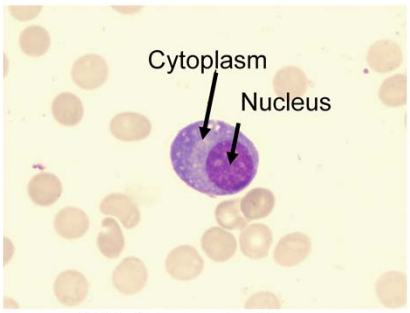
Clinical Tasks
Plasma Cell counting
Observer Training

Identifying Plasma Cells

- **Plasma cells are large cells**
  (lymphocytes)
- **Typical features:**
  1. nucleus-to-cytoplasm (N/C) ratio between 1 and 2
  2. oval cell shape
  3. dark blue/purple nucleus
     (basophilic)
  4. off-center nucleus
     (eccentric nucleus)
  5. Nucleus color is non-uniform
     (nucleus heterochromatin)
  6. Nucleus non-uniformity makes characteristic clock face pattern

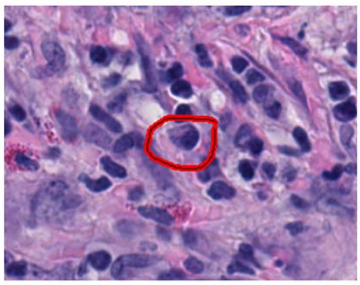


✓ N/C ratio here is about 1
✓ Cell shape is oval
✓ Nucleus is darker purple
✓ Nucleus is off-center
✓ Nucleus color is non-uniform
o Nucleus non-uniformity
not really characteristic clock face

Don't have to identify all features.
More features = More confidence

Identifying Plasma Cells

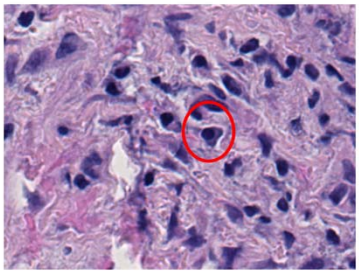
- **Additional characteristics of plasma cells:**
  - Flare or candy corn cell shape
  - Baseball diamond with nucleus the outfield



  - Pale halo around nucleus
    (Presence of Golgi body)

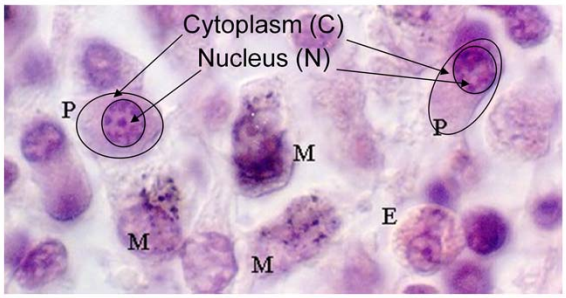
Identifying Plasma Cells

- False Positive
  - Bi-lobular cell (feels like a flare)



This shows typical features, Off-center nucleus, typical N/C ratio, presence of Golgi bodies, but also shows atypical bimodal shape of cytoplasm.

Identifying Plasma Cells



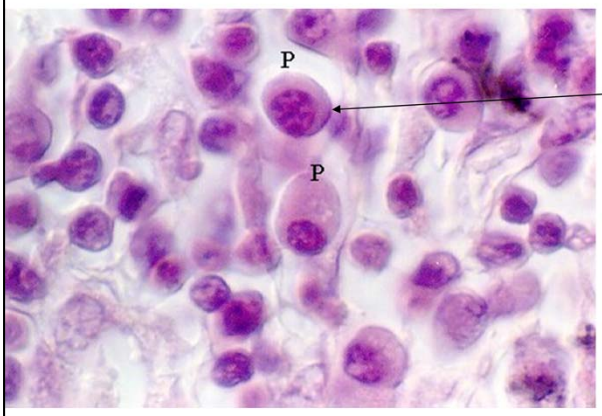
Index:
P: plasma cells
M: macrophages
E: eosinophils

- ✓ N/C ratio here is about 1
- ✓ Cell shape is oval
- ✓ Nucleus is darker purple
- ✓ Nucleus is off-center
- ✓ Nucleus color is non-uniform
- ✓ Nucleus non-uniformity ***IS*** characteristic clock face

Source: microanatomy.net (just image not illustration)

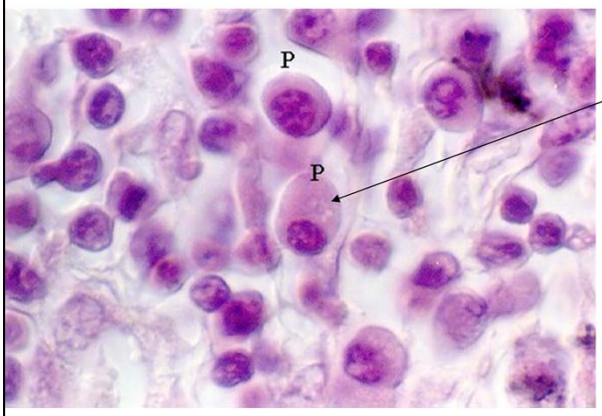
These are some textbook examples of plasma cells to demonstrate their features.

Identifying Plasma Cells



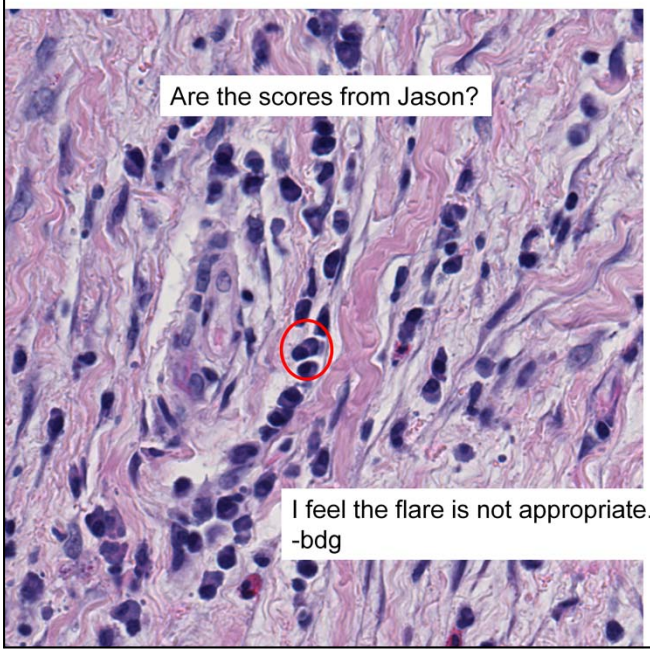
- ✓ N/C ratio is about 1.5
- ✓ Cell Shape is oval
- ✓ Nucleus is darker purple
- ✓ Nucleus is off-center
- ✓ Nucleus color is non-uniform
- ✓ Nucleus non-uniformity ***IS*** characteristic clock face

Identifying Plasma Cells



o N/C ratio is about 2.5
✓ Cell Shape is oval
✓ Nucleus is darker purple
✓ Nucleus is off-center
✓ Nucleus color is non-uniform
✓ Nucleus non-uniformity ***IS*** characteristic clock face

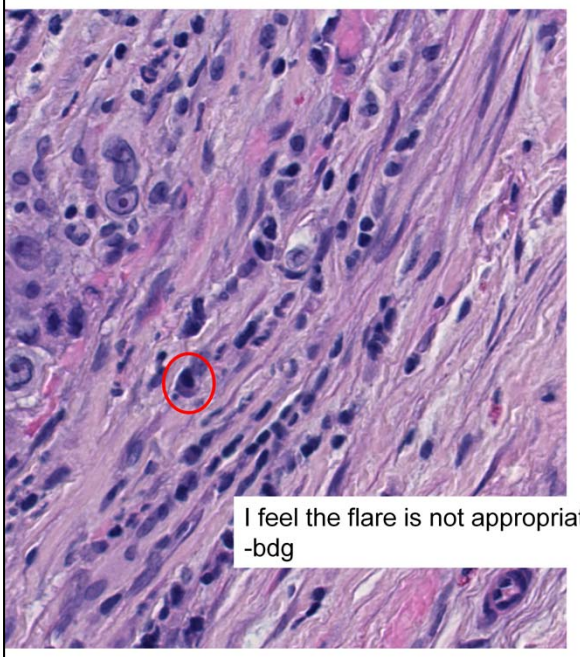
Training example 1/15



Probability being a plasma cell (0-100)	90	
Feature	Yes	No
Off-center nucleus	X	
Halo around nucleus	X	
1 <N/C<2	X	
Oval cell	X	
Nucleus clock-face	maybe (low-resolution	
Flare pattern	X	
Other (describe):		

Here are examples of plasma cells in colon tissue, which will be the tissue type used in our study. These are classic true positives, displaying all typical features.

