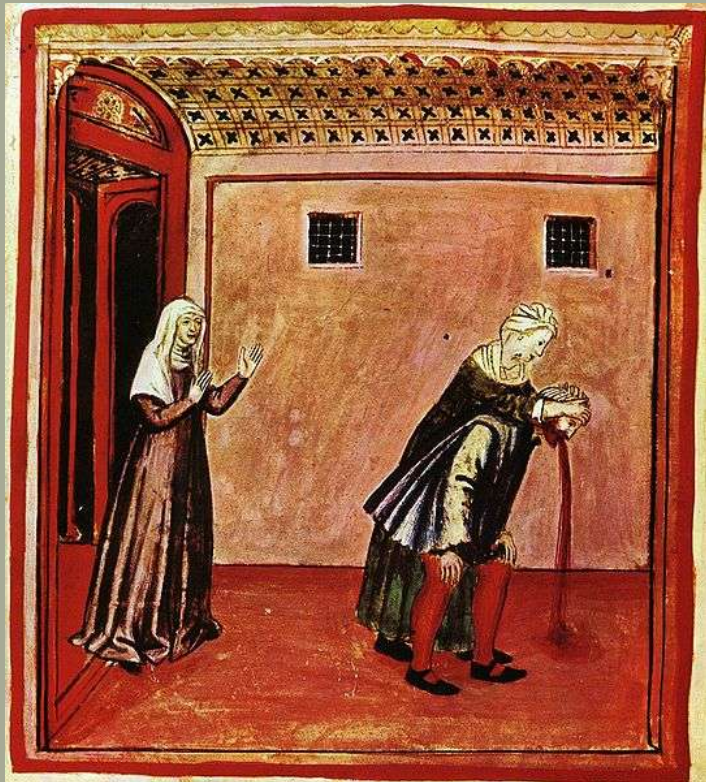


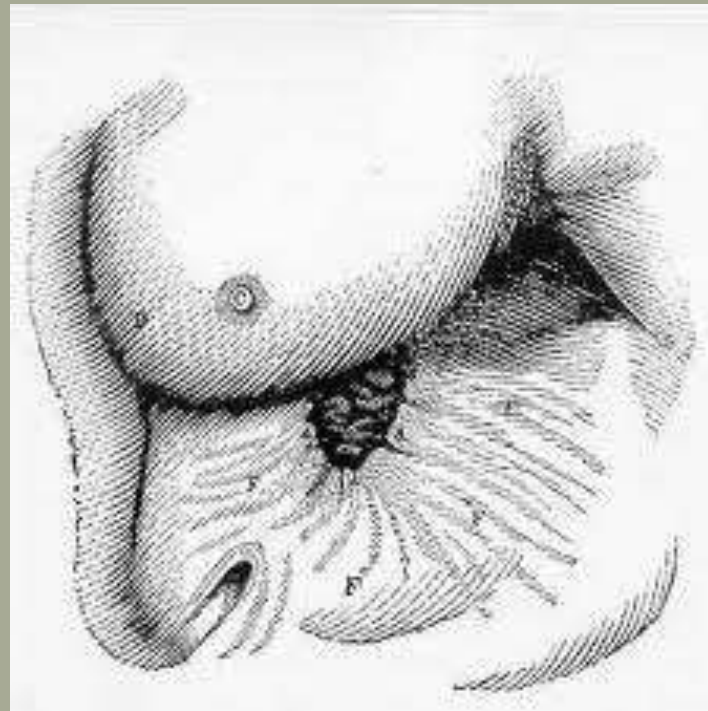
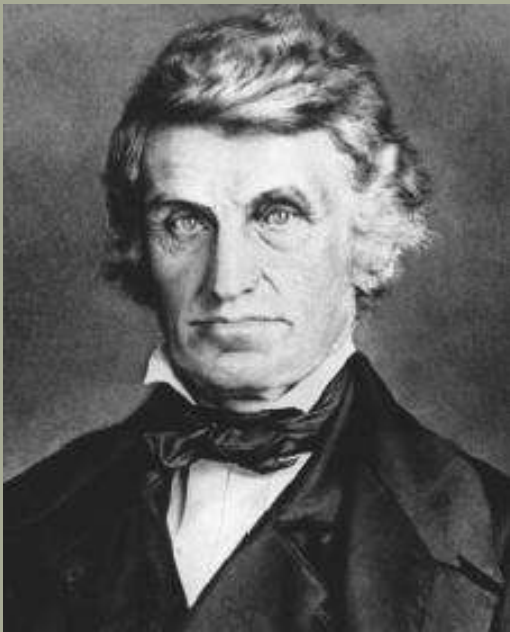
Case Studies and Methods in the Identification of Food Microtraces Derived from Vomit and Gastric Contents



William Schneck
Washington State Patrol Crime Laboratory

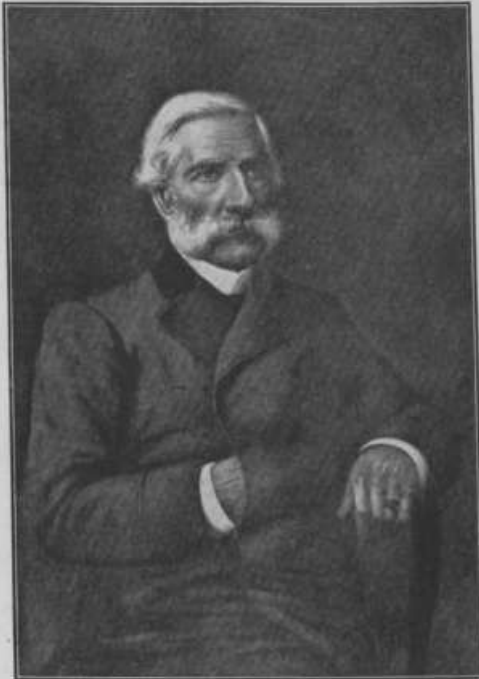
Historical Perspective

- ◉ William Beaumont M.D.
- ◉ *Gastric Juice and the Physiology of Digestion, 1833.*



Alexis St. Martin

Dr. Arthur Hill Hassall



DR. ARTHUR HILL HASSALL

AUTHOR OF "FOOD: ITS ADULTERATIONS AND THE METHODS FOR THEIR DETECTION"; AND OTHER WORKS

From the Picture, by Signor Italo Sabatini, in the Board Room at the Offices of the Royal National Hospital for Consumption and Diseases of the Chest.

Photograph by Messrs. Clark and Mann, 6, York Buildings, Duke Street, Strand.

WORKS RELATING TO FOOD,

CHIEFLY THOSE DEALING PROMINENTLY OR SOLELY WITH METHODS OF MICROSCOPIC INVESTIGATION. INCLUDED ARE SQUARE-BRACKETED REFERENCES TO CERTAIN EARLIER WORKS, IN WHICH THE MICROSCOPE WAS ENTIRELY, OR ALMOST ENTIRELY, NEGLECTED.

- [1820. ACCUM, F. A Treatise on Adulterations of Food, and Culinary Poisons.]
- [1831. WILLIAMS, J. D. Deadly Adulteration and Slow Poisoning; or, Disease and Death in the Pot and the Bottle.]
1843. DUJARDIN, F. Nouveau Manuel complet de l'observateur au Microscope . . . accompagné d'un Atlas. Paris.
- [1844. GARNIER, J. J. J., and HAREL, C. Des Falsifications des Substances Alimentaires. Paris.]
1844. DONNÉ, A. Cours de Microscopie. Paris.
1845. DONNÉ, A., and FOUCAULT, L. Atlas . . . Microscope-daguerréotype. Paris.
- [1848. MITCHELL, J. Treatise on the Falsifications of Food.]
1848. QUEKETT, J. T. A Practical Treatise on the Use of the Microscope. [Second edition, 1852.]
- [1850. NORMANDY, A. R. The Commercial Handbook of Chemical Analysis.]
1850. QUEKETT, J. T. Descriptive Catalogue . . . Histological Series . . . College of Surgeons. [Tissues of Vegetables.]
- [1850. CHEVALIER, J. B. A. Dictionnaire des Altérations et Falsifications des Substances Alimentaires, Médicamenteuses et Commerciales.] Paris. Later editions, 1875 (with E. Baudrimont), 1878, 1882 (sixth edition).
- 1852-54. QUEKETT, J. T. Lectures on Histology.
- 1851-52-53-54. HASSALL, A. H. Series of Reports on the Adulteration of Food, Drink, and Drugs. [Published in *The Lancet* under the title of the 'Analytical Sanitary Commission.']

3. *Mesocarp (mes)*. Owing to the presence of numerous stone cells (*st*) this layer is strikingly different from the mesocarp of the other com-

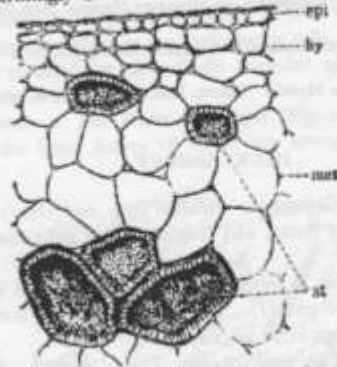


FIG. 291. Huckleberry. Cross section of outer portion of the pericarp. *epi* epidermis; *hy* hypodermis; *mes* mesocarp; *st* stone cells. $\times 160$. (WINTON.)

