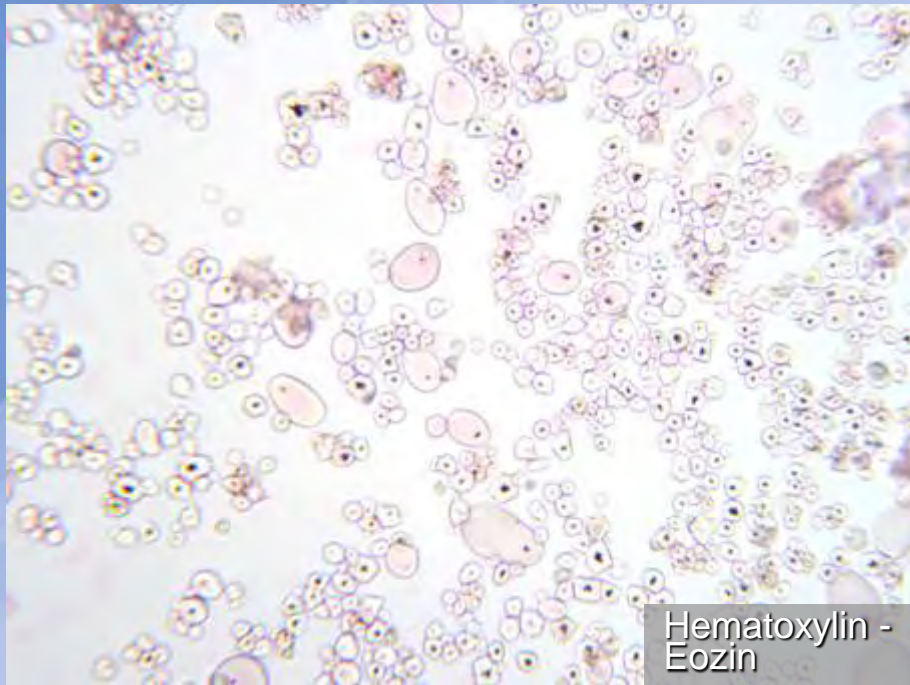
The determination of quality

- heat treatment



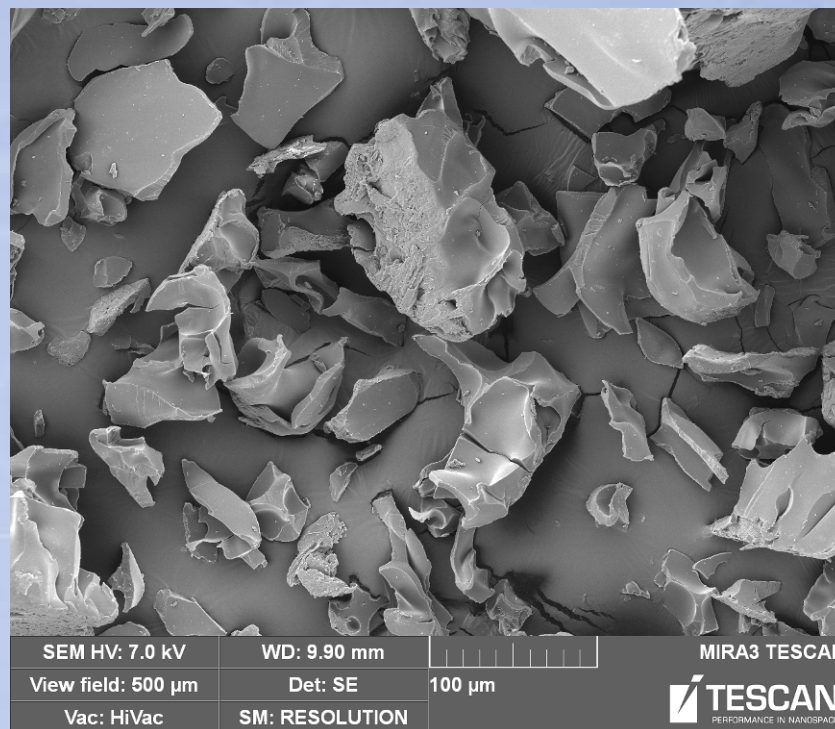
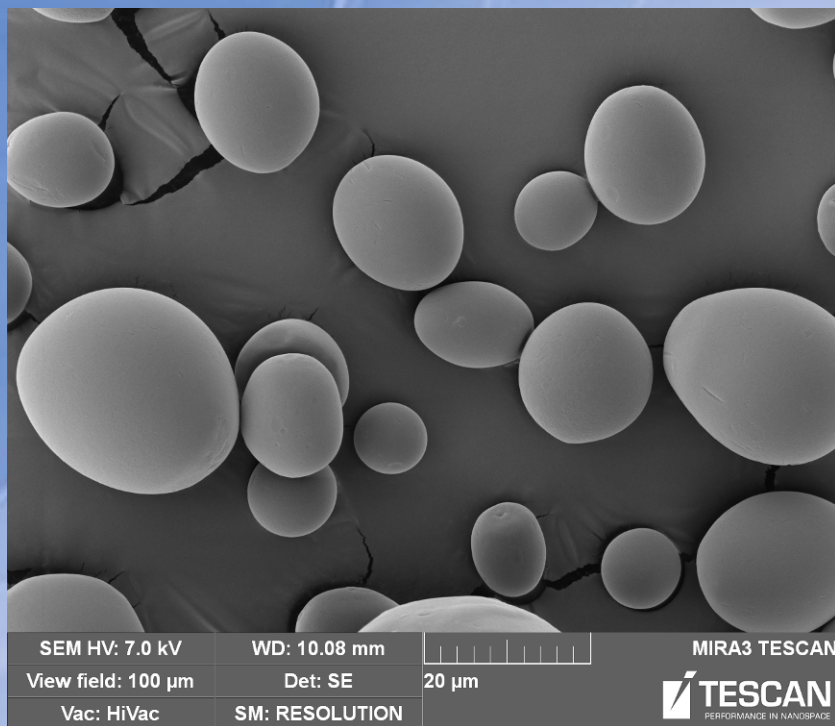
The determination of quality

