Microscopy TODAY

## Coming Events

### 2013

**EMAS 2013**
May 12–16, 2013
Porto, Portugal
www.emas-web.net

**Scandem 2013**
June 10–14, 2013
Copenhagen, Denmark
cfim.ku.dk/scandem2013

**Microscopy & Microanalysis 2013**
August 4–8, 2013
Indianapolis, IN
www.microscopy.org

**Denver X-ray Conference**
August 5–9, 2013
Westminster, CO
www.dxcicdd.com

**EMAG 2013**
September 3–6, 2013
University of York, UK
emag-iop.org

**CIASEM 2013**
September 24–28, 2013
Cartagena, Columbia
ciasem2013.com/index_ing.html

**Neuroscience**
November 9–13, 2013
San Diego, CA
www.sfn.org/am2013

### 2014

**Microscopy & Microanalysis 2014**
August 3–7, 2014
Hartford, CT
www.microscopy.org

### 2015

**Microscopy & Microanalysis 2015**
August 2–6, 2015
Portland, OR
www.microscopy.org

### 2016

**Microscopy & Microanalysis 2016**
July 24–28, 2016
Columbus, OH
www.microscopy.org

### 2017

**Microscopy & Microanalysis 2017**
July 23–27, 2017
St. Louis, MO
www.microscopy.org

### 2018

**Microscopy & Microanalysis 2018**
August 5–9, 2018
Baltimore, MD
www.microscopy.org

**More Meetings and Courses**
Check the complete calendar near the back of this magazine and in the MSA journal *Microscopy and Microanalysis*.

Carmichael's Concise Review

# Look in a Microscope to Determine the Age of a Shrimp, Crab, or Lobster!

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The ability to determine the age of commercially important aquatic species is important to managing their populations. Whereas the age of most aquatic animals can be found by counting annual growth bands in hard structures, such as the fish otoliths (stone-like structures in the ear that are important for balance and orientation) and bivalves' shells, a technique to directly and accurately age individual crustaceans does not exist. At least it didn't until the recent study by Raouf Kilada, Bernard Sainte-Marie, Rémy Rochette, Neill Davis, Caroline Vanier, and Steven Campana [1]. This is a bit of surprise because nothing equivalent to the hard structures of fish or bivalves had been found, or even expected to exist, in crustaceans. This is simply because this group of animals grow by molting or by shedding off their skins. Not only does molting frequency vary considerably among species of crustaceans, but molting individuals are assumed to lose and replace all calcified structures, including the cuticle (exoskeleton), that might record annual growth.

Kilada et al. examined the eyestalk and gastric mill (the first of a two-part stomach lined with chitinous teeth that acts as a gizzard) of four decapod crustaceans: American lobster (*Homarus americanus*), snow crab (*Chionoecetes opilio*), sculptured shrimp (*Sclerocrangon boreas*), and northern shrimp (*Pandalus borealis*). The eyestalks and gastric mills were embedded and then sectioned transversely or longitudinally. Growth bands (Figure 1) were recognized as paired light and dark bands in the endocuticle (the crustacean cuticle has 3–4 main layers: the epicuticle, exocuticle, and endocuticle from the outside in). The mesocardiac ossicle (one of several small ossicles in the gastric mill) also demonstrated growth bands in the American lobster. In the crab, growth bands were most easily interpreted in transverse sections of the eyestalk, whereas in the two shrimp species, longitudinal sections of eyestalk were best. In lobster, growth bands were most clearly seen in longitudinal sections of the mesocardiac ossicle. Up to 6 growth bands were seen in the shrimps and up to 10 or 15 in the crab and lobster, respectively, agreeing with longevity expectations. Additional data confirmed that the growth bands provided an accurate correlation with known ages. However, the match between growth bands and estimated age was not good for a certain population of larger lobsters. Whereas this discrepancy could not be explained, similar challenges have been encountered in the application of well-established, otolith-based ageing techniques to certain fish species. Further detailed statistical analyses supported the concept of growth bands being a reliable indicator of age in these four crustacean species.

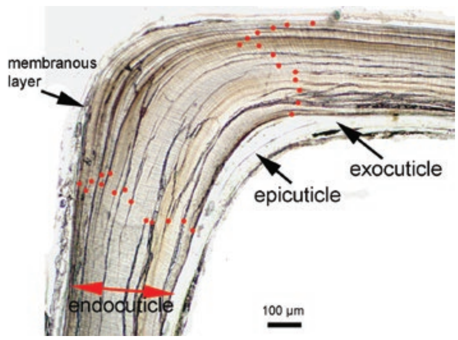


**Figure 1:** Growth bands (indicated by red dots) in a longitudinal section of the mesocardiac ossicle of the gastric mill of an American lobster.

To determine whether any mineralized features of the cuticle were conserved through molting, some juvenile lobsters were immersed in seawater containing the fluorescent marker calcein (a calcium-binding compound). The results provided the first evidence that any mineral features of the cuticle are perpetuated through molting, which provides a possible mechanism for growth bands to accumulate and record age in the endocuticle throughout the life of the crustacean.

Kilada et al. showed that age information obtained from growth band counts allowed the development of sex-specific size-at-age relationships for all four study species. The implications of this method for future stock assessments and biological studies of these commercially important crustaceans around the world are likely to be substantial!

## References

[1] R Kilada, B Sainte-Marie, R Rochette, N Davis, C Vanier, and S Campana, *Can J Fish Aquat Sci* 69 (2012) 1728–33.

[2] The author gratefully acknowledges Dr. Raouf Kilada for reviewing this article.

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