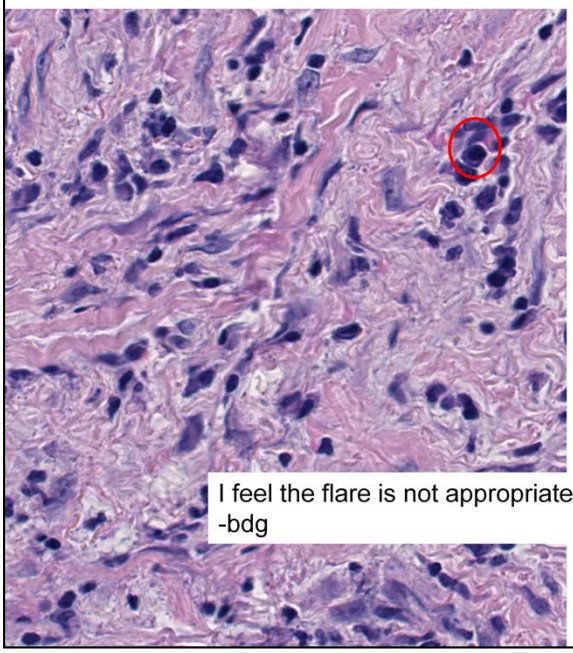
Training example 2/15



Probability being a plasma cell (0-100)	80	
Feature	Yes	No
Off-center nucleus	X	
Halo around nucleus	X	
1 <N/C<2	X	
Oval cell	X	
Nucleus clock-face	maybe (low-resolution)	
Flare pattern	X	
Other (describe):		

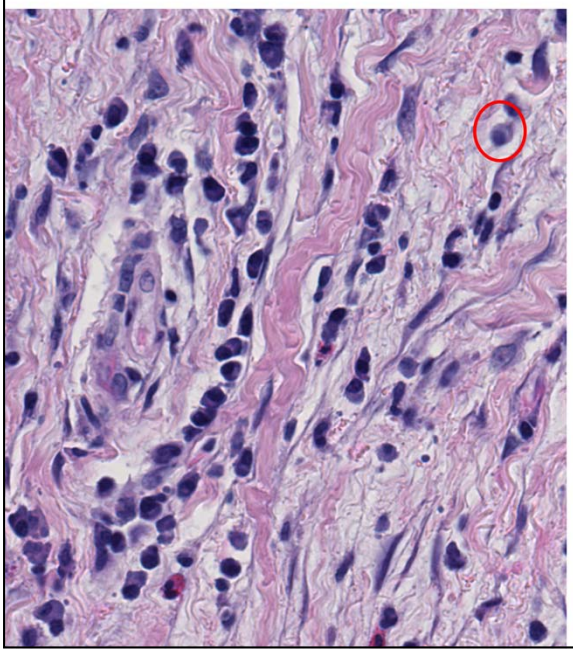
Clear flare (candy corn) pattern. The clock-face feature might be more apparent on microscope due to better resolution.

Training example 3/15



Probability being a plasma cell (0-100)	70	
Feature	Yes	No
Off-center nucleus	X	
Halo around nucleus	X	
1 <N/C<2	X	
Oval cell	X	
Nucleus clock-face	maybe (low-resolution)	
Flare pattern	X	
Other (describe):		

Training example 4/15



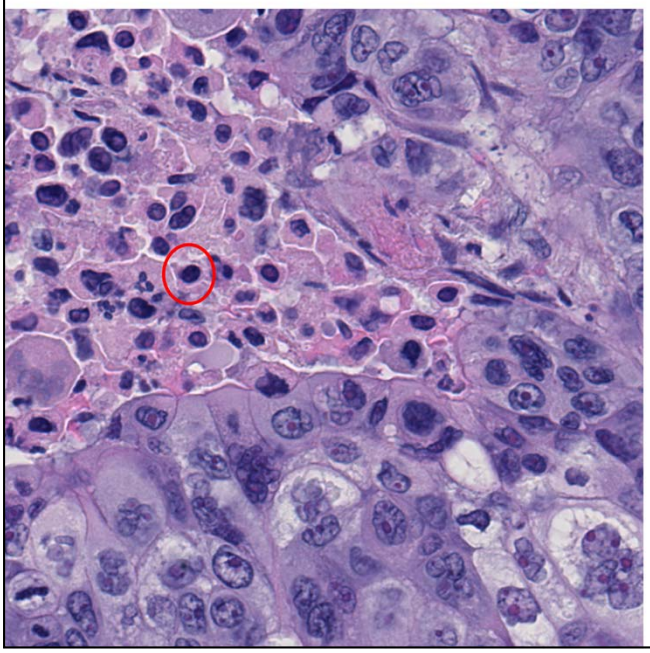
Probability being a plasma cell (0-100)	70	
Feature	Yes	No
Off-center nucleus	X	
Halo around nucleus	X	
1 <N/C<2	X	
Oval cell	X	
Nucleus clock-face		
Flare pattern	X	
Other (describe):		

Training example 5/15

Probability being a plasma cell (0-100)	60	
Feature	Yes	No
Off-center nucleus	X	
Halo around nucleus		X
1 <N/C<2	X	
Oval cell		X
Nucleus clock-face		X
Flare pattern	X	
Other (describe):		

A bit difficult to discern nucleus from cytoplasm, but most features are apparent

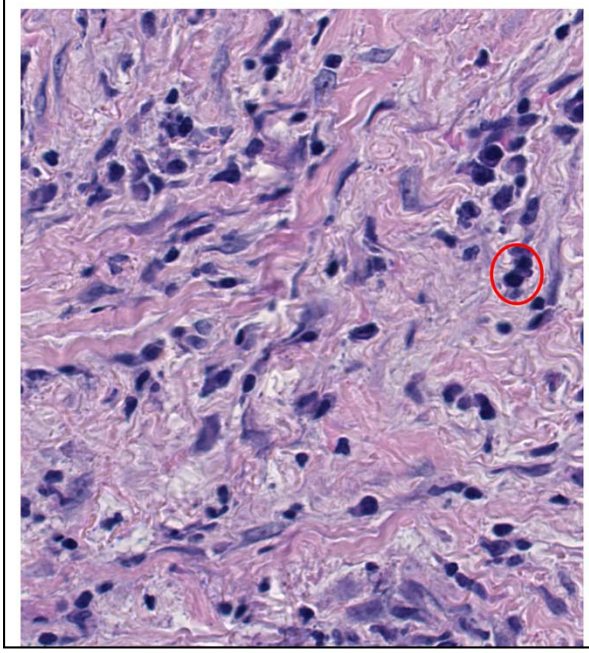
Training example 6/15



Probability being a plasma cell (0-100)	20	
Feature	Yes	No
Off-center nucleus		X
Halo around nucleus		X
1 <N/C<2		X
Oval cell	X	
Nucleus clock-face		X
Flare pattern		X
Other (describe):		

Looking now at examples with low probability of being a plasma cell. None of the classic features is apparent, this is an easy false positive.

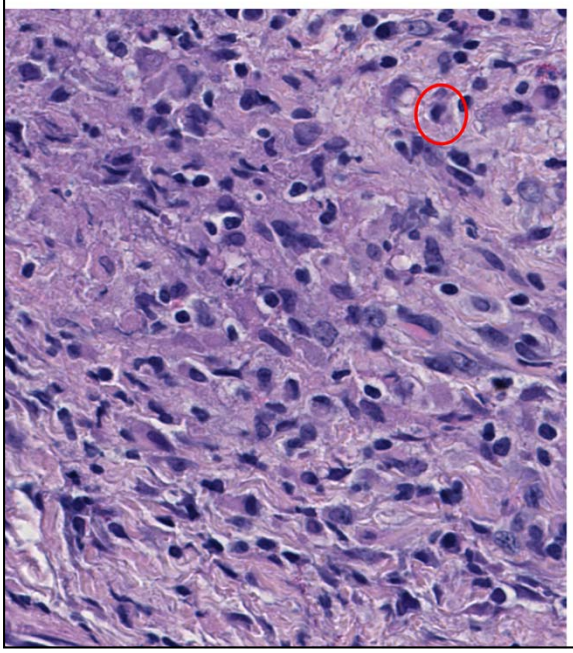
Training example 7/15



Probability being a plasma cell (0-100)	20	
Feature	Yes	No
Off-center nucleus		X
Halo around nucleus		X
1 <N/C<2		X
Oval cell		X
Nucleus clock-face		X
Flare pattern		X
Other (describe):		

Another example of low probability of being a plasma cell

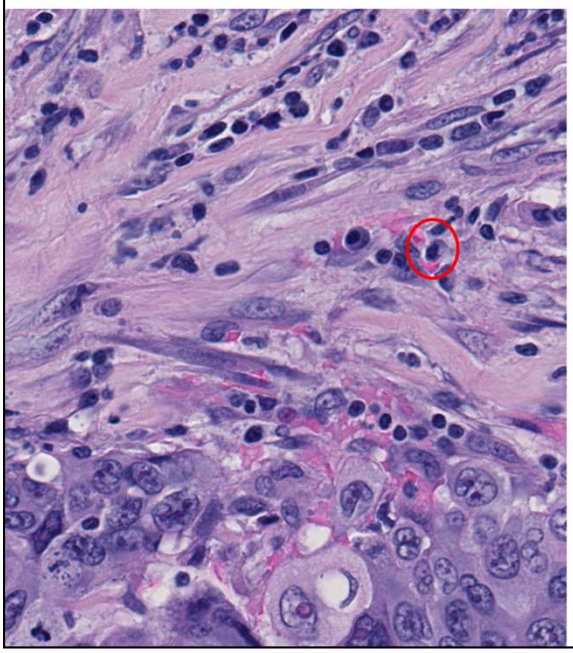
Training example 8/15



Probability being a plasma cell (0-100)	10	
Feature	Yes	No
Off-center nucleus		X
Halo around nucleus		X
1 <N/C<2		X
Oval cell		X
Nucleus clock-face		X
Flare pattern		X
Other (describe):		

Again, none of the features are apparent.

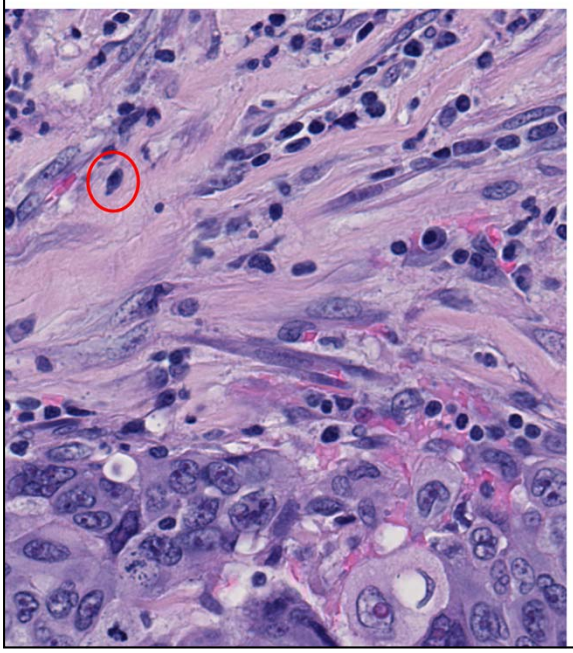
Training example 9/15



Probability being a plasma cell (0-100)	30	
Feature	Yes	No
Off-center nucleus		X
Halo around nucleus		X
1 <N/C<2		X
Oval cell	X	
Nucleus clock-face		X
Flare pattern		X
Other (describe):		

Another example that does not look like a plasma cell.