- heat treatment



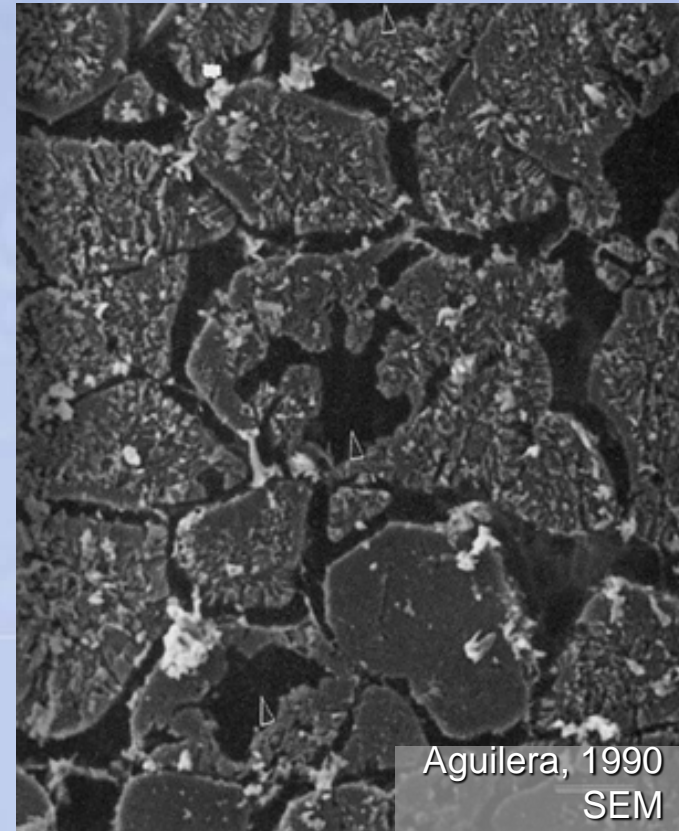
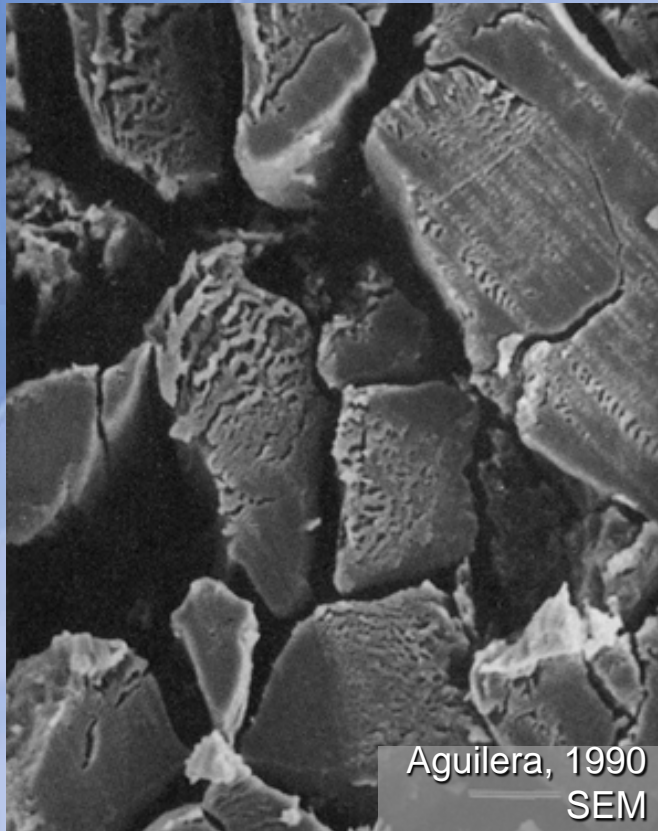
The determination of quality

- heat treatment



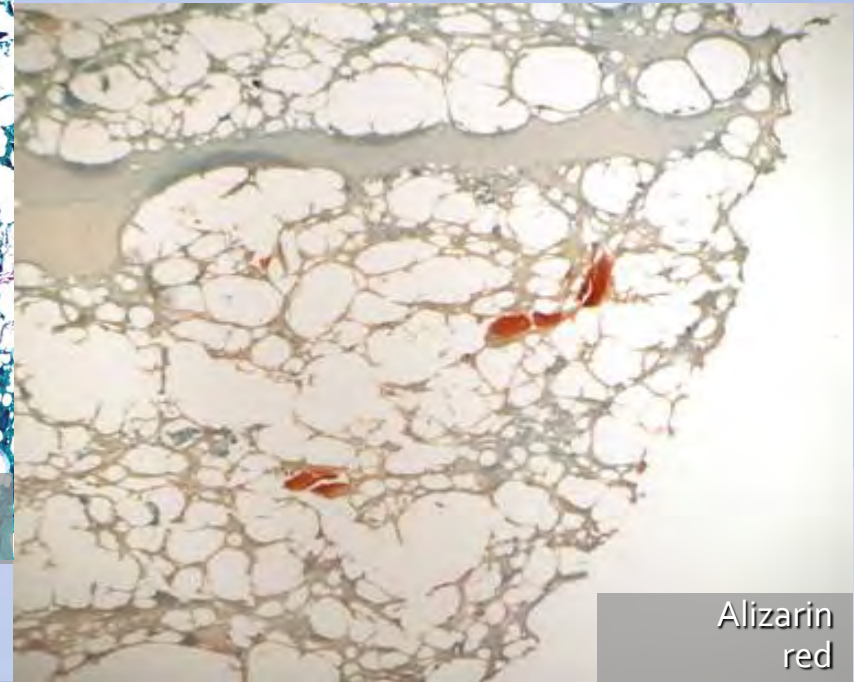
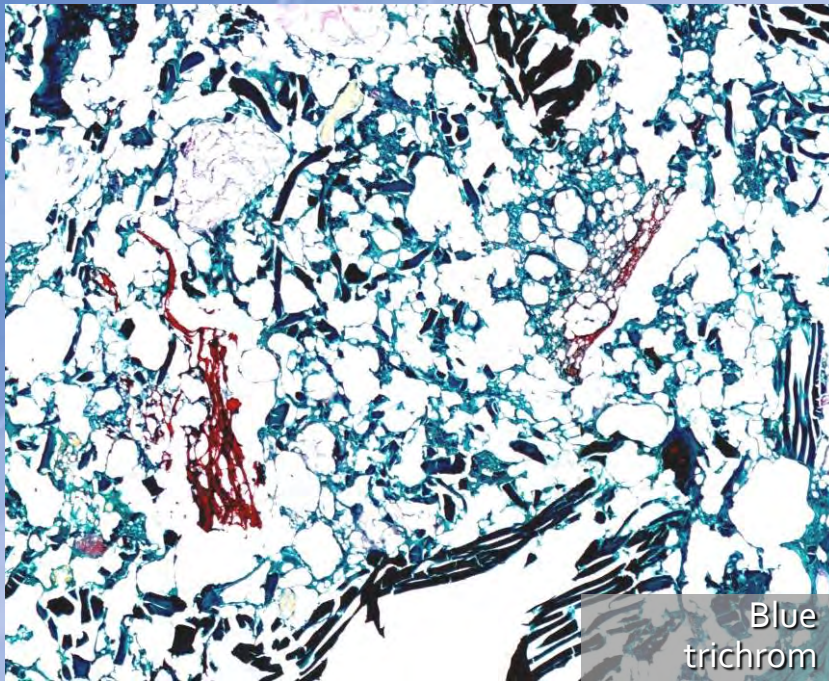
The determination of quality