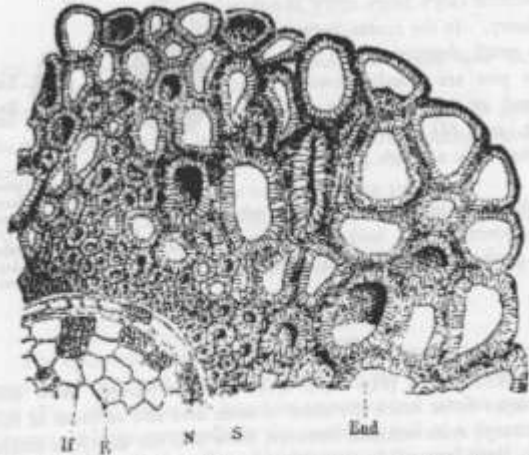
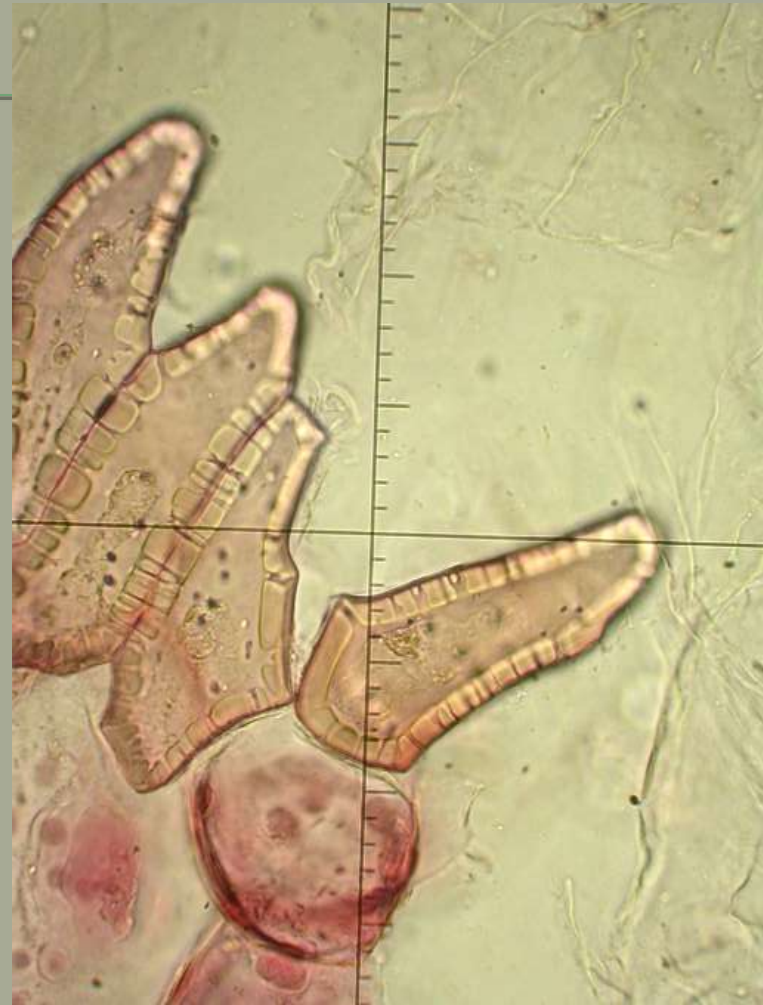


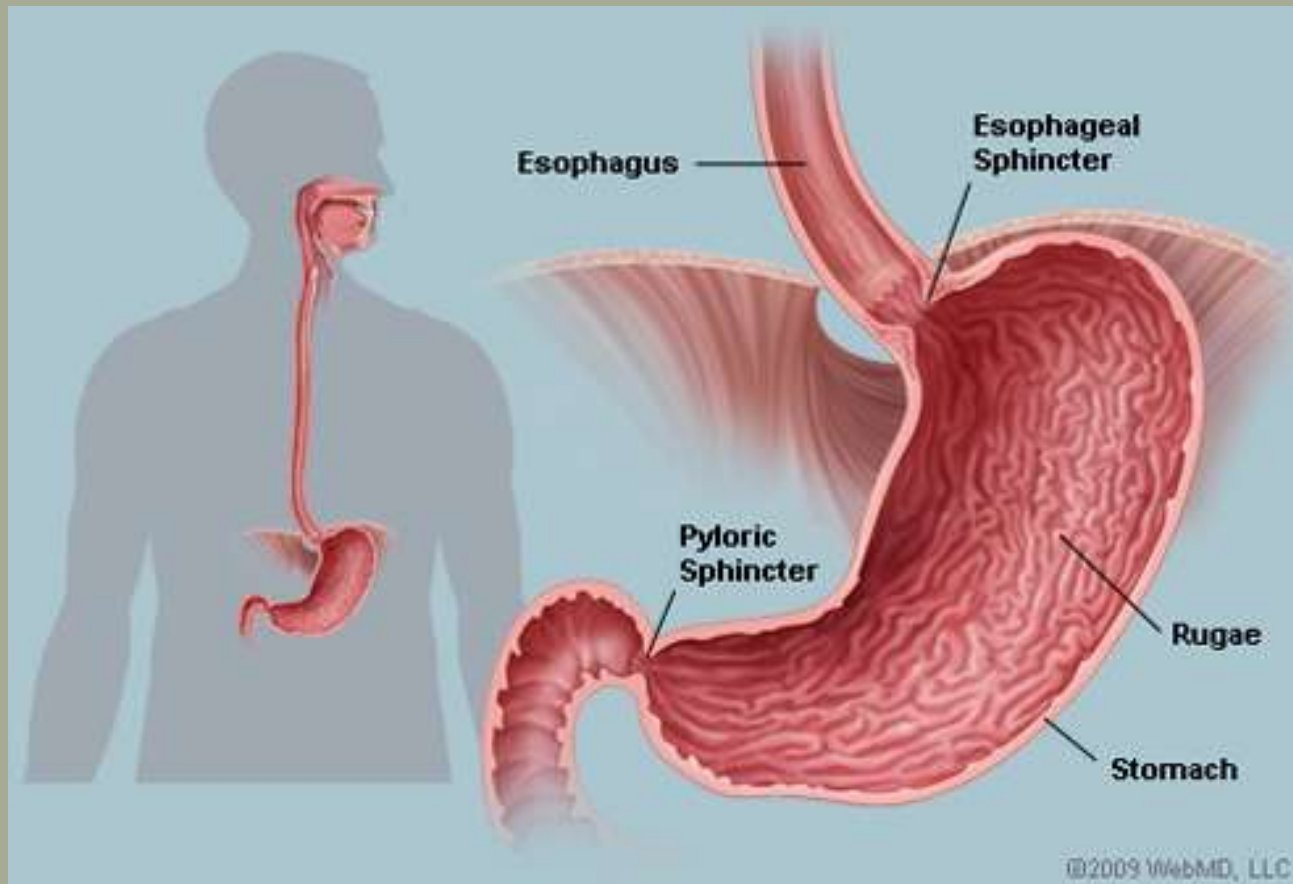
FIG. 292. Huckleberry. Cross section of endocarp and seed. *st* endocarp with large isodiametric stone cells and *lf* narrow longitudinally extended fibers; *S* spermoderm; *N* perisperm; *E* endosperm. $\times 160$. (WINTON.)



The Microscopy of Vegetable
Foods, Winton, A.L., Moeller, J.,
1906

Huckleberry Honey

Human Anatomy and Physiology



Digestion process times:

Mouth: 0-2 minutes

Stomach: 2-6 hours

Small intestine: 2-8 hours

Large intestine: 6-9 hours

Total time 10-25 hours

Rate of Gastric emptying affected by:

Volume of the meal

Caloric content

pH

Temperature

Electrolyte content

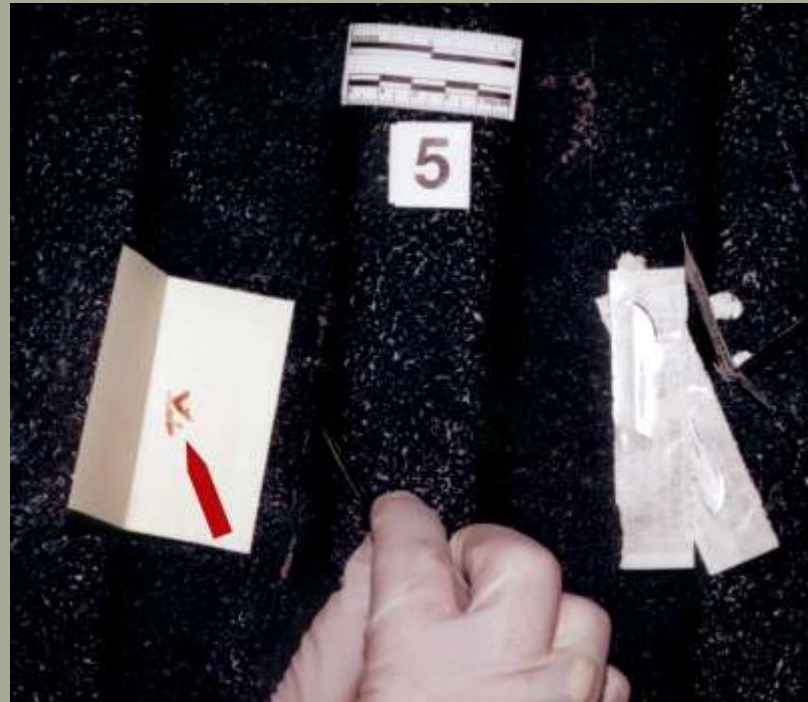
Exercise

Level of hydration

Individual variation

Collection of dried vomit stains

- Particle picking and scrapping
- Re-hydration to preserve structures
- Describe contact deposition of stains
 - Smears
 - Wipes/swipes
 - Drips



Vomit stain on side of Mazda

- Downward angle
- Gravitational flow
- Soot overlying vomit



Gastric Contents Examination

- Photograph container, remove contents, obtain weight and photograph.
- Visual examination, look for any obvious particles (seeds, non-foods, etc)
- Stereomicroscopy
- If sufficient quantity, divide sample and retain half for other examiners.
- Add solution of 70% ethanol or formalin

Time of death determination:

College student found outdoors.
Date & time stamped Taco Time receipt.
Do the stomach contents match receipt?



Gastric Contents Procedures

- Sieve contents to clean and separate large and small pieces
- Store in clear labeled Petri dishes and photograph
- Save fine fluids for possible latter examination



Sieves



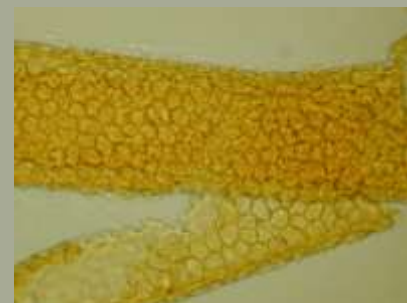
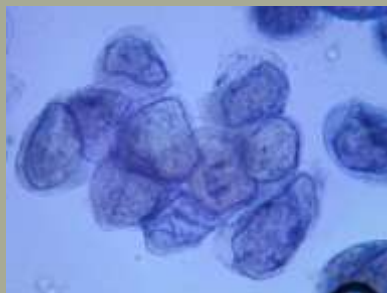
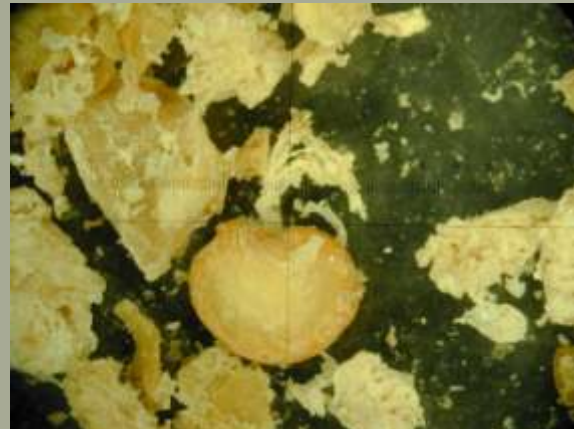
coarse sieve sample



fine mesh sample

Gastric Contents Procedures

- Stereomicroscopy of particles in each sieve fraction
- Identification at this stage may be possible (e.g. seeds, corn, nuts..)