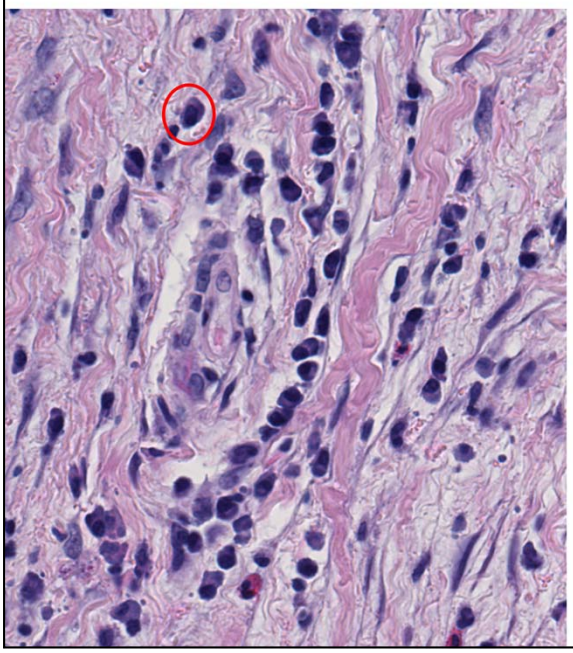
Training example 10/15



Probability being a plasma cell (0-100)	20	
Feature	Yes	No
Off-center nucleus		X
Halo around nucleus		X
1 <N/C<2		X
Oval cell	Maybe, regular?	
Nucleus clock-face		X
Flare pattern		X
Other (describe):		

Looks too squeezed, cytoplasm and nucleus not well-defined.

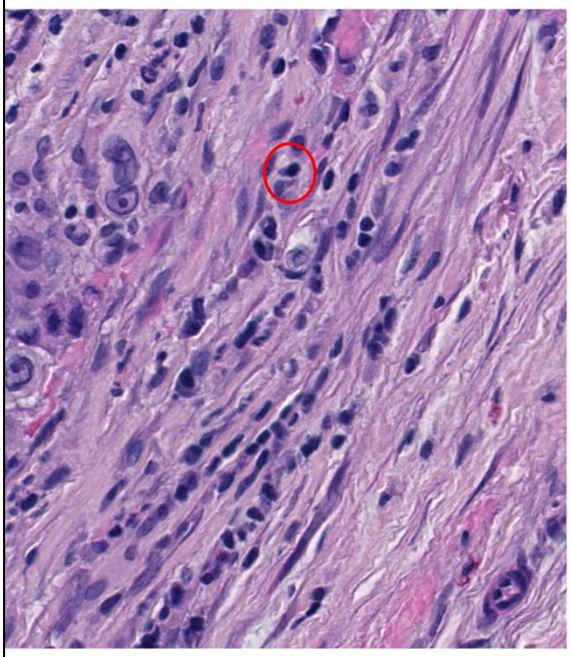
Training example 11/15



Probability being a plasma cell (0-100)	40	
Feature	Yes	No
Off-center nucleus		X
Halo around nucleus	X	
1 <N/C<2		X
Oval cell		X
Nucleus clock-face		X
Flare pattern	X	
Other (describe):		

Now looking at examples that might be intermediate in probability of being plasma cells. This example has some features of plasma cells, Off-center nucleus possible presence of Halo around nucleus, but cytoplasm is not well-defined and nucleus is too big. Any other comments?

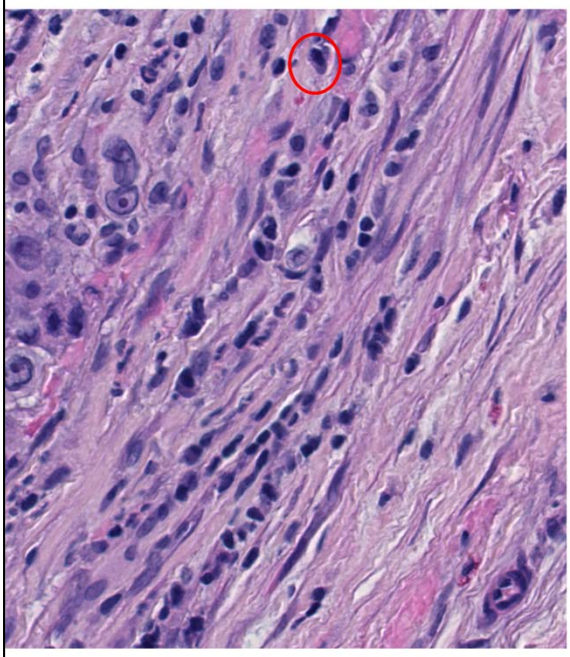
Training example 12/15



Probability being a plasma cell (0-100)	50	
Feature	Yes	No
Off-center nucleus	X	
Halo around nucleus		X
1 <N/C<2		X
Oval cell		X
Nucleus clock-face		X
Flare pattern		X
Other (describe):		

This has shows some features of plasma cells like Off-center nucleus, but overall cell is too small and N/C larger than typical

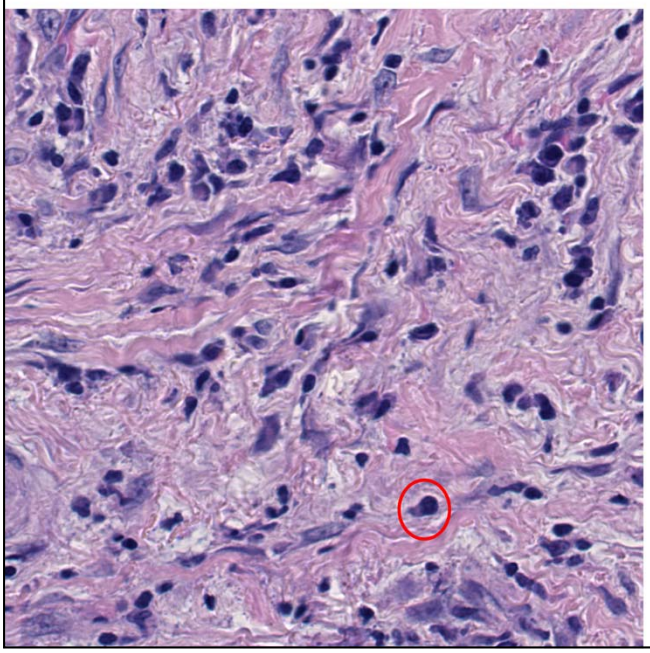
Training example 13/15



Probability being a plasma cell (0-100)	60	
Feature	Yes	No
Off-center nucleus	X	
Halo around nucleus	maybe	
1 <N/C<2	X	
Oval cell		X
Nucleus clock-face		X
Flare pattern		X
Other (describe):		

This does not have the classic look of as plasma cell but does show some typical features.

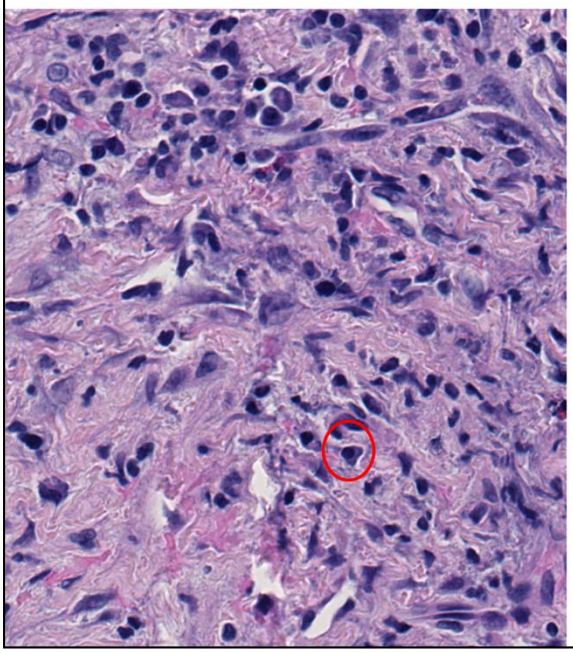
Training example 14/15



Probability being a plasma cell (0-100)	40	
Feature	Yes	No
Off-center nucleus	X	
Halo around nucleus	maybe	
1 <N/C<2		X
Oval cell		X
Nucleus clock-face		X
Flare pattern		X
Other (describe):		

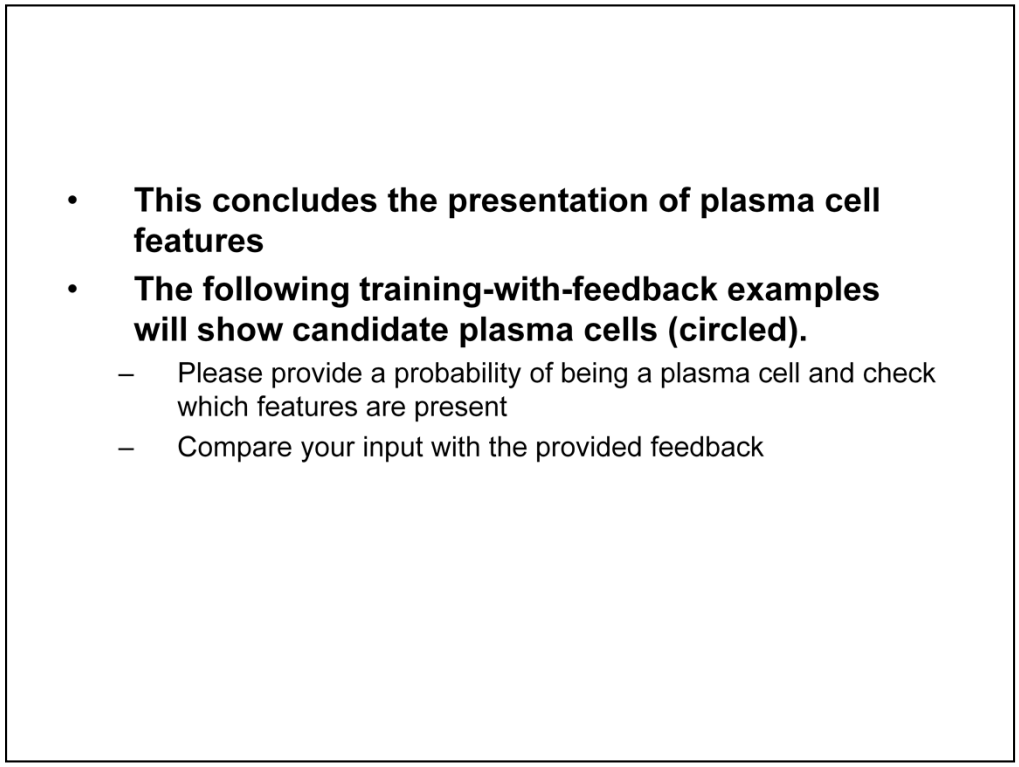
Cytoplasm not well defined, but some of the other features are visible.