- freezing



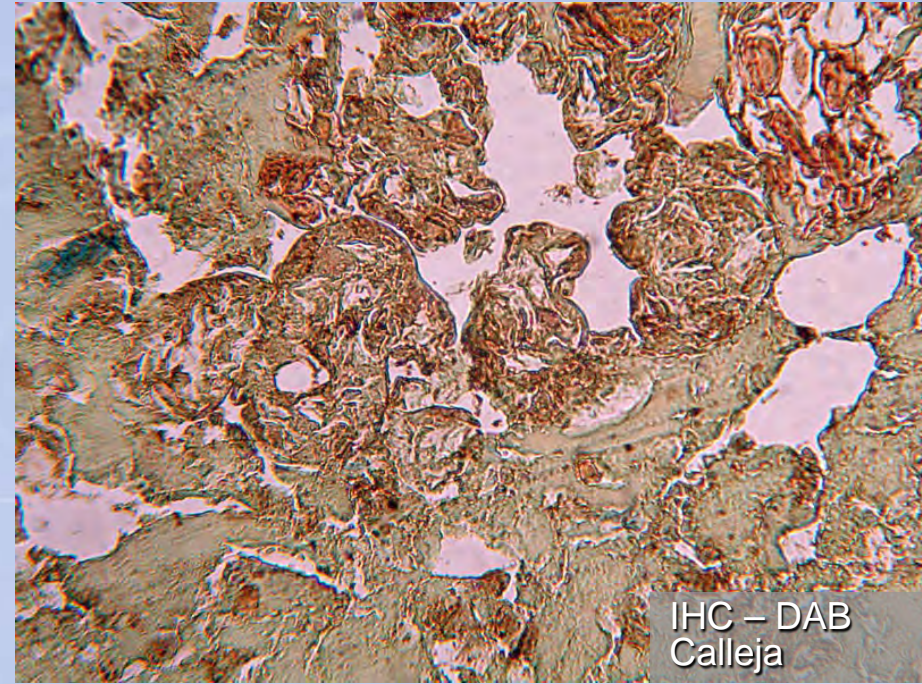
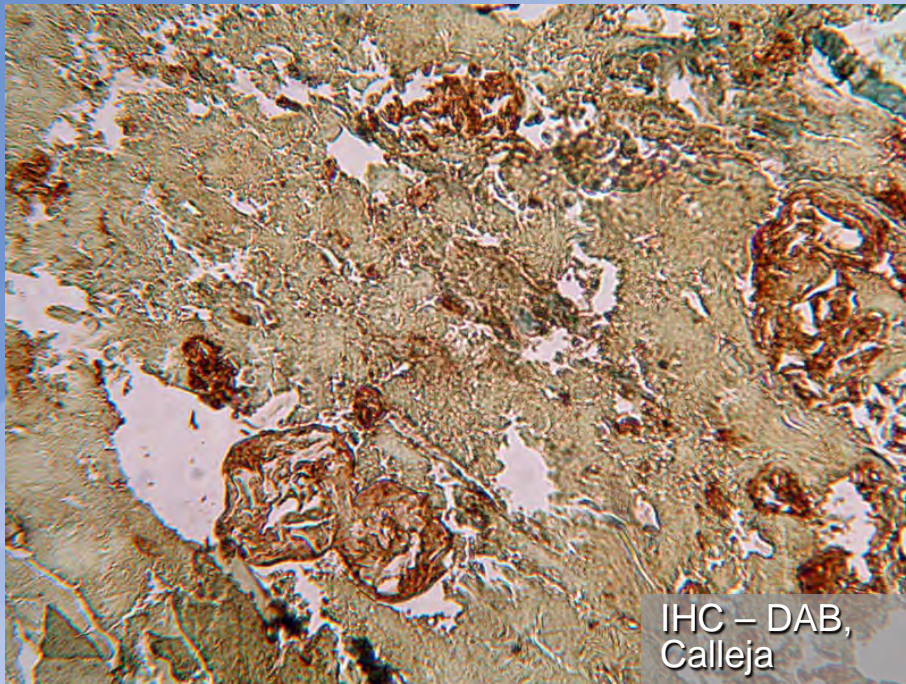
The determination of quality