Q stained with Trypan blue

'Mexi-Fries'

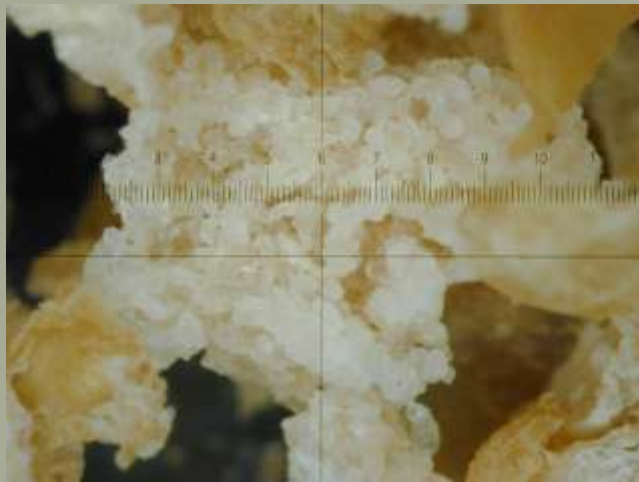
Q cellular structure

Yellow bell pepper

Gastric Contents Procedures

Comparative Analysis using known foods

- Chew known about 40 times and deposit in Petri dish
- May want to add preservative such as 70% ethanol or FAA
 - 5 ml 100% formalin (37% formaldehyde)
 - 90 ml 70% ethanol
 - 5 ml glacial acetic acid
- Stain if necessary, describe and compare to Q material



Q Gastric



Chewed bean burrito

Gastric Contents Procedures

Some Stains and Microchemical Tests

- General differential stain

- Toluidine blue (CI 52040)

- Starch

- Aqueous Iodine solutions
- Trypan Blue

- Lipids

- Oil Red O

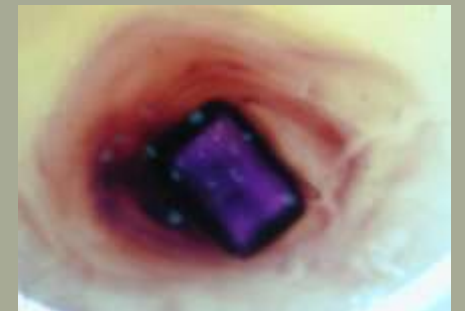
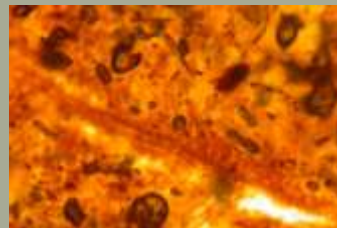
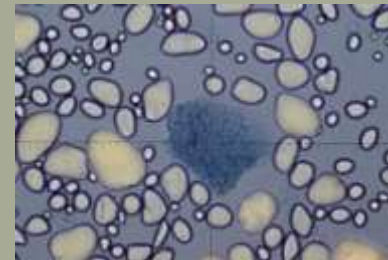
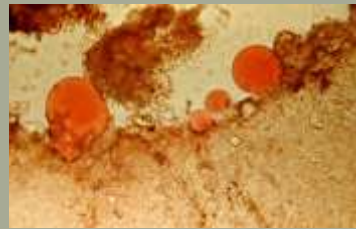
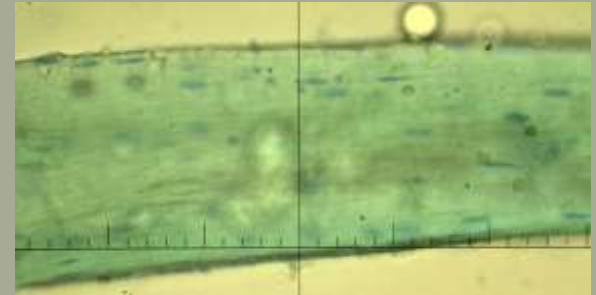
- Safranin

- Clearing agents

- Chloral hydrate

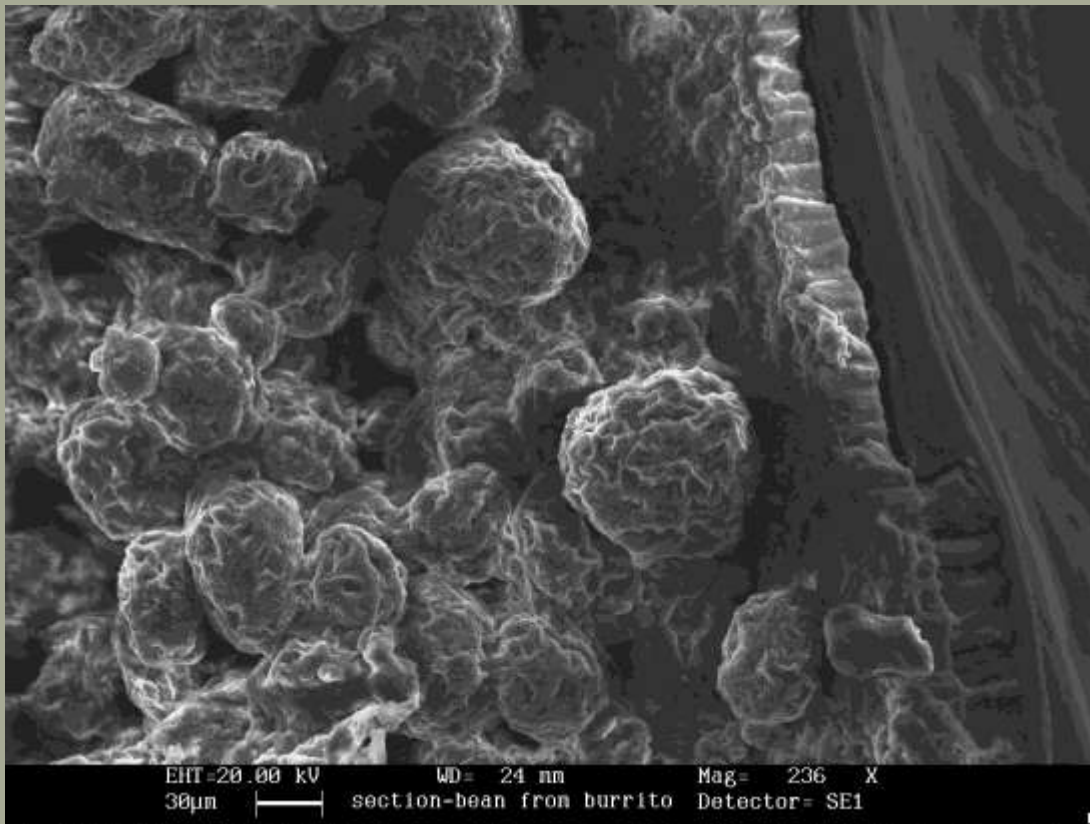
- Sugar

- Naphthol test



Gastric Contents Technical Procedures

Scanning electron microscopy vs PLM

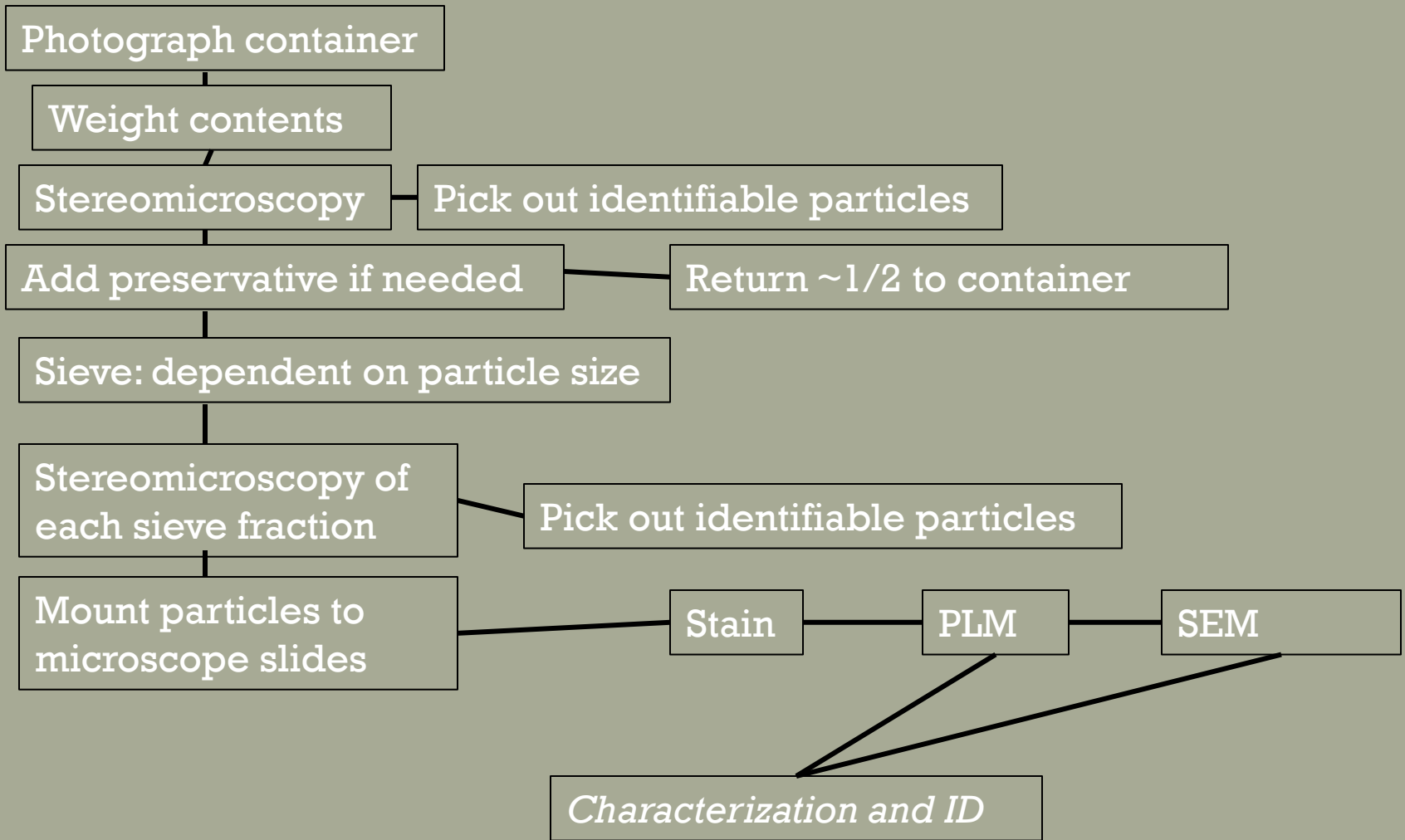


Summary

- V debt's Taco Time charge of \$5.47 on 1-27-xx at 18:22.
- V last seen alive by husband ~ midnight and into morning of 1-28-xx.
- V reported missing by husband on 1-29-xx.
- V body found on 2-6-xx
- Gastric contents contained:
non-meat bean taco or burrito.
 - Pinto beans
 - Yellow bell pepper
 - Fried potato
 - Corn starch
 - Wheat starch
- Gastric contents consistent with receipt
- Victim probably died early on 1-28-xx



Gastric Contents Processing in Lab



Gastric Enzyme Testing

Test for “Rennin-like” Activity

Lee, Gaensslen, Galvin & Pagliaro, *Enzyme Assays for the Identification of Gastric Fluid, JFS, January, 1985, pp 97-102.*

Pepsin: a proteolytic enzyme found in the gastric secretions of mammals.