Training example 15/15



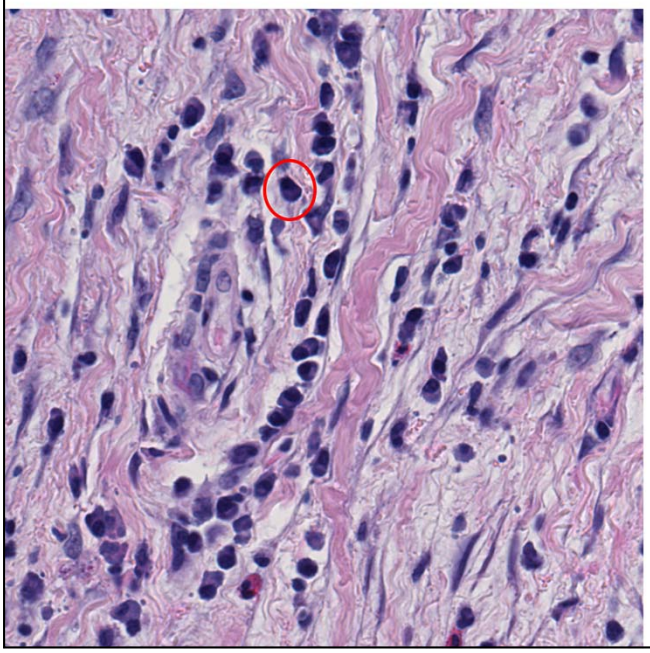
Probability being a plasma cell (0-100)	50	
Feature	Yes	No
Off-center nucleus	X	
Halo around nucleus	X	
1 <N/C<2	maybe	
Oval cell		X
Nucleus clock-face		X
Flare pattern		X bi lobular
Other (describe):		

This shows typical features, Off-center nucleus, typical N/C ratio, presence of Golgi bodies, but also shows atypical bimodal shape of cytoplasm.



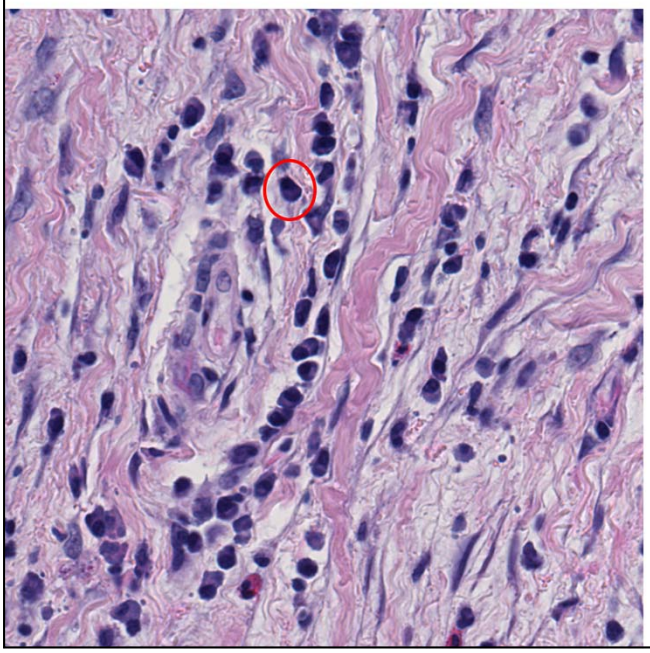
This shows typical features, eccentric nucleus, typical N/C ratio, presence of Golgi bodies, but also shows atypical bimodal shape of cytoplasm.

Training-with-feedback 1/15



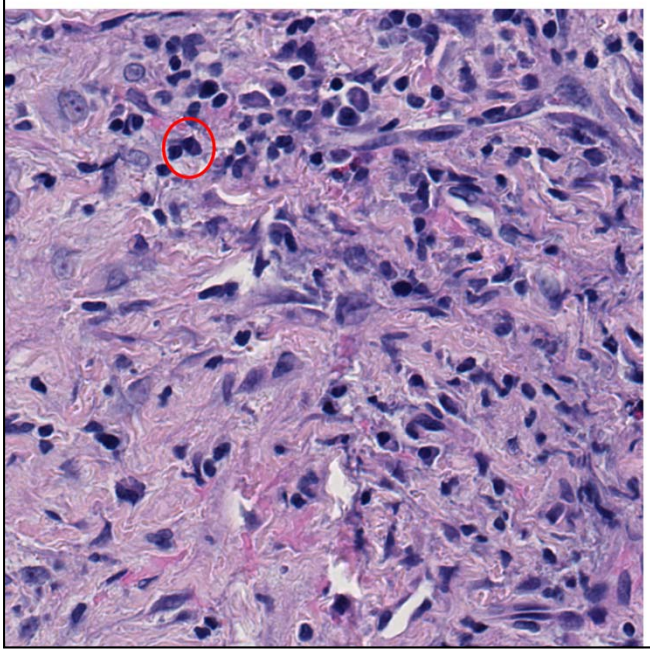
Probability being a plasma cell (0-100)		
Feature	Yes	No
Eccentric nucleus		
Halo around nucleus		
1 <N/C<2		
Oval cell		
Nucleus clock-face		
Flare pattern		
Other (describe):		

Training-with-feedback 1/15



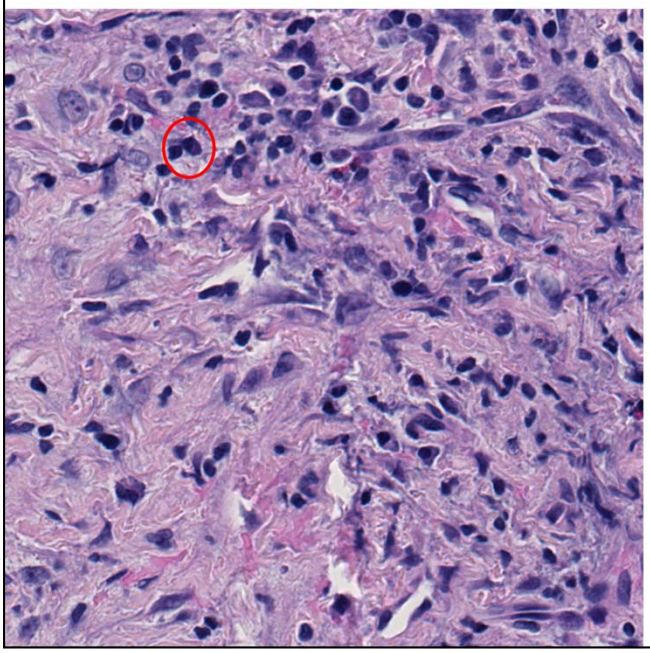
Probability being a plasma cell (0-100)	70	
Feature	Yes	No
Eccentric nucleus	X	
Halo around nucleus		X
1 <N/C<2	X	
Oval cell	X	
Nucleus clock-face		
Flare pattern	X	
Other (describe):		

Training-with-feedback 2/15



Probability being a plasma cell (0-100)		
Feature	Yes	No
Eccentric nucleus		
Halo around nucleus		
1 <N/C<2		
Oval cell		
Nucleus clock-face		
Flare pattern		
Other (describe):		

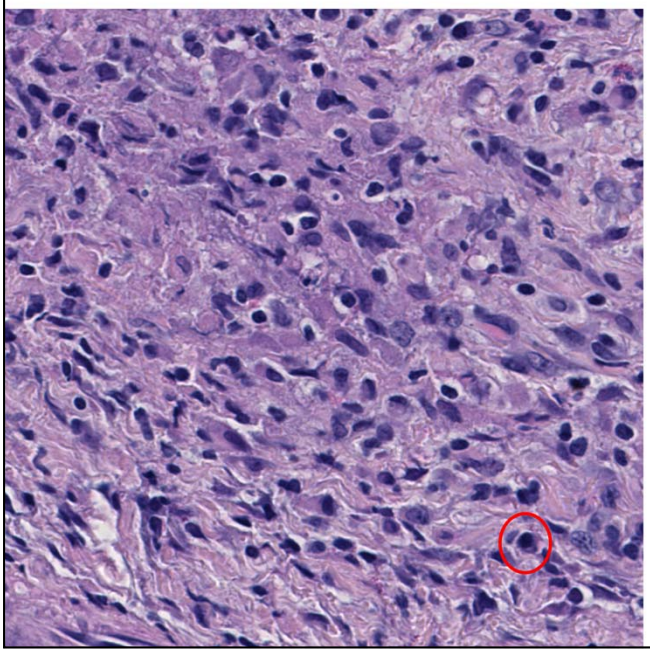
Training-with-feedback 2/15



Probability being a plasma cell (0-100)	40	
Feature	Yes	No
Eccentric nucleus	X	
Halo around nucleus		X
1 <N/C<2	X	
Oval cell	X	
Nucleus clock-face		
Flare pattern		X
Other (describe):		