- the use of inappropriate raw materials



The determination of quality

- distribution of food ingredients

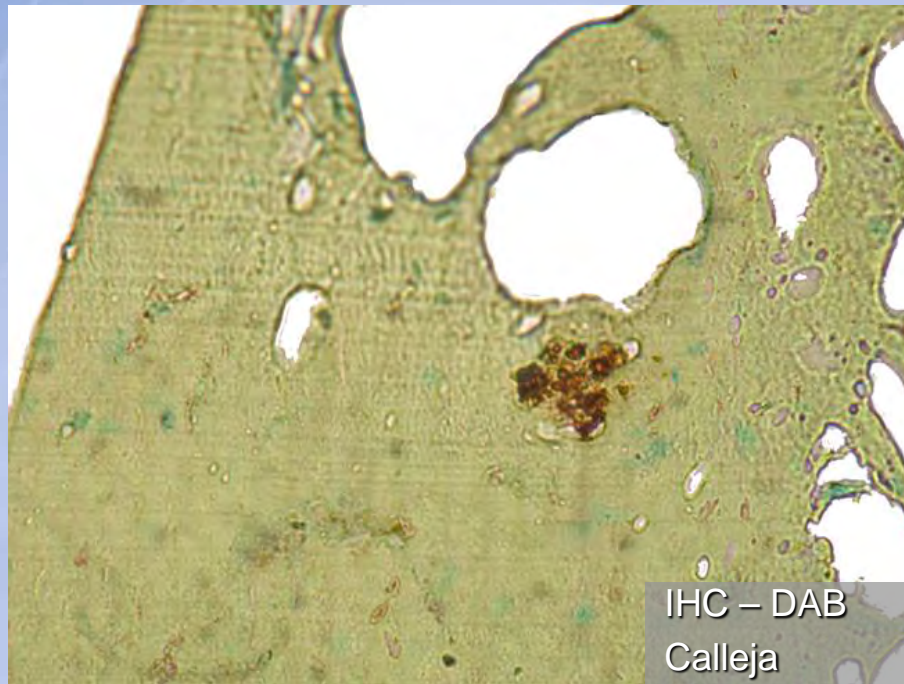


The detection of adulteration and hazardous components in food

- Consumer protection against hazardous substances
 - antinutritional substances
 - allergens
 - microbial contaminants
 - other hazardous substances

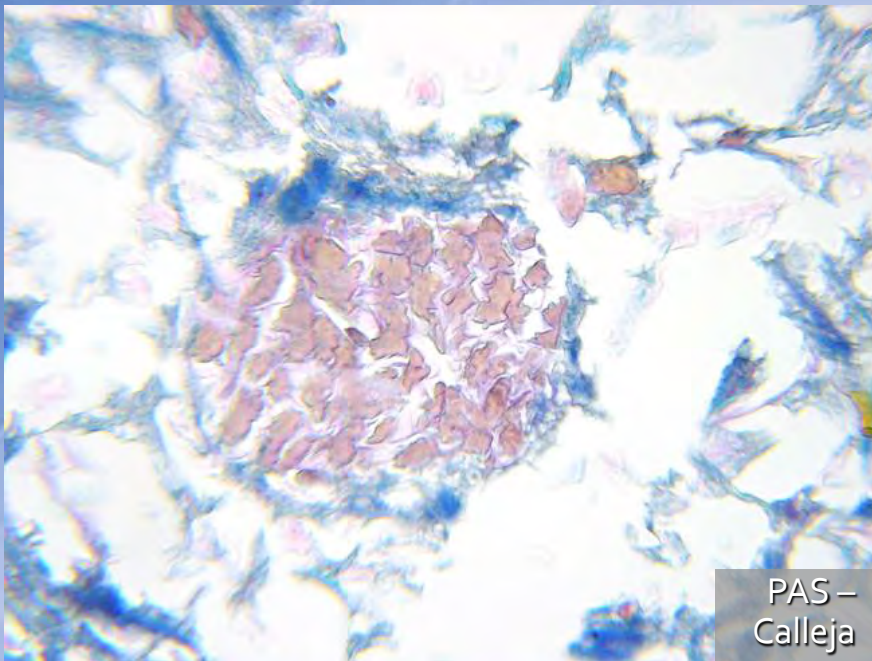
Detection of adulteration and hazardous components in food