Rennin (also called chymosin): a gastric enzyme known to curd milk.

Materials Needed

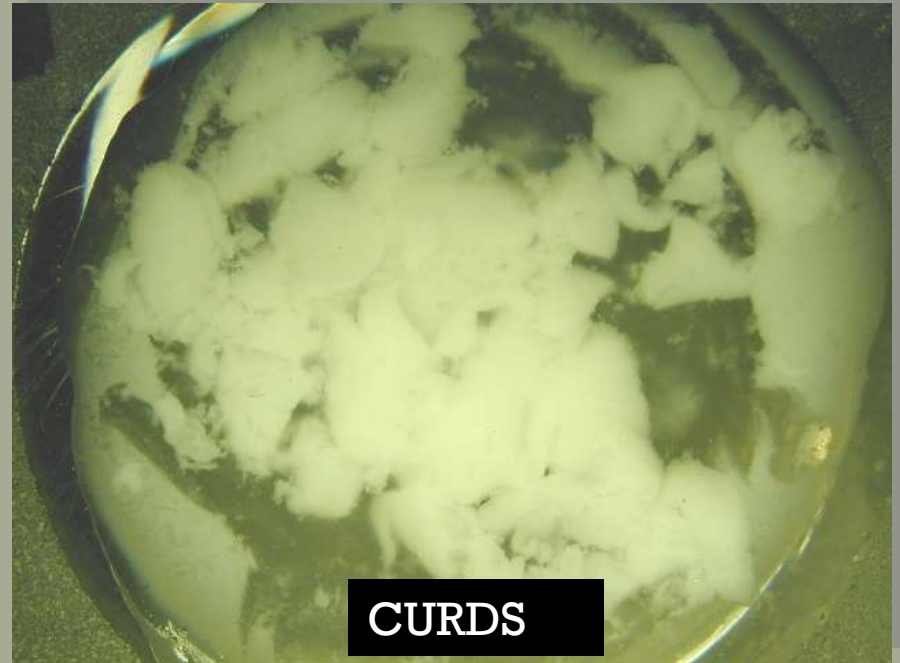
- **Whole cow's milk**
- **Dried vomit 'standard'**
- **Samples to test**
- **Oven set at ~38 degrees C x 30 minutes**
- **Humidity chamber**
- **Clear spot plate or cavity slides**
- **Pipettes**
- **Stereo microscope**

Place in oven for 30 minutes @38 C

Before

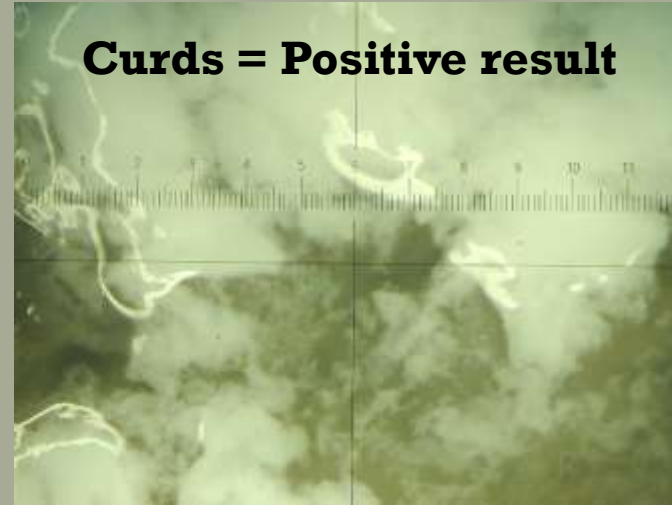
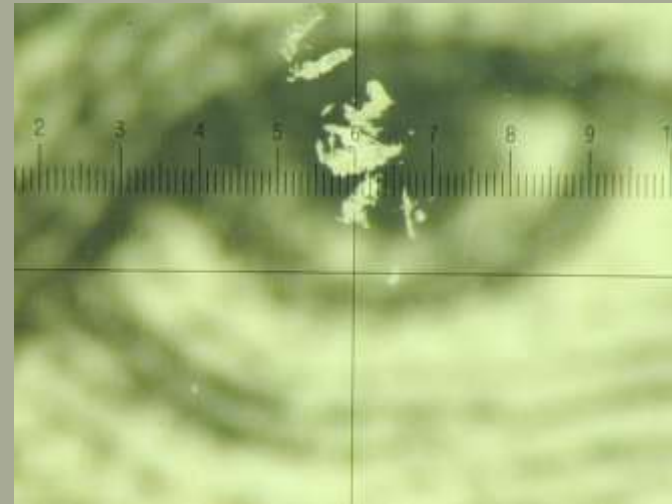
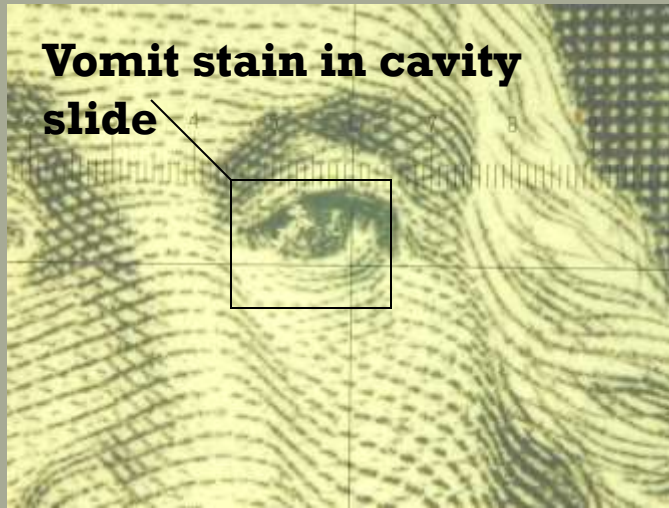