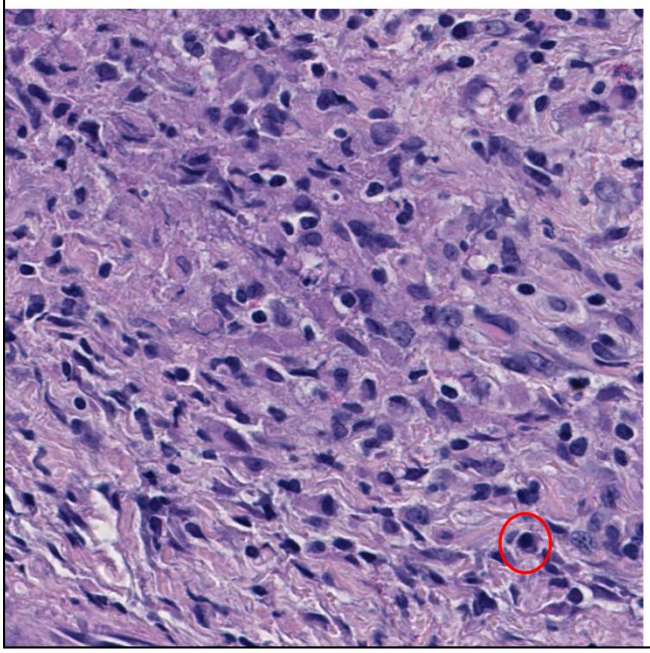
Atypical overall cell shape

Training-with-feedback 3/15



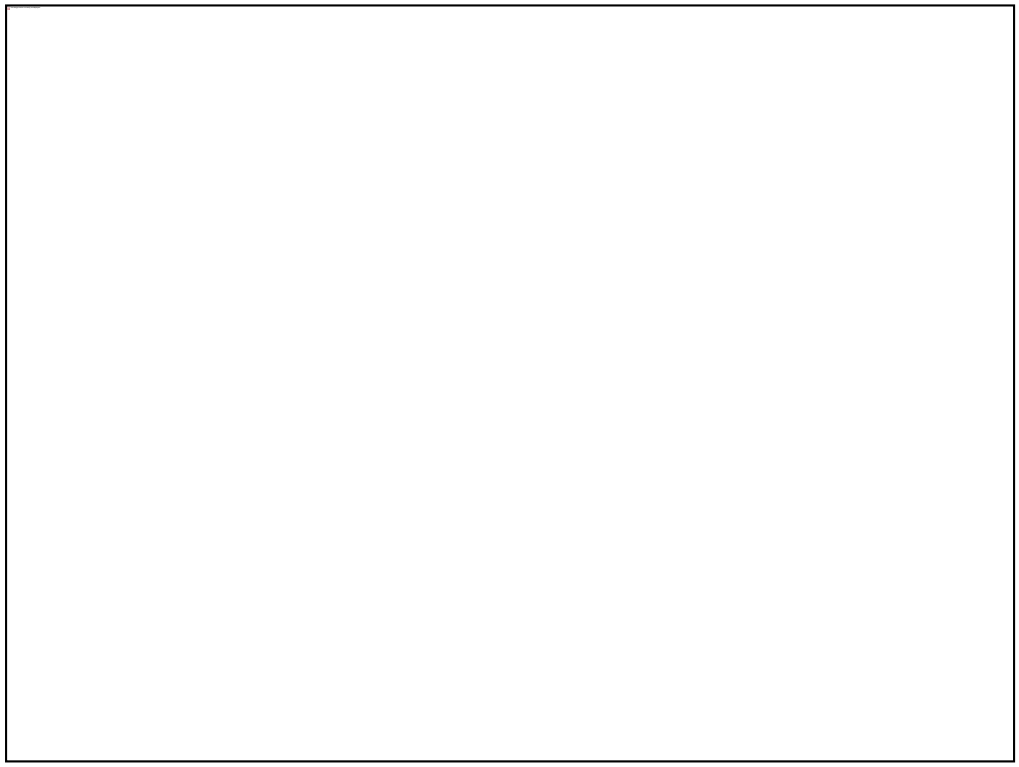
Probability being a plasma cell (0-100)		
Feature	Yes	No
Eccentric nucleus		
Halo around nucleus		
1 <N/C<2		
Oval cell		
Nucleus clock-face		
Flare pattern		
Other (describe):		

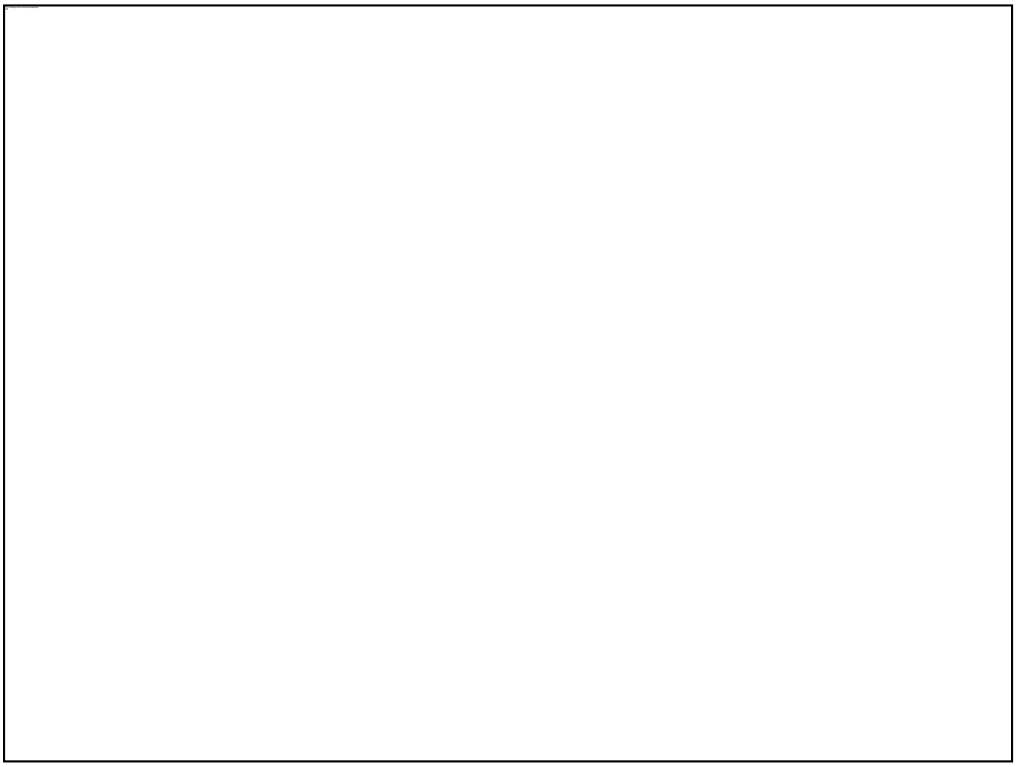
Training-with-feedback 3/15



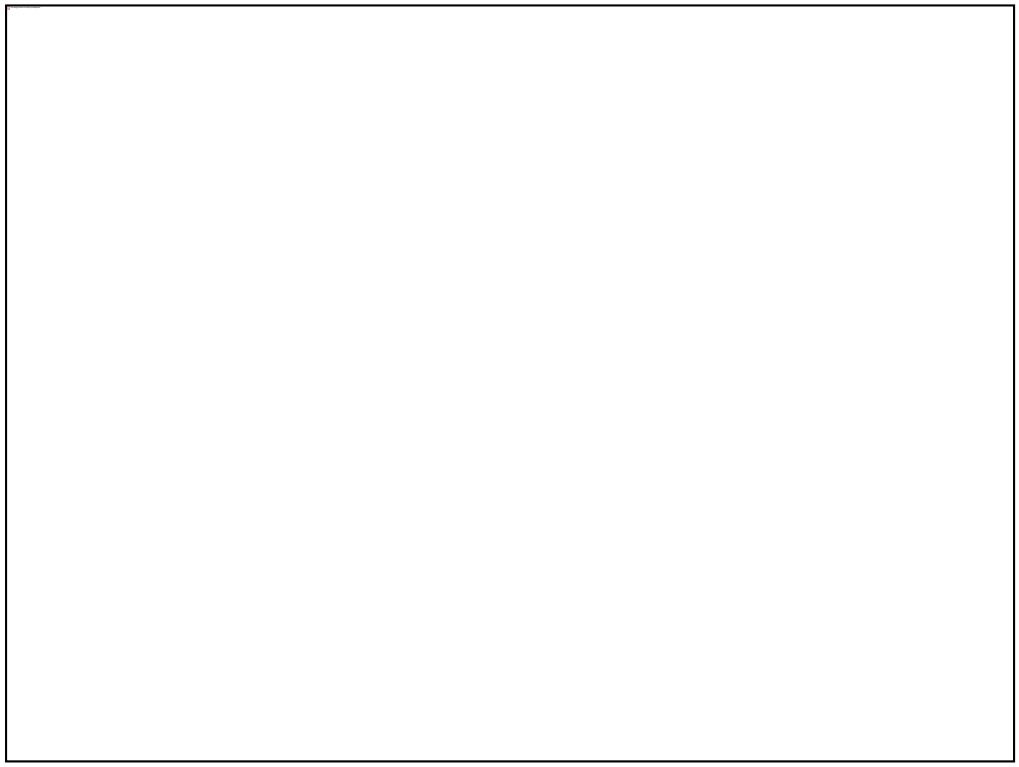
Probability being a plasma cell (0-100)	50	
Feature	Yes	No
Eccentric nucleus	X	
Halo around nucleus	X	
1 <N/C<2	X	
Oval cell	X	
Nucleus clock-face		
Flare pattern		X
Other (describe):		