- antinutritional substances

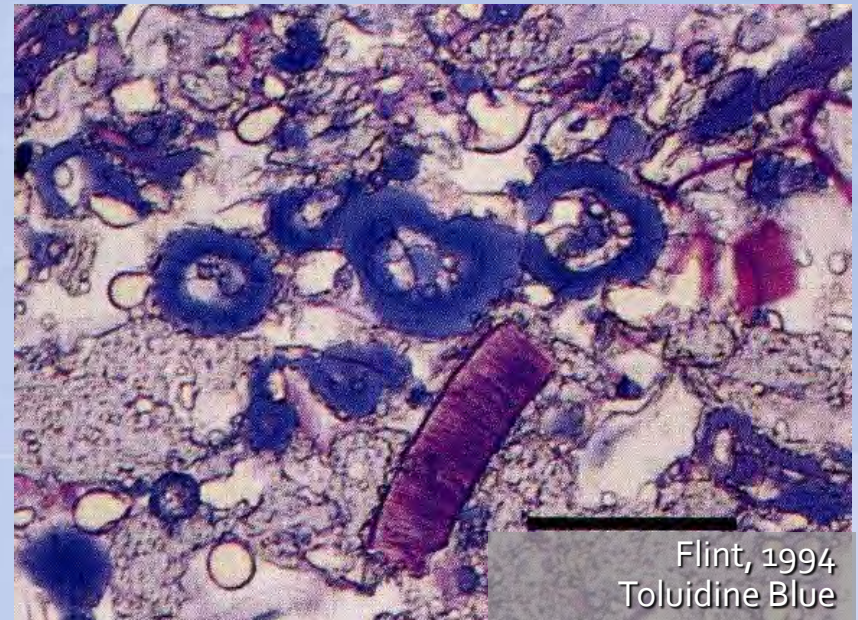


The detection of adulteration and hazardous components in food

- food allergens



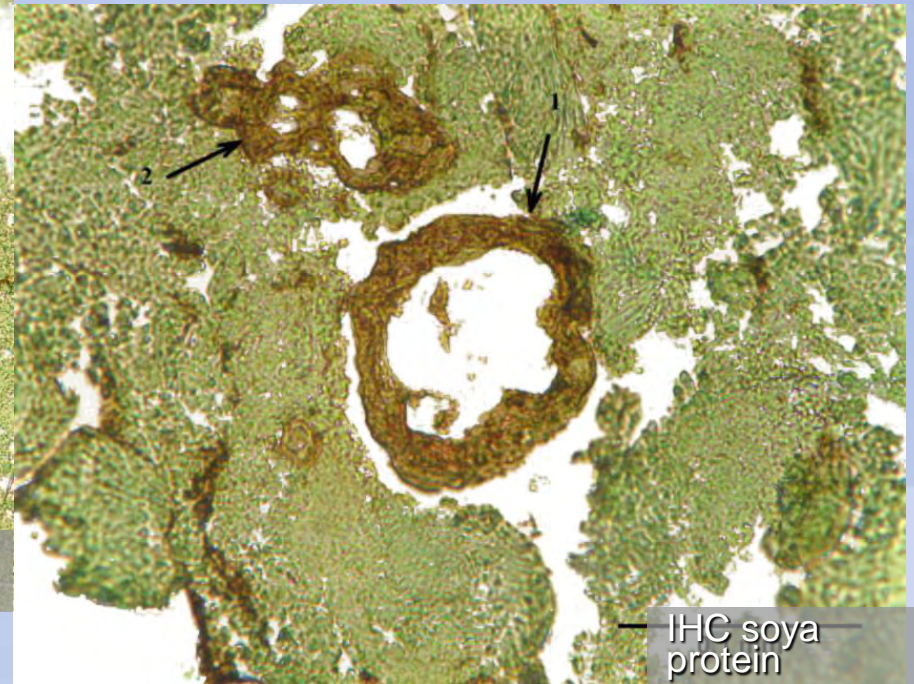
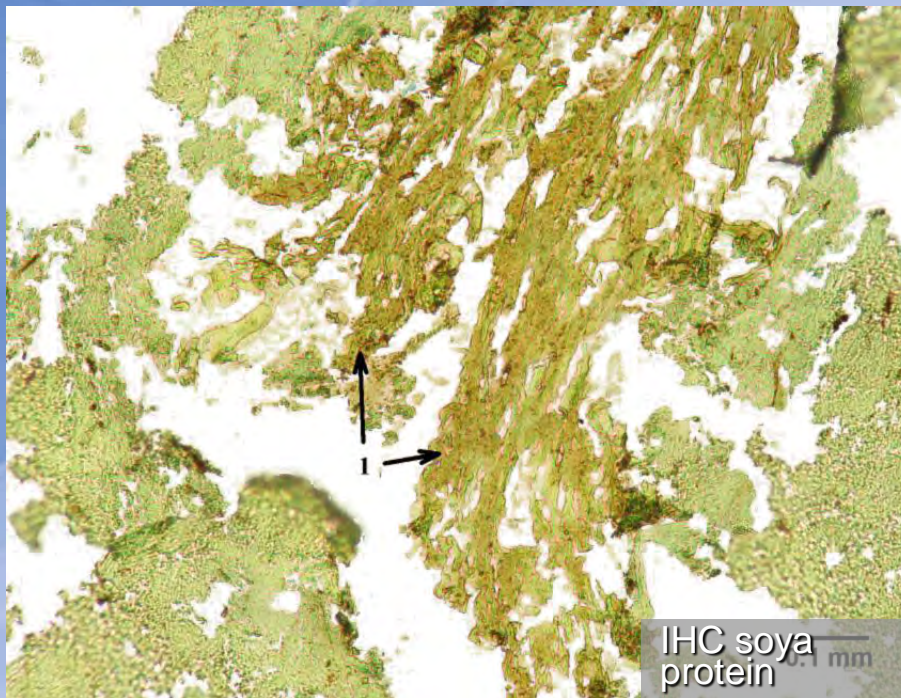
PAS –
Calleja



Flint, 1994
Toluidine Blue

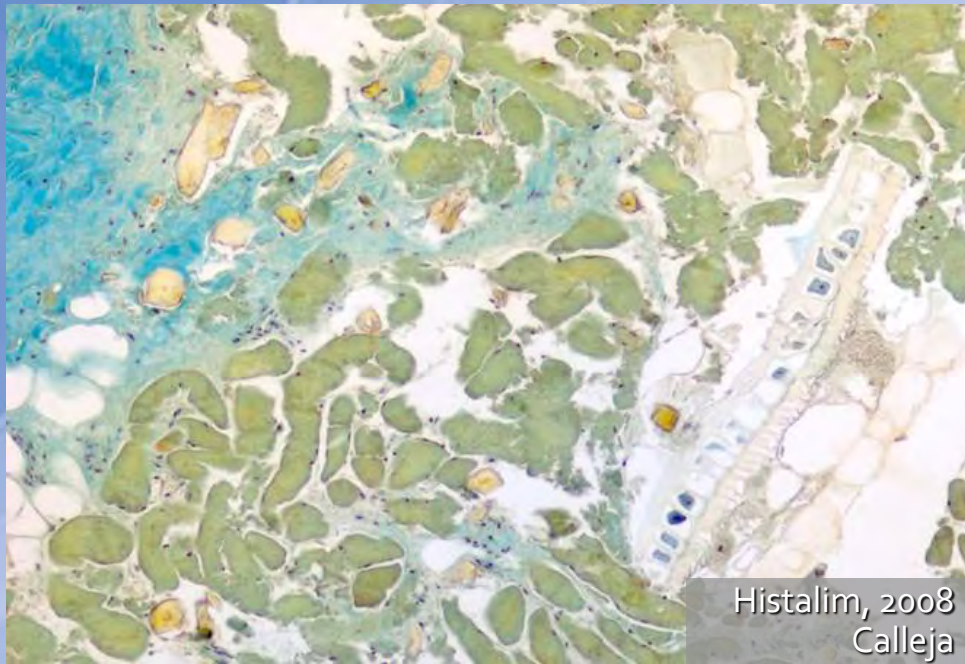
The detection of adulteration and hazardous components in food