30 minutes later



Micro-scale vomitus testing

\$1.00 bill for scale



#1. Case Study: The last meal



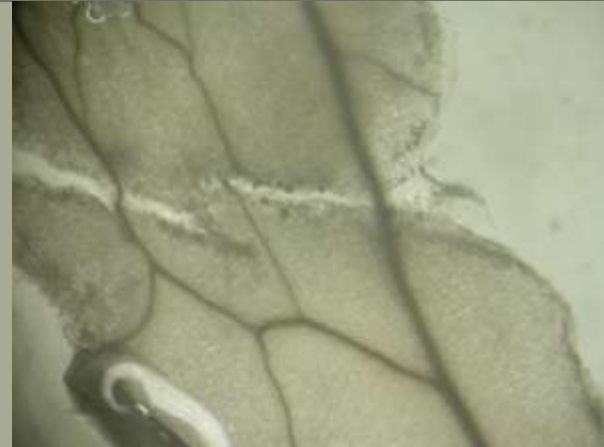
Particle pick



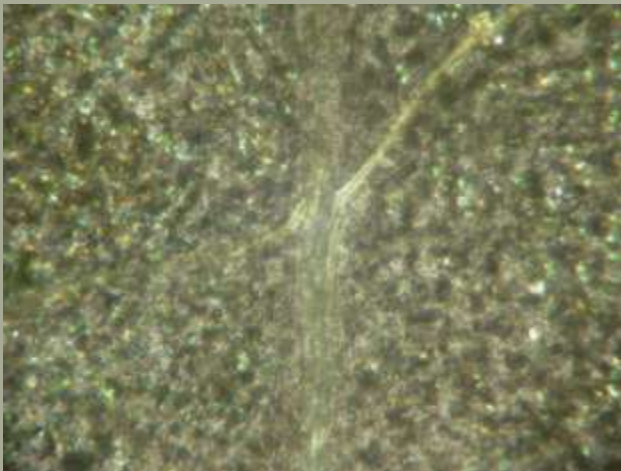
Botanicals in the gastric contents



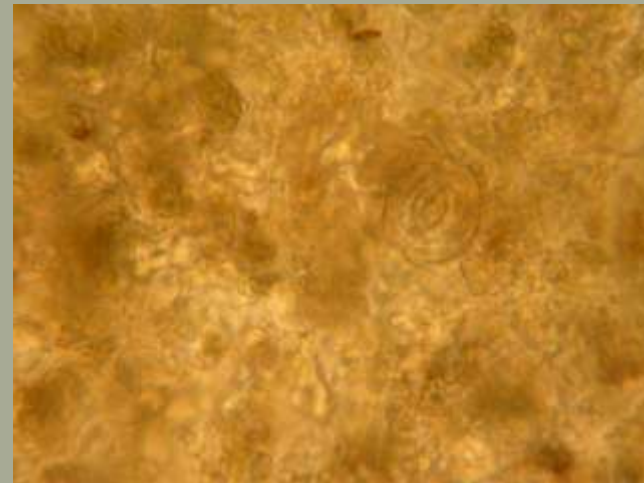
Epidermal tissue



Veins

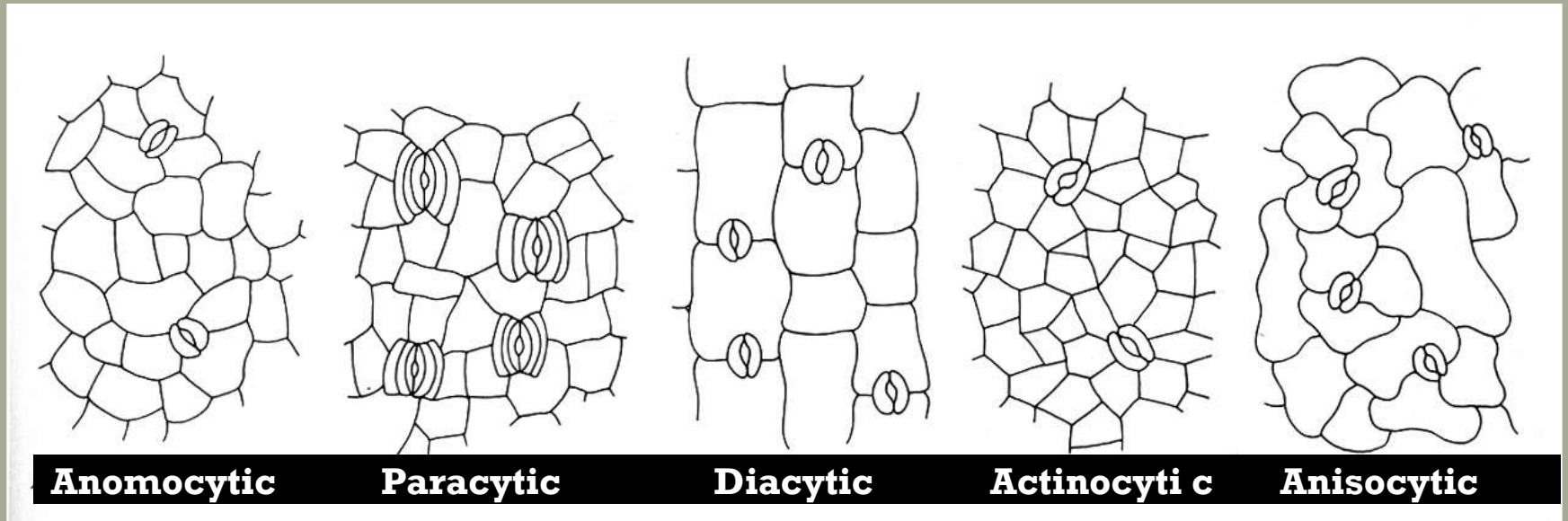


Vasecentric tracheids



Stomata in epidermis

Types of Stomatal Complexes



Anomocytic – no obvious subsidiary cells

Paracytic – subsidiary cells parallel to guard cells

Diacytic – 2 large subsidiary cells perpendicular to guard cells

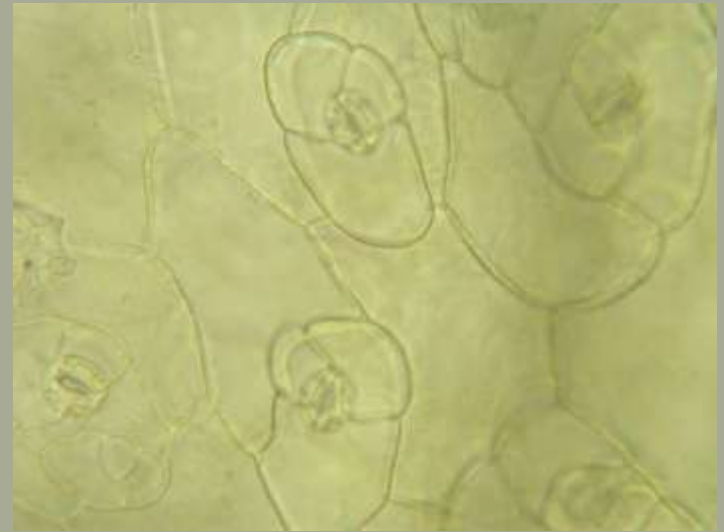
Actinocytic – many subsidiary cells radial to guard cells

Anisocytic – 3 unequally sized subsidiary cells

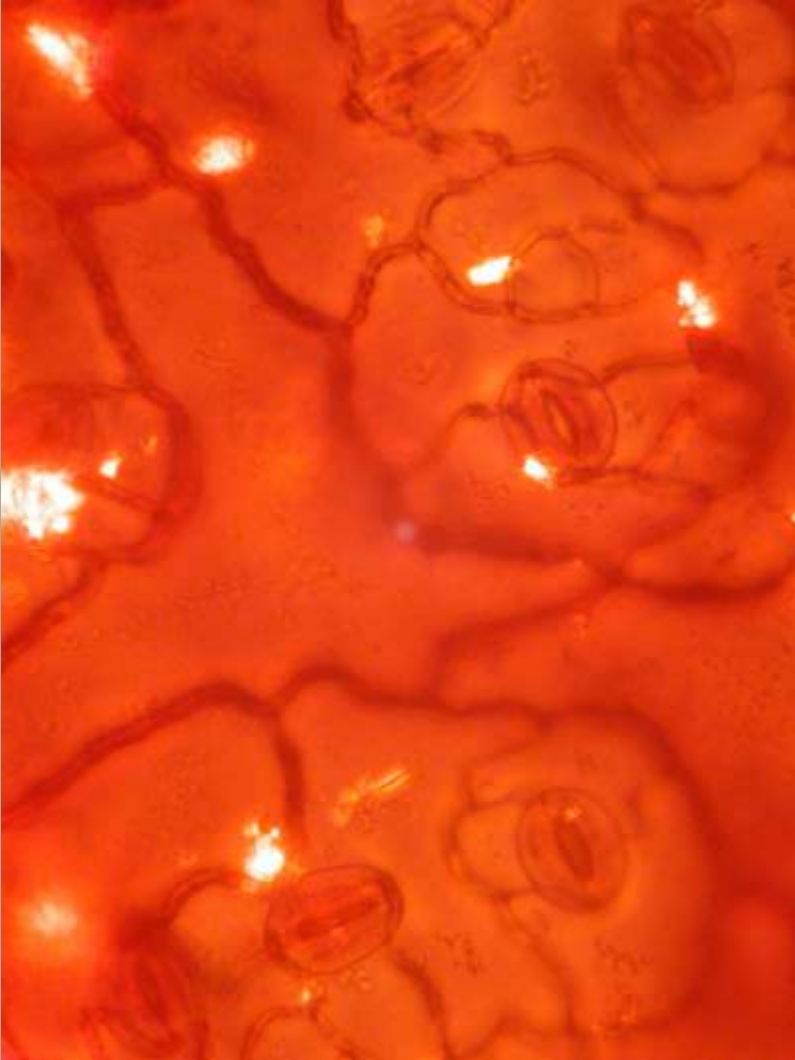
Comparison examinations of specific vegetables