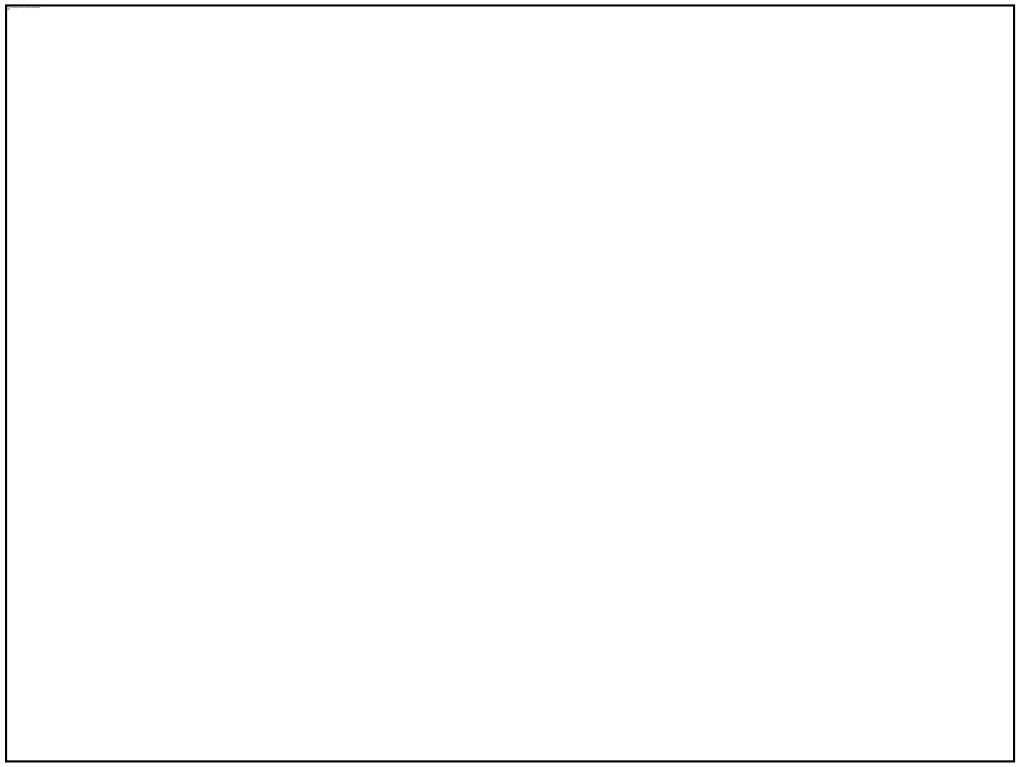
Some feature are there, atypical cytoplasm