- food allergens

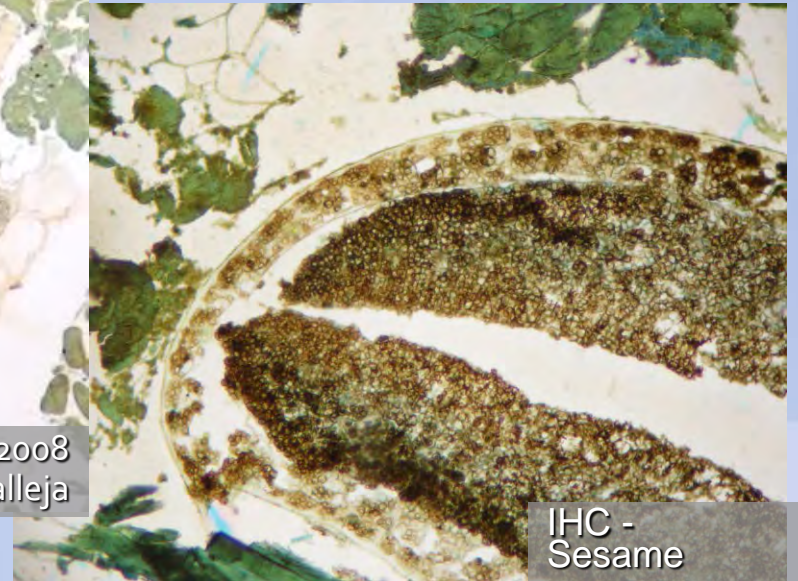


Detection of adulteration and hazardous components in food

- food allergens



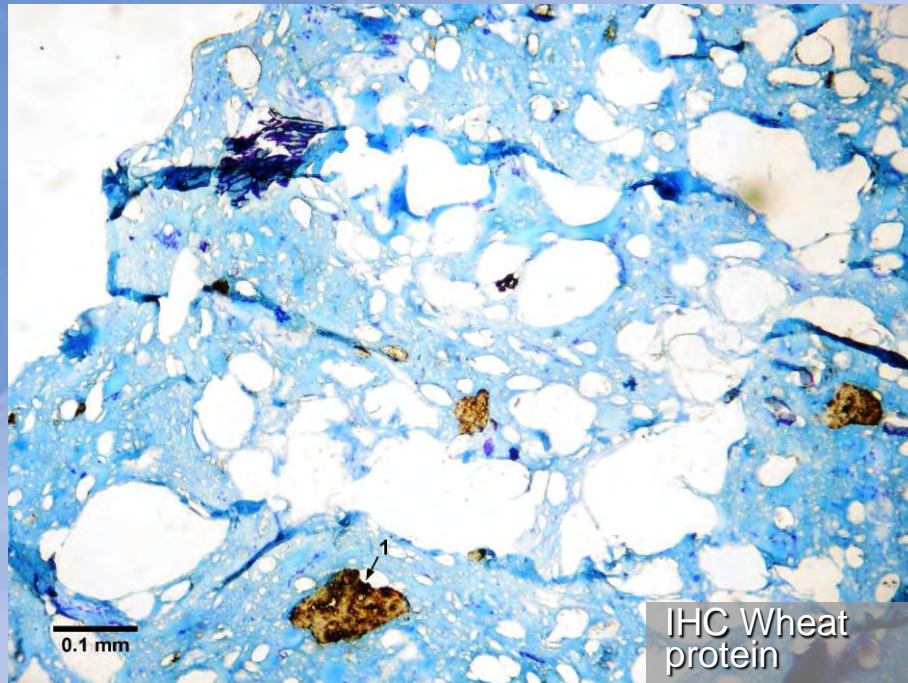
Histalim, 2008
Calleja



IHC -
Sesame

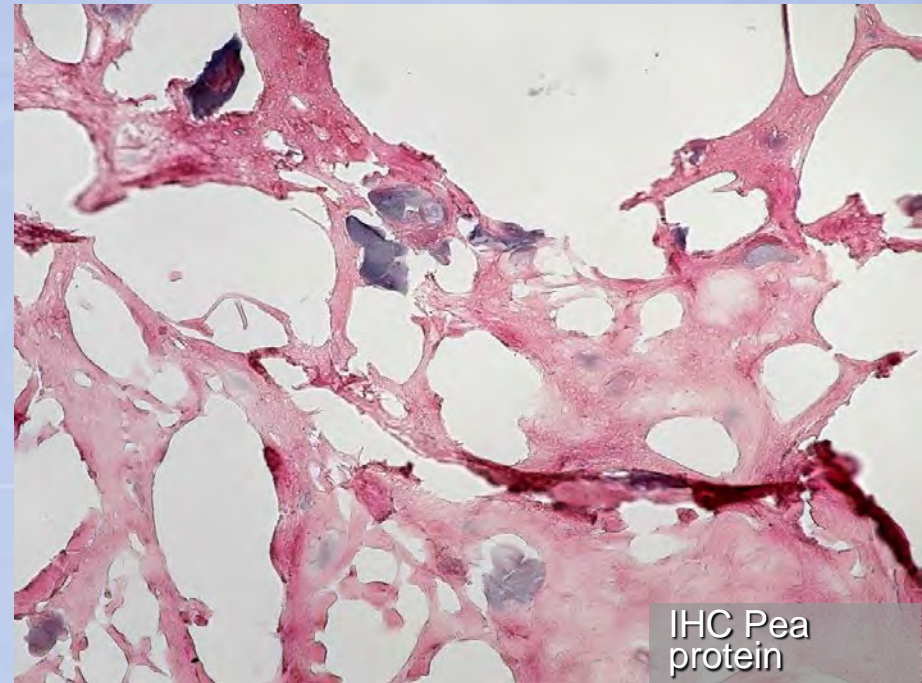
The detection of adulteration and hazardous components in food