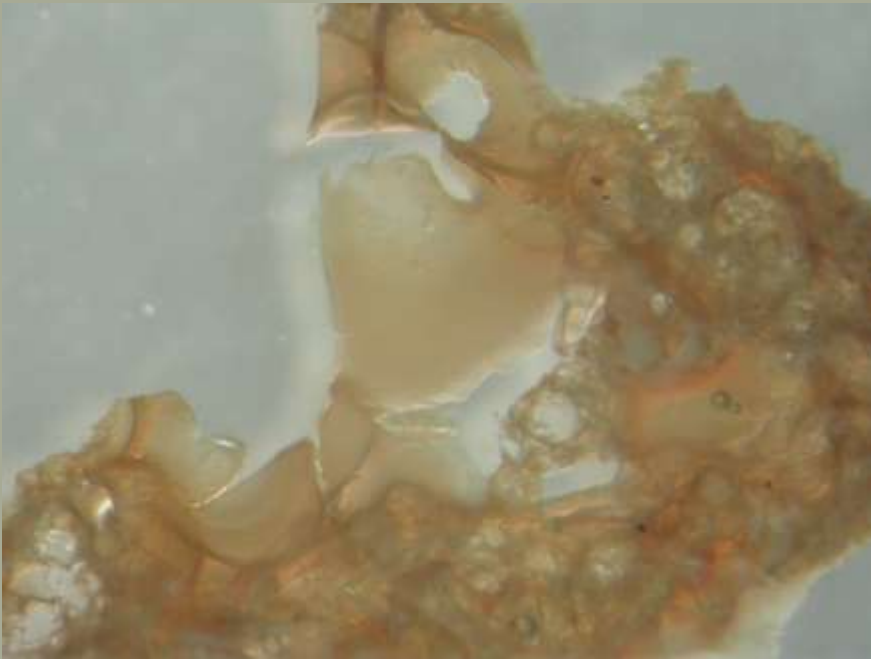
Stomatal comparisons



Bok Choy



Other ingredients

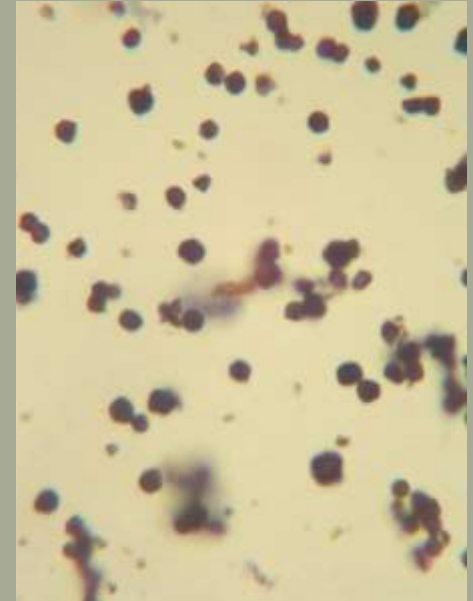


Gastric contents. FTIR = chitin

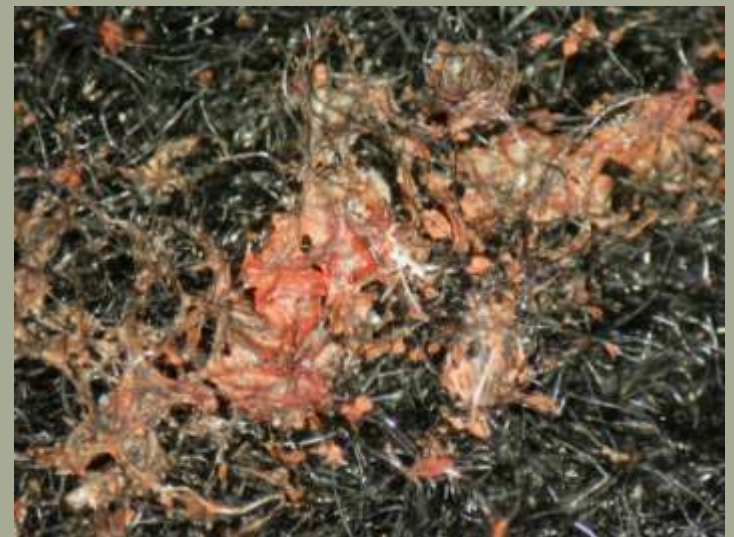
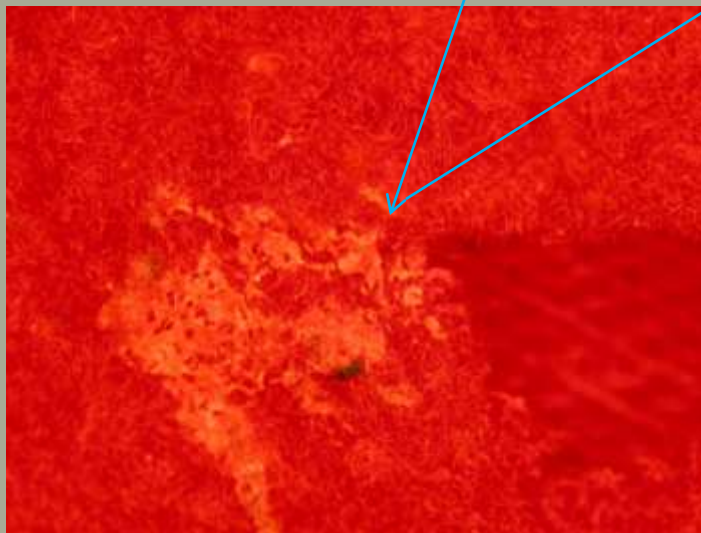
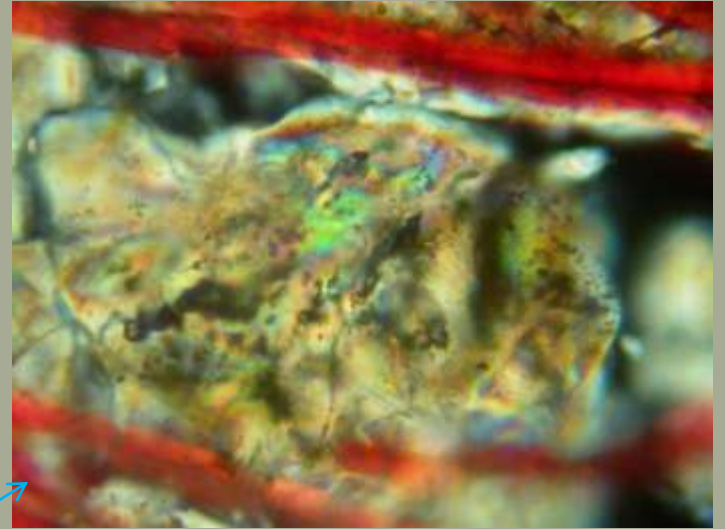
Chitin : Main component of arthropods such as crustaceans (shrimp) and insects.



Peppercorn fragments



#2 Case Study: Airway obstruction: unattended Death



Hard candy found in vehicle



#3 Case Study:

Fractured arm in restroom

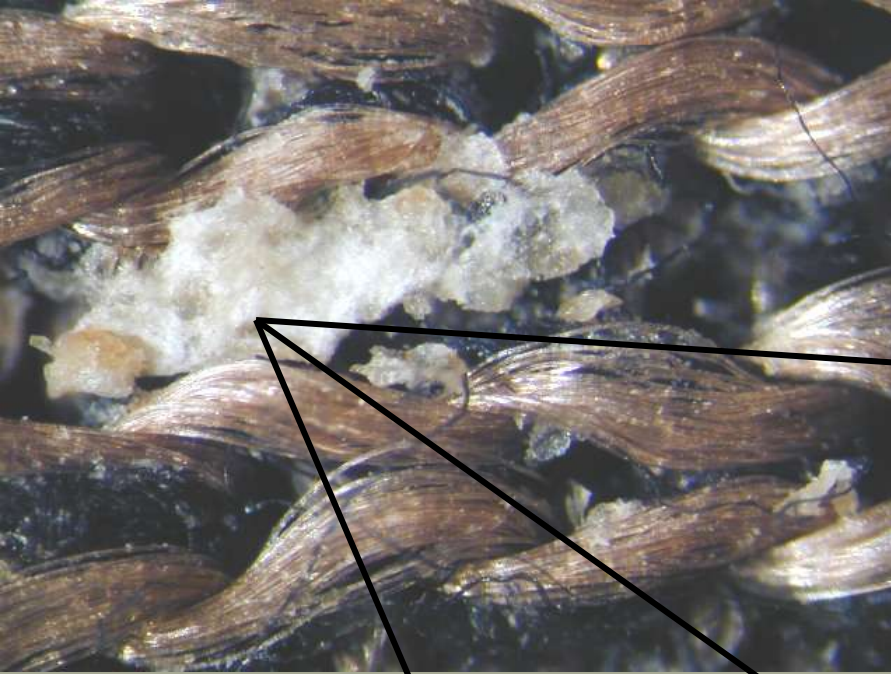
- Civil Litigation
- Victim allegedly slipped on greasy floor in restaurant bathroom.
- Victim sustained fractured arm.
- Opposing expert observed oil/grease on back of pants.



Clothing Examination



FOOD ID



Potato starch



Plant seed hairs



Wheat: cells in the endosperm

Potato starch – unprocessed



Potato starch - processed



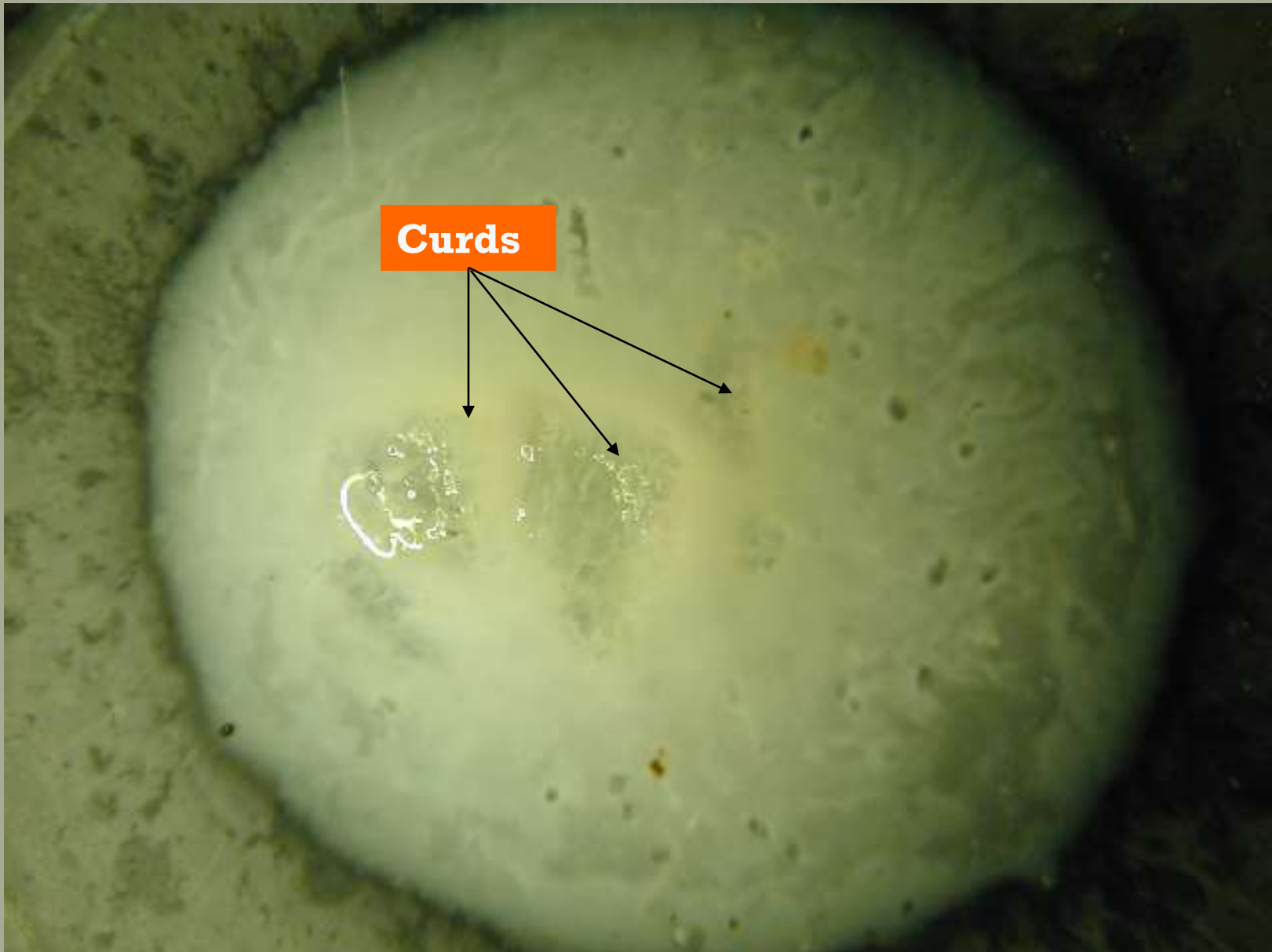
Plane polarized light, stained with Iodine/Potassium Iodine

Skeletal muscle bundle. Striations are from actin and myosin containing filaments within each myofibril



Phase contrast light microscopy

Q particles from clothing: Positive for gastric enzyme



Vomit confirmed on clothing

Food ingredients identified:

Unprocessed wheat starch

Unprocessed corn starch

Unprocessed rice starch

Cereal grains:wheat

Processed potato starch (fried potatoes)

Skeletal muscle (beef, poultry, vertebrate fish)

Perforated lower bowel

#4 Case Study:

Gross Diagnosis: wood splinter perforating
small bowel.



Civil Litigation

Case History Prior to Analysis

- ◉ Victim dies from perforated lower bowel.
- ◉ Victim was eating cake at party.
- ◉ Others at party found 'wood-like' fragments in cake.
- ◉ These fragments were not saved.
- ◉ Foreign body removed at autopsy.
- ◉ Remainder of cake was retained for exam.

The Cake



Microscopic Examination of Cake

- Cake was digested in warm water and sieved through 10 and 20 mesh screens.
- Stereobinocular microscopic examination of residue at 12 to 40 x.
- Negative for the presence of a foreign body.

Laboratory Instrumentation

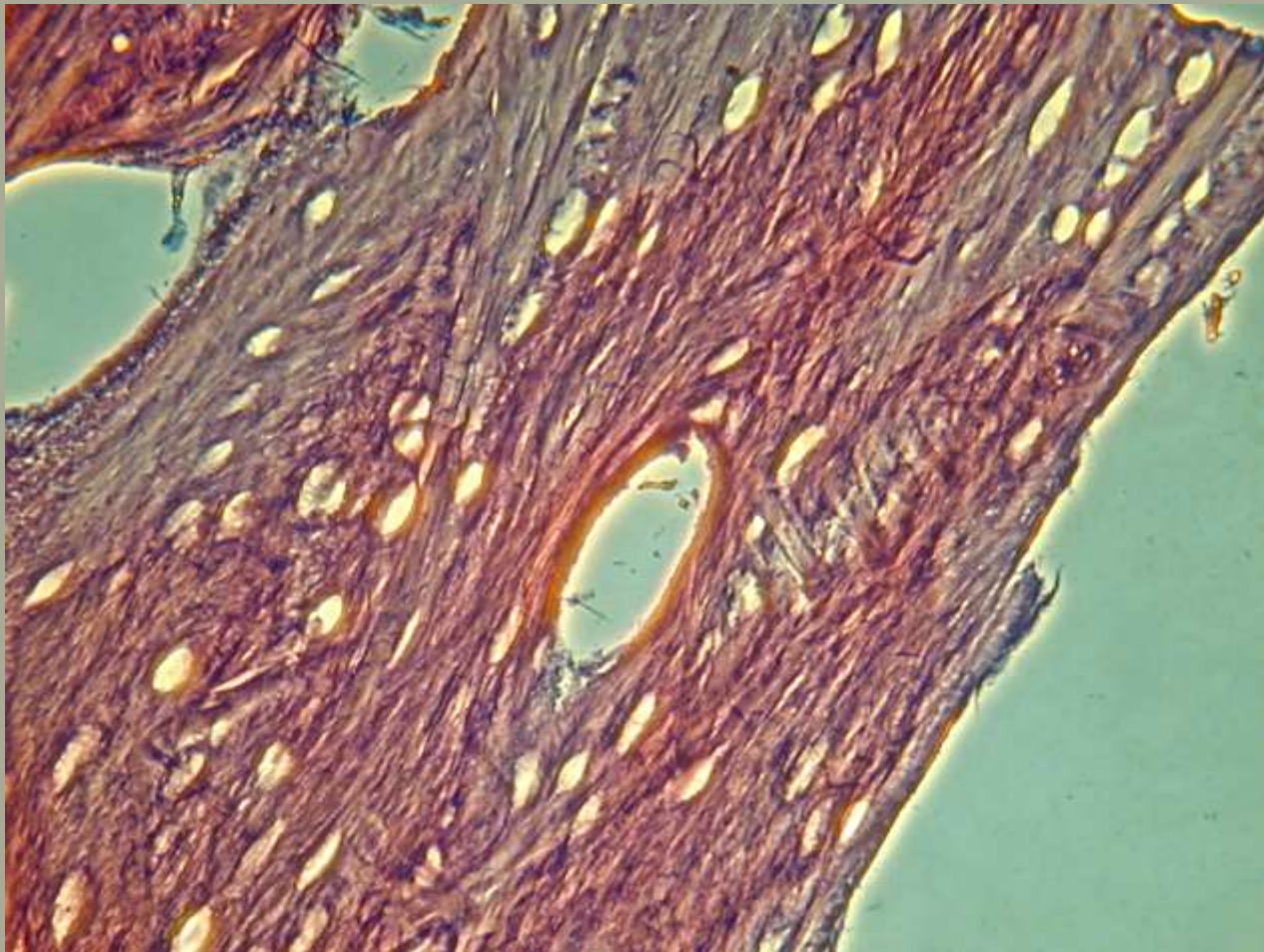


Wood-like splinter



Scale in mm

Thin section: Bone not wood



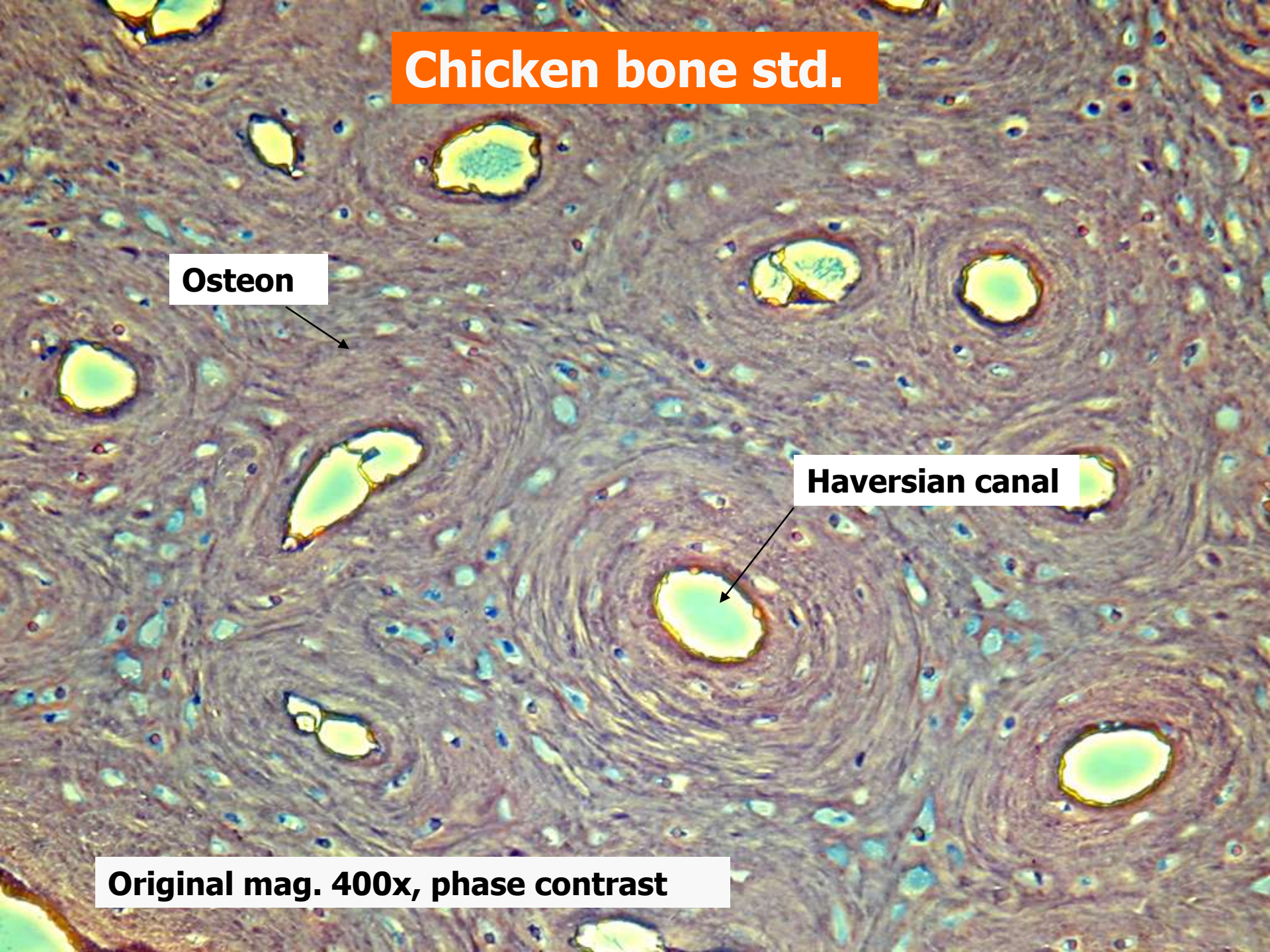
Phase contrast original mag. 400x

Chicken bone std.

Osteon

Haversian canal

Original mag. 400x, phase contrast



Conclusions

- ◉ Victim was edentulous
- ◉ Had eaten chicken prior to cake
- ◉ Victim probably swallowed chicken bone
- ◉ Victims children dropped charges

Gastric Contents Analysis

#5 Case Study

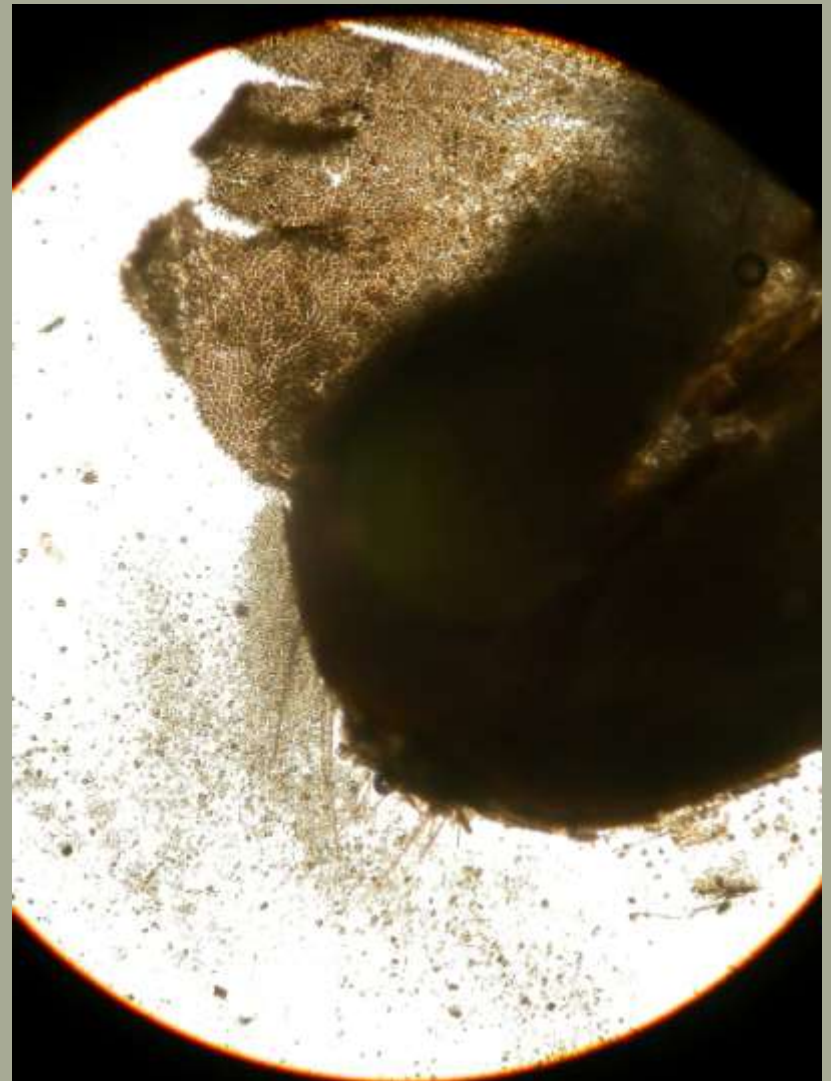
Request: Are the dried stains consistent with vomit containing oatmeal and raisins?