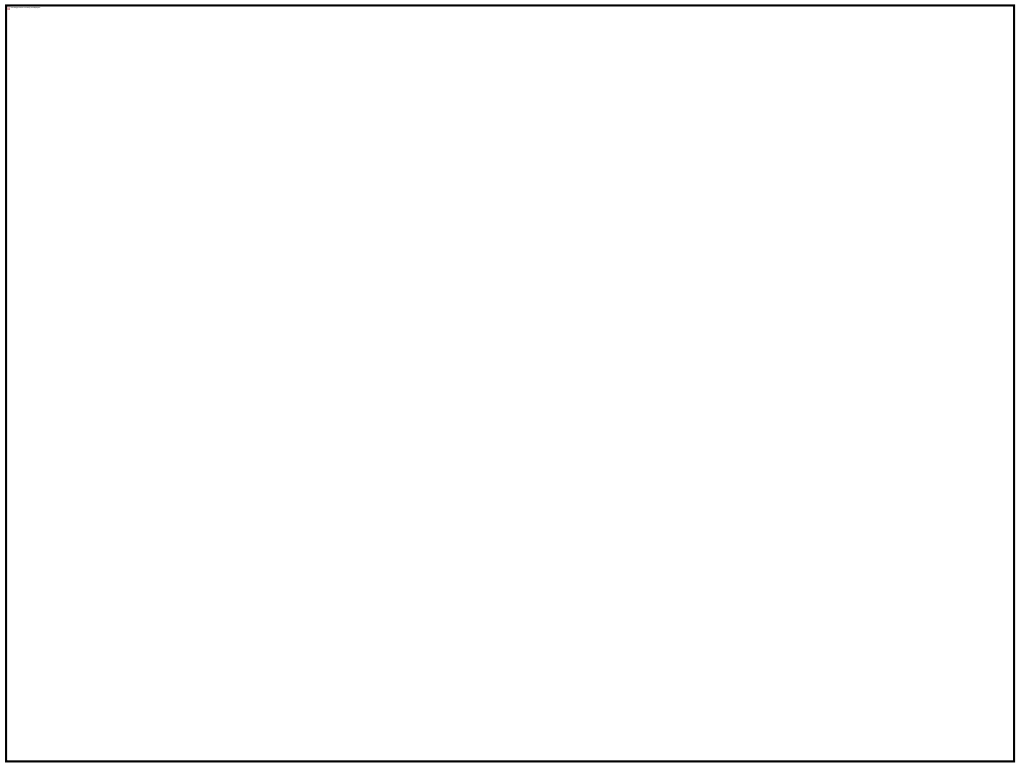


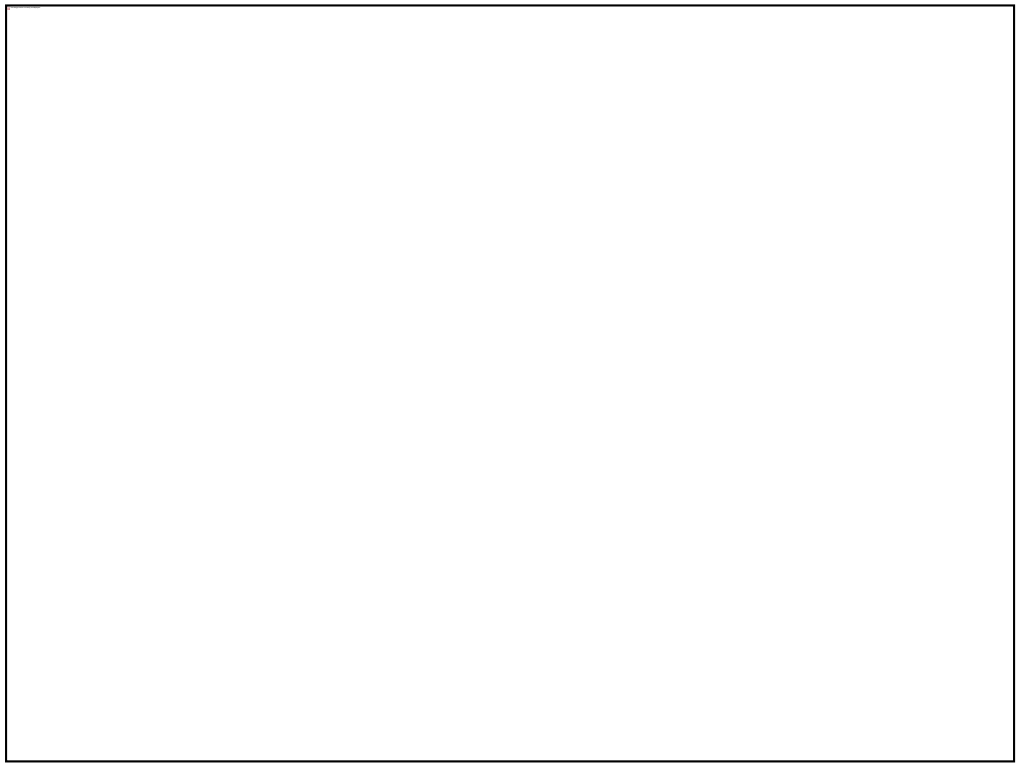
Atypical cell shape



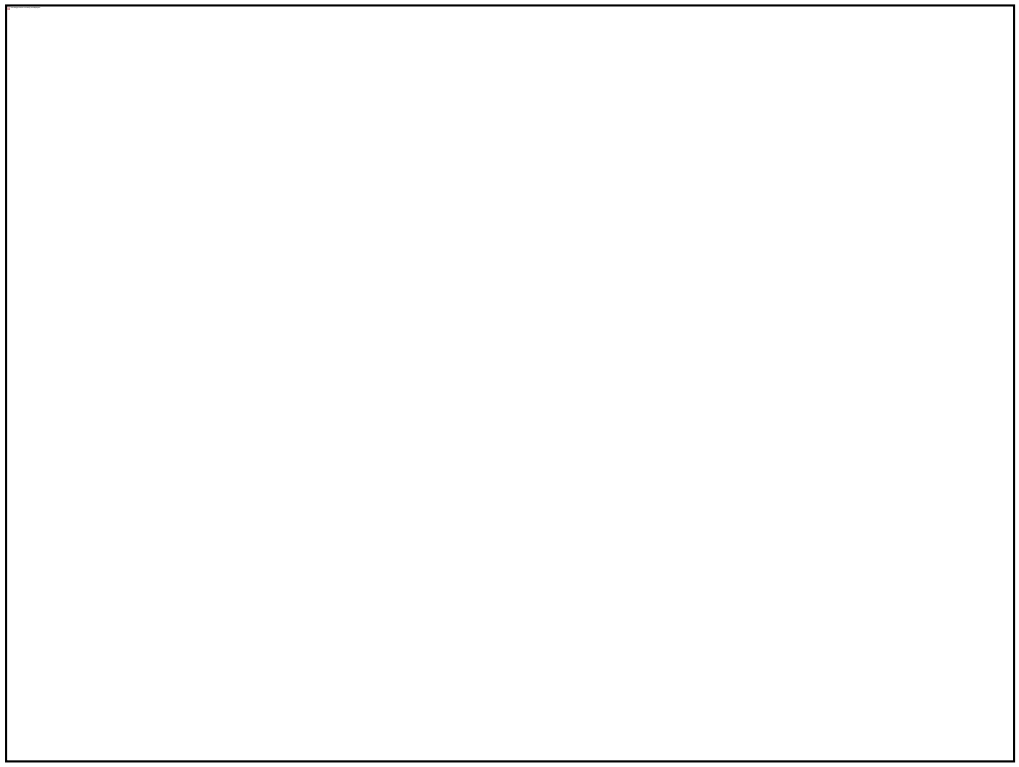


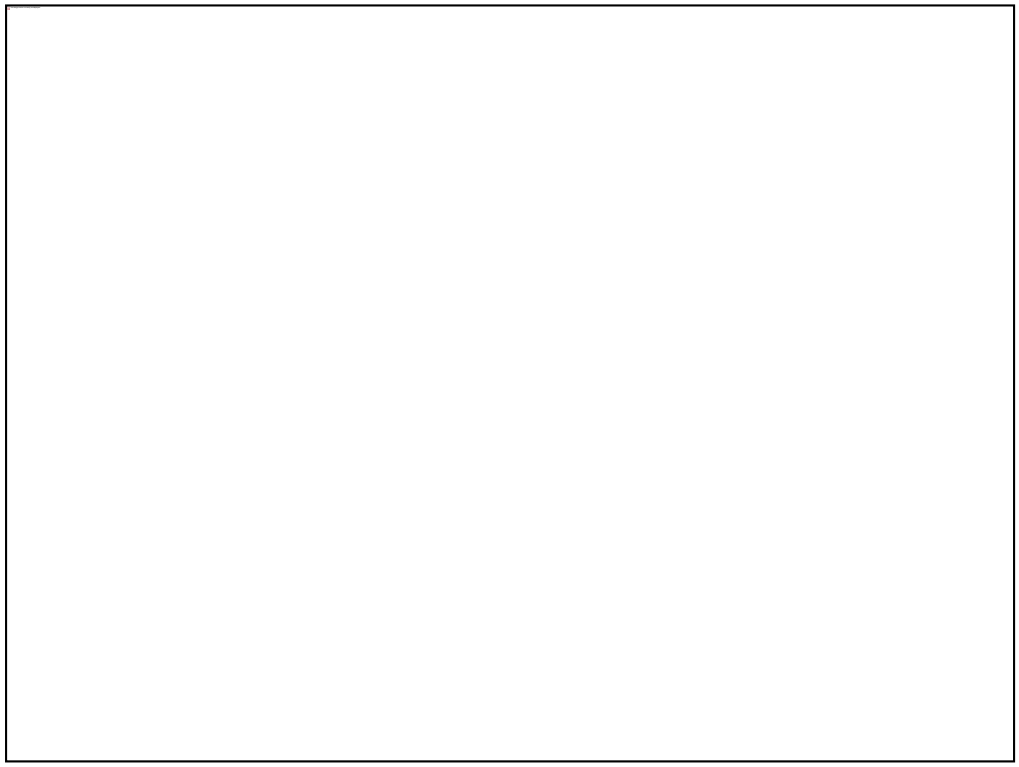
Typical features, including pronounced Halo around nucleus

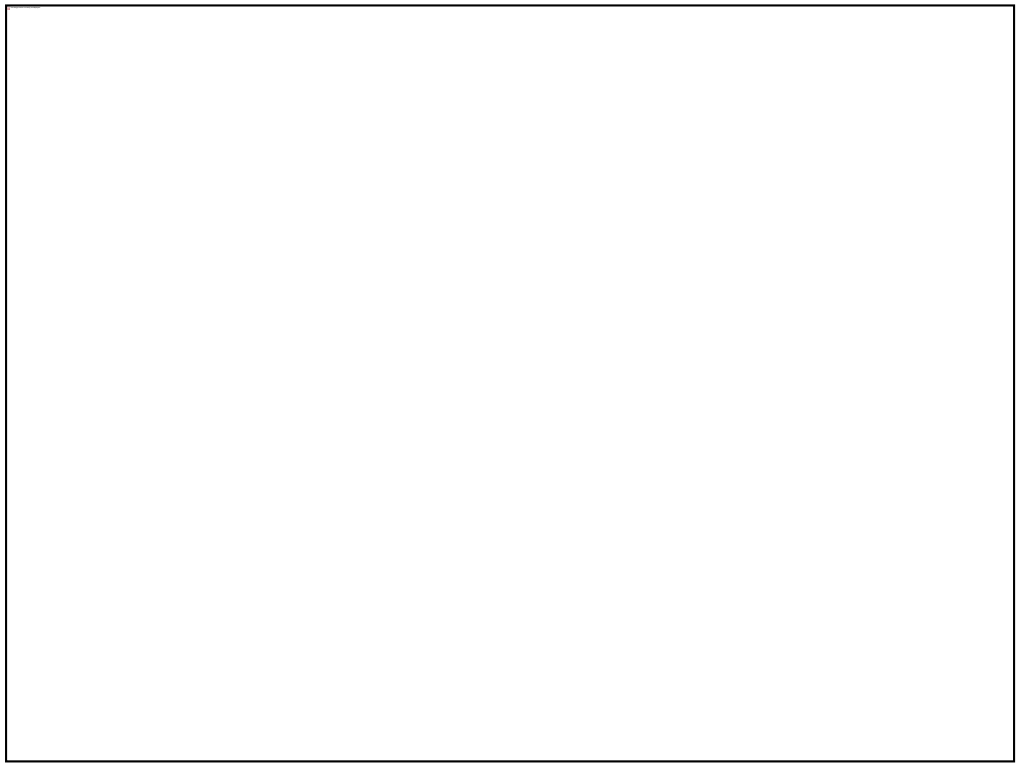


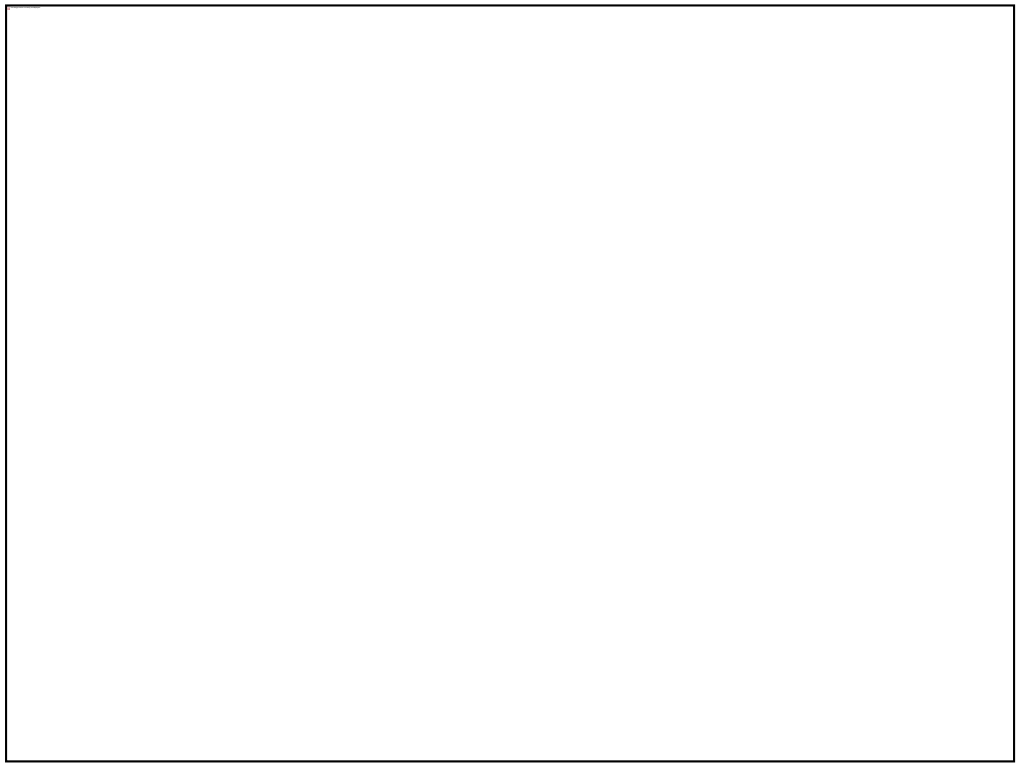


For this Brandon and Jason had a big disagreement (20 vs 70). I would say 50-60.