- food allergens



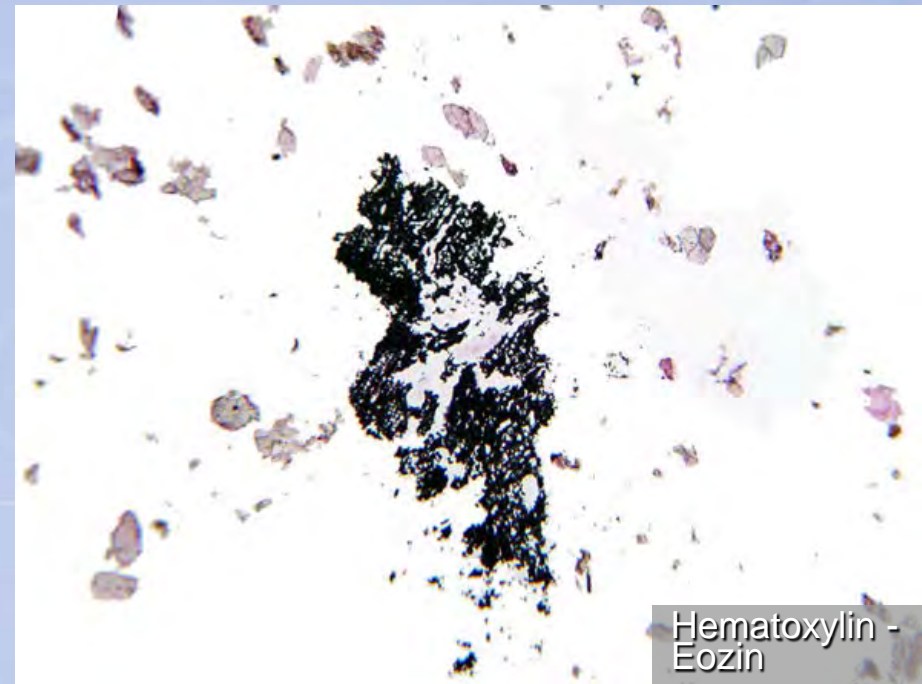
The detection of adulteration and hazardous components in food

- food allergens



The detection of adulteration and hazardous components in food

- hazardous substances

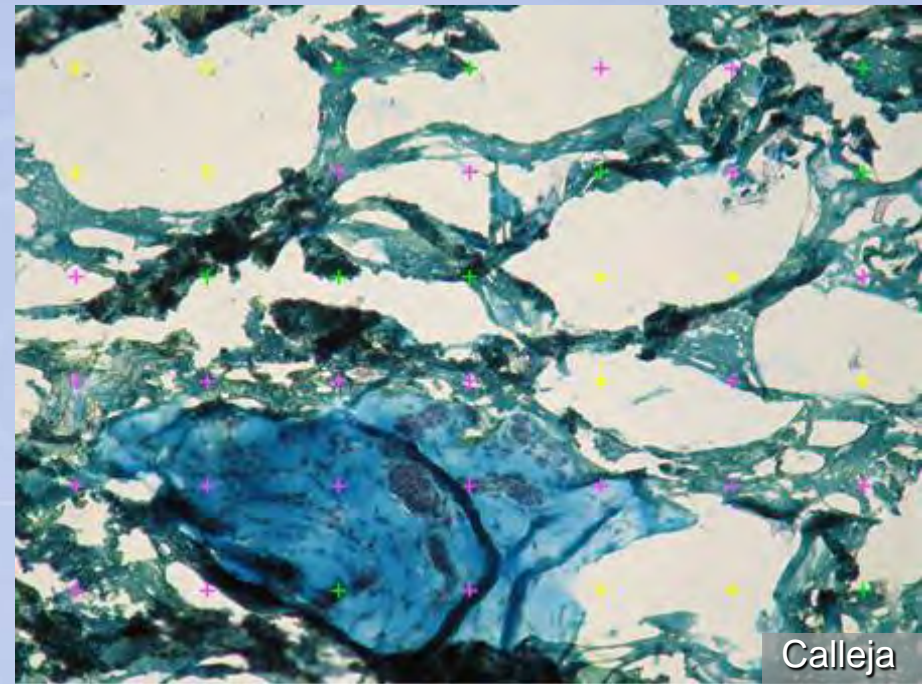


The **Quantitative** analysis of food ingredients

- histometry
 - approximate (verbal description)
 - exact (percentages, number of units)
- stereology
 - methods based on statistics
 - three-dimensional interpretation of two-dimensional images
- image analysis
 - use of modern computer technology
 - fast analysis
 - high objectivity