William Schneck, M.S.
Microvision Northwest-Forensic Consulting
Forensicsci@comcast.net

Gastric Contents



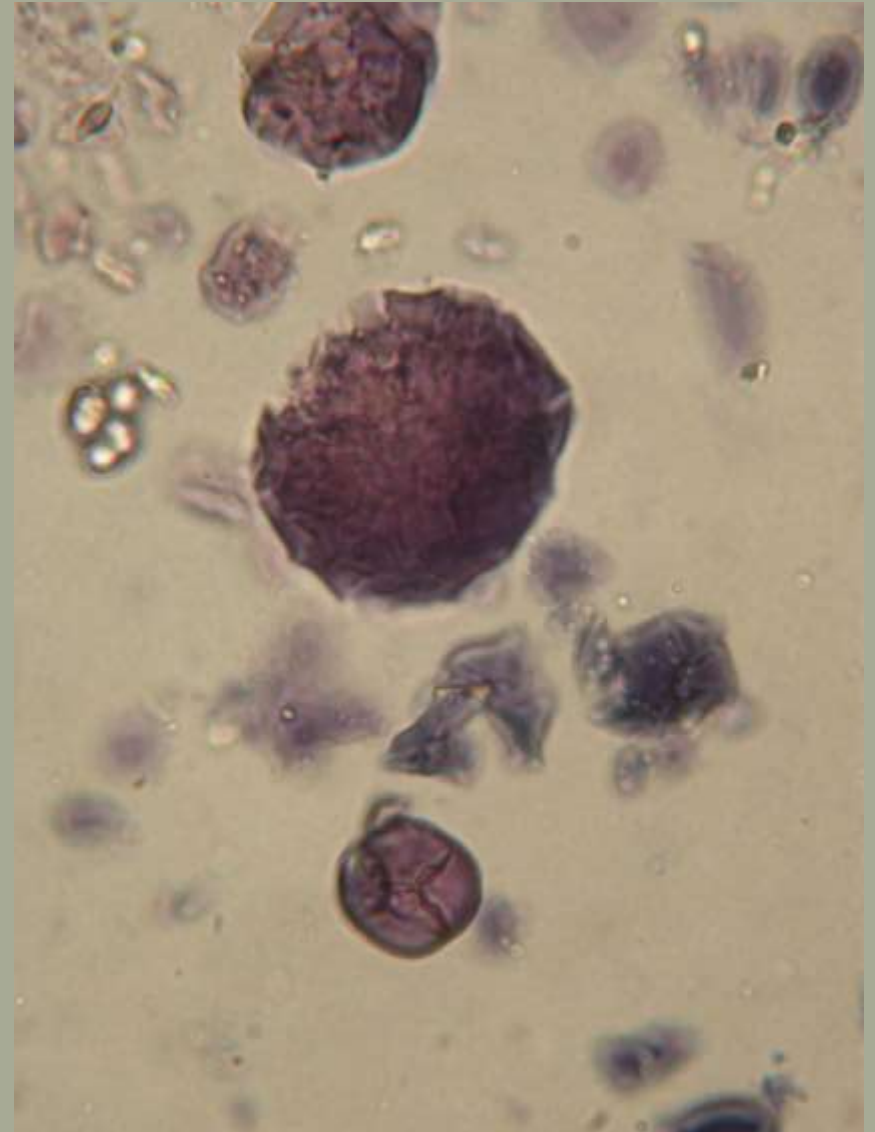
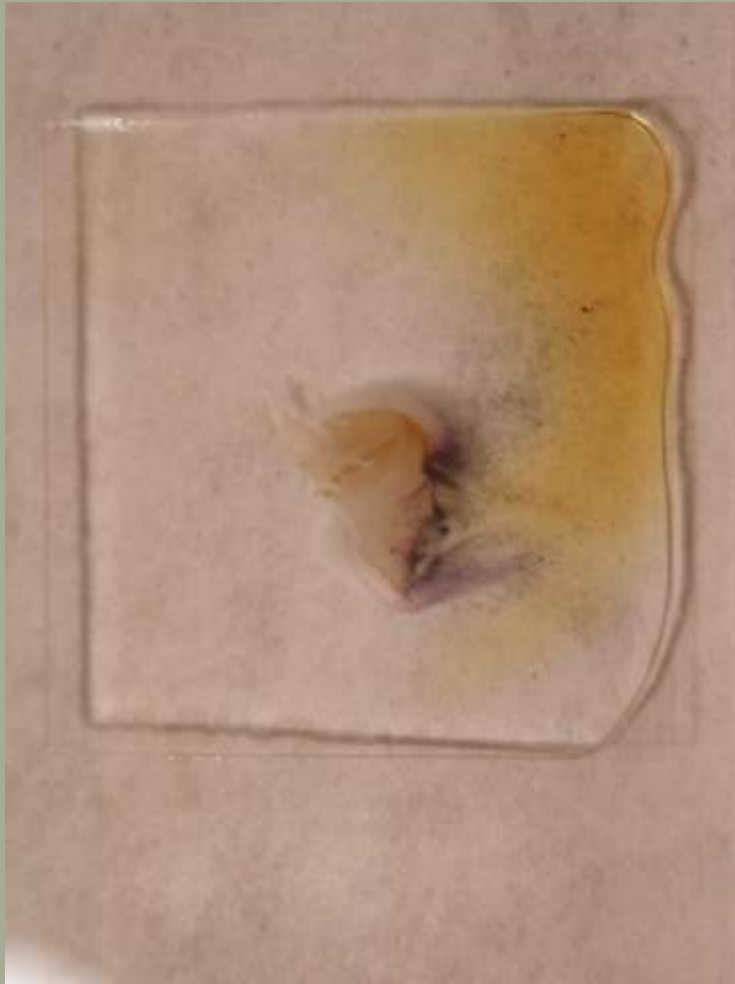
Gastric Contents



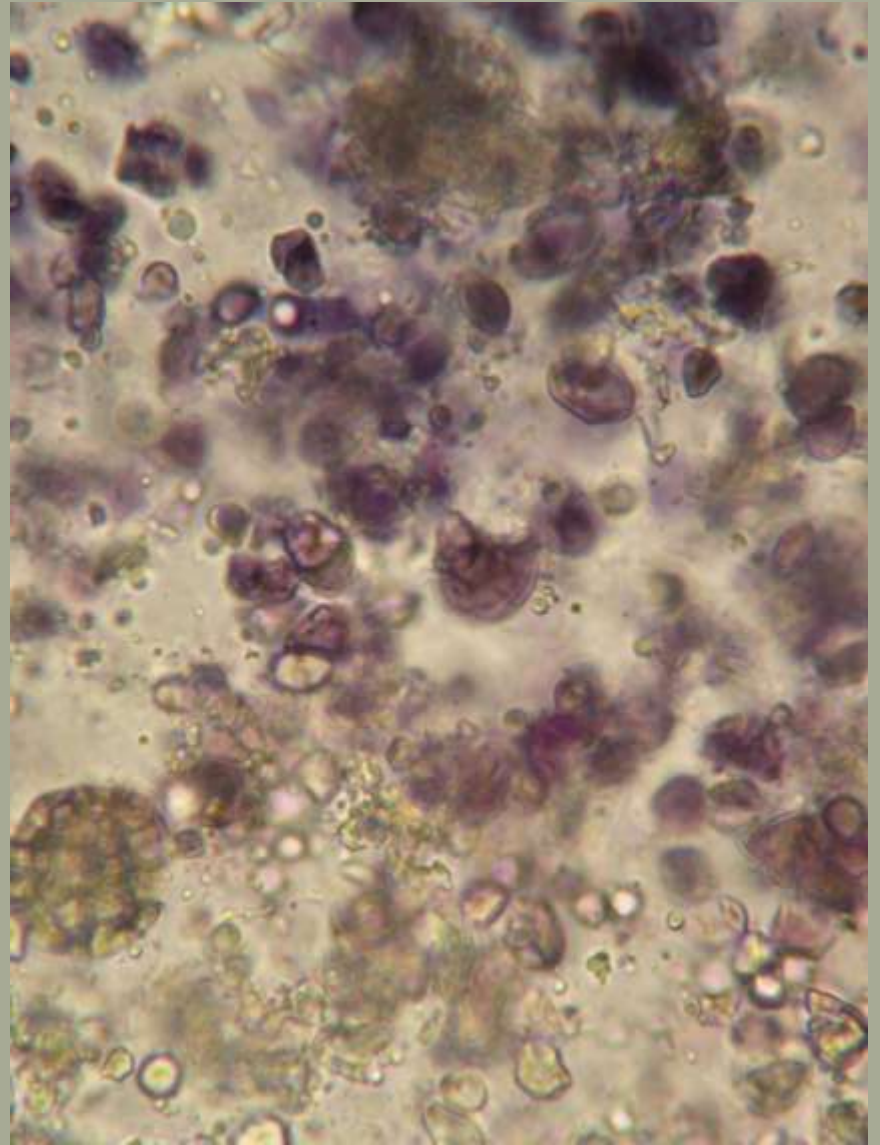
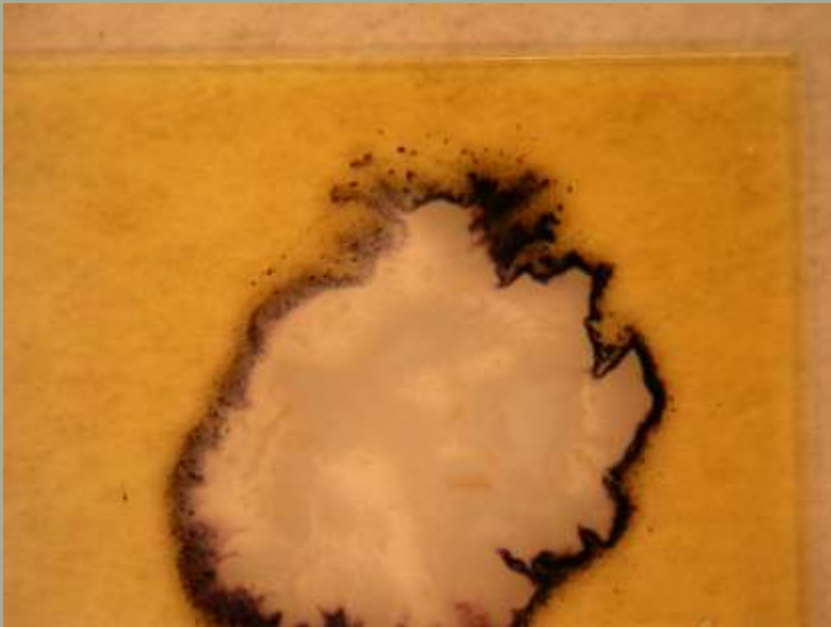
Known Oatmeal kernels



Gastric contents = Oat starch



Known Oat starch



Known oat cellular structures