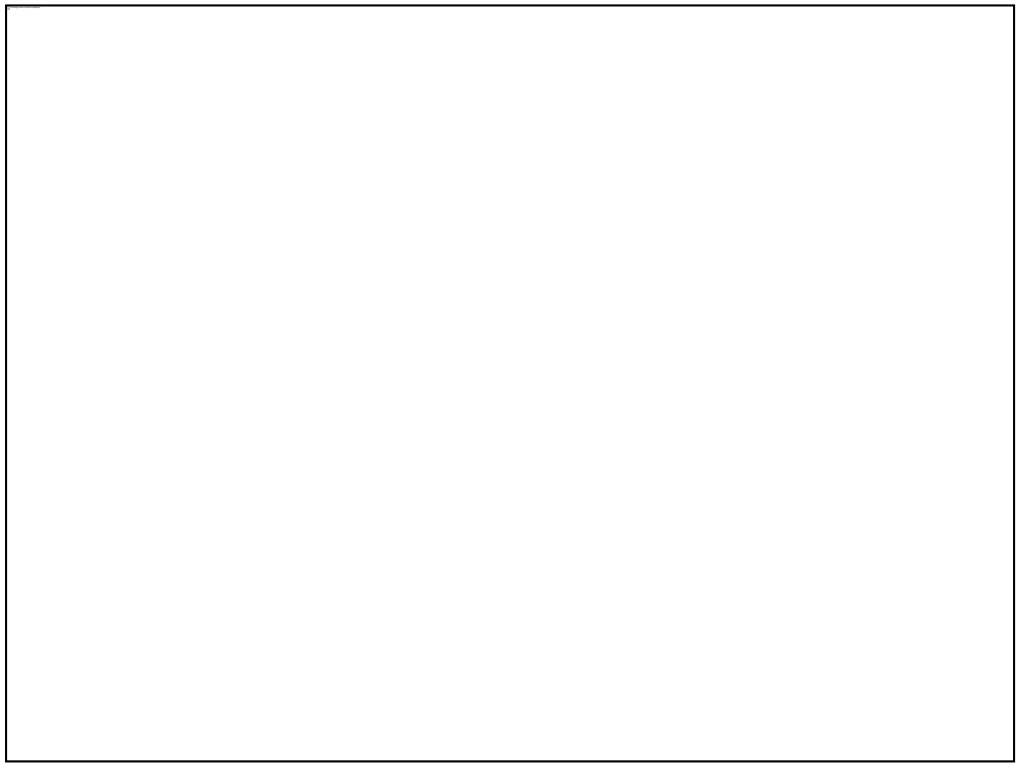


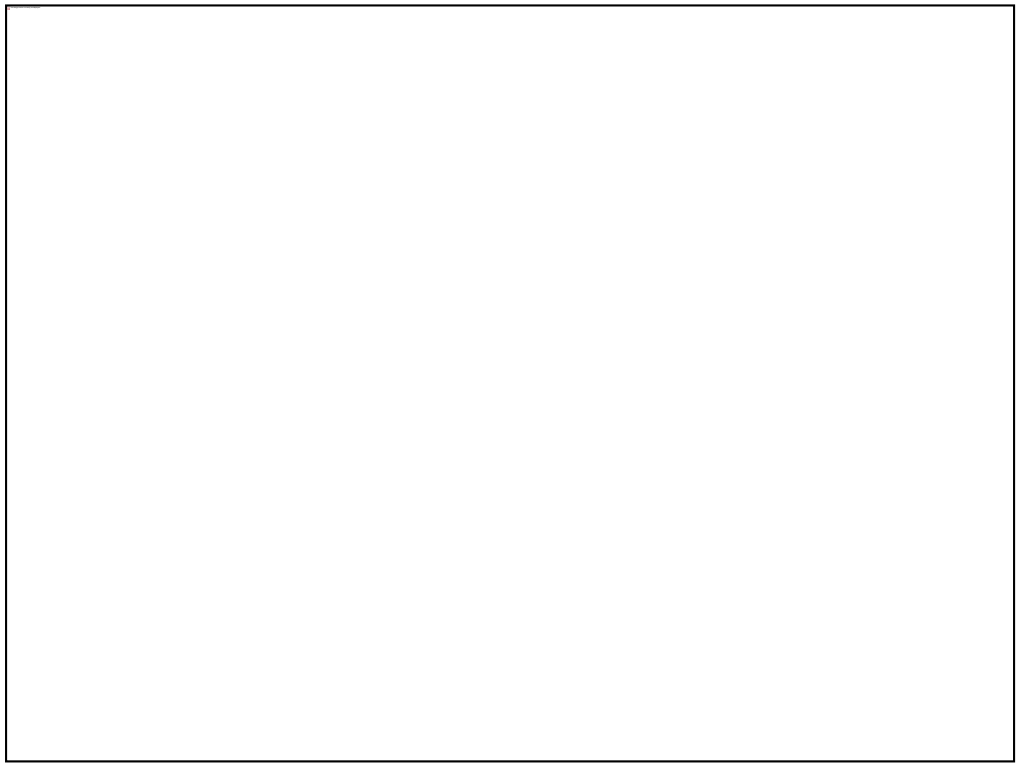




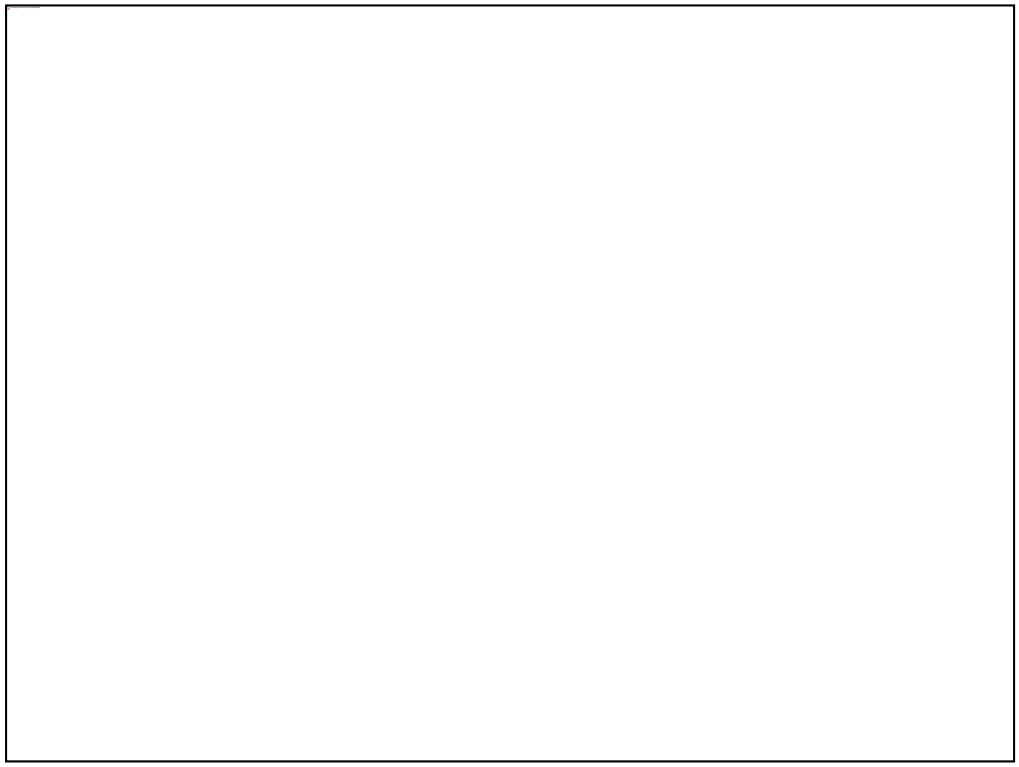


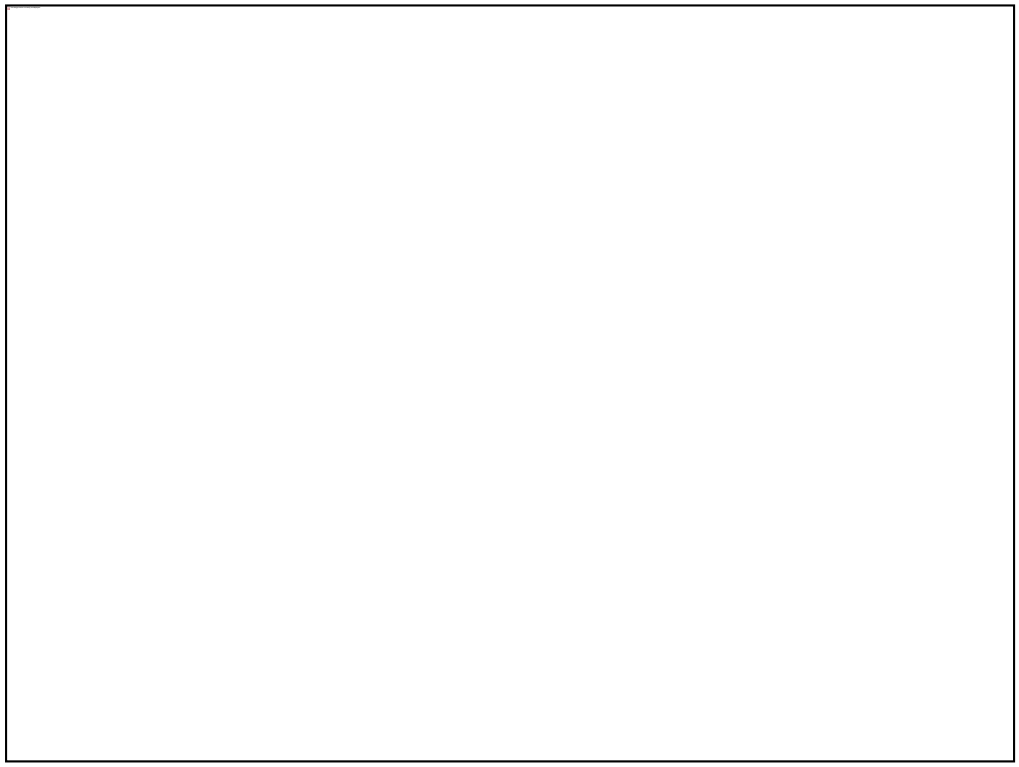
Atypical cell shape and N/C ratio

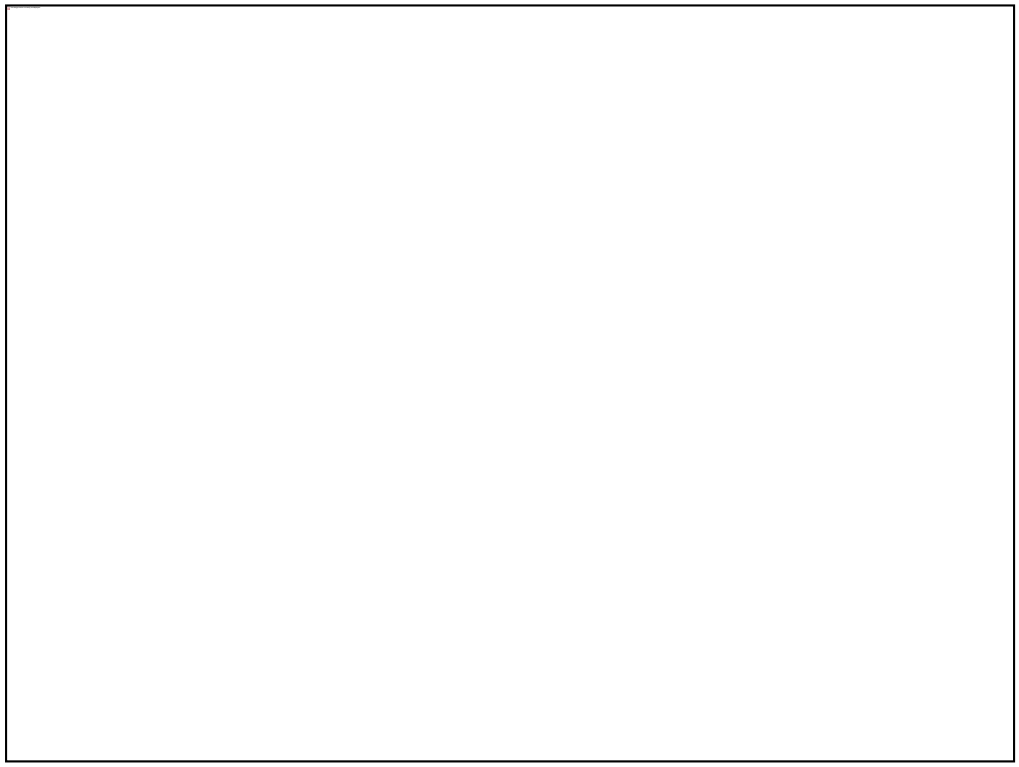