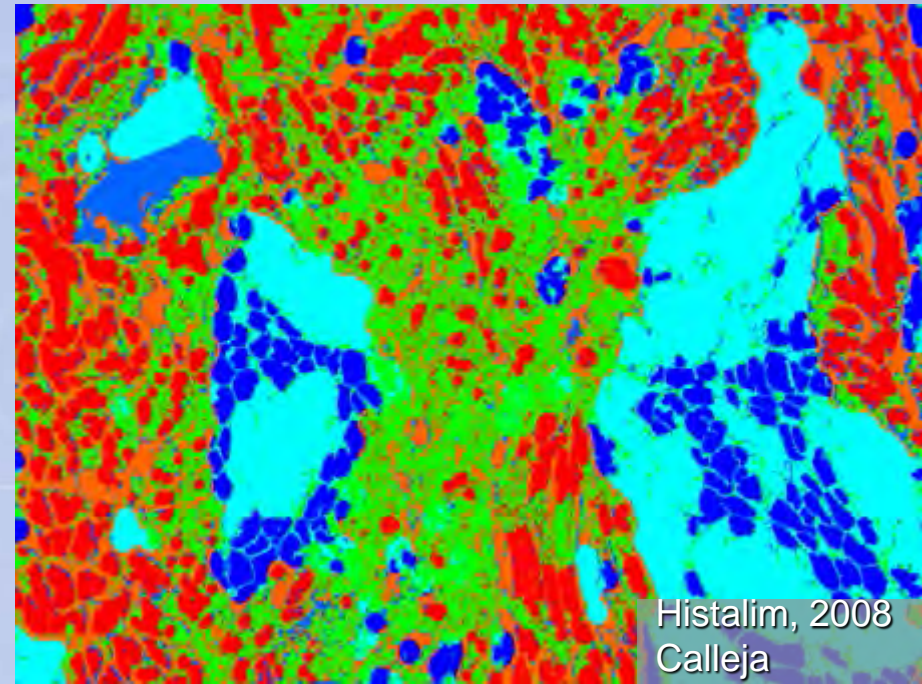
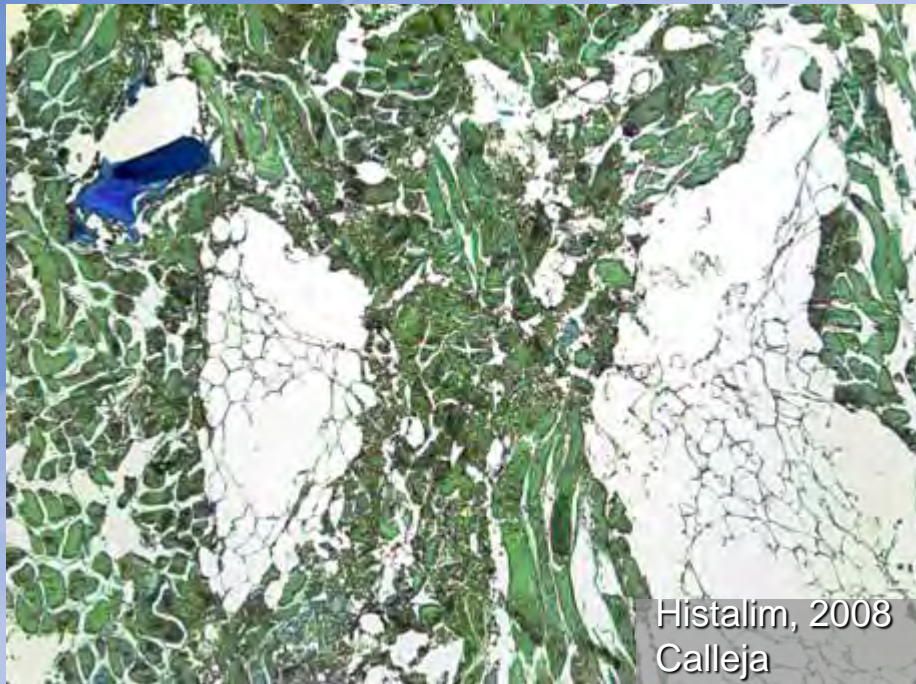
The **Quantitative** analysis of food ingredients

- stereology methods



The **Quantitative** analysis of food ingredients

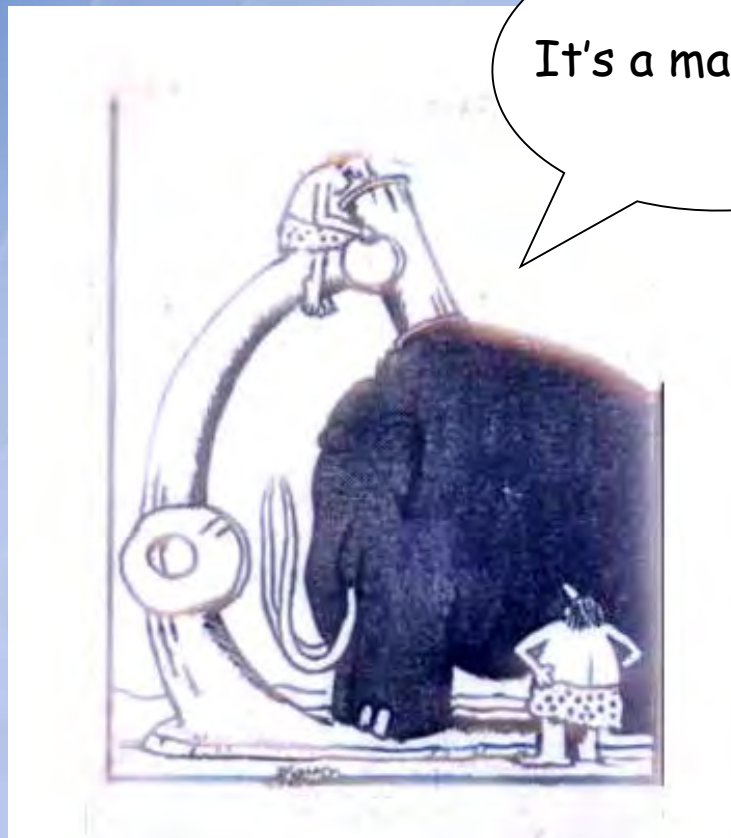
- image analysis



Conclusion

- microscopic methods may be an alternative to some chemical methods
- are indispensable in examination of the product structure
- more labour intensive and time consuming examination may be replaced by the complex microscopy examination
- with modern immunology methods (immunohistochemistry) most of the food components can be detected with high specificity

Thank you for your attention



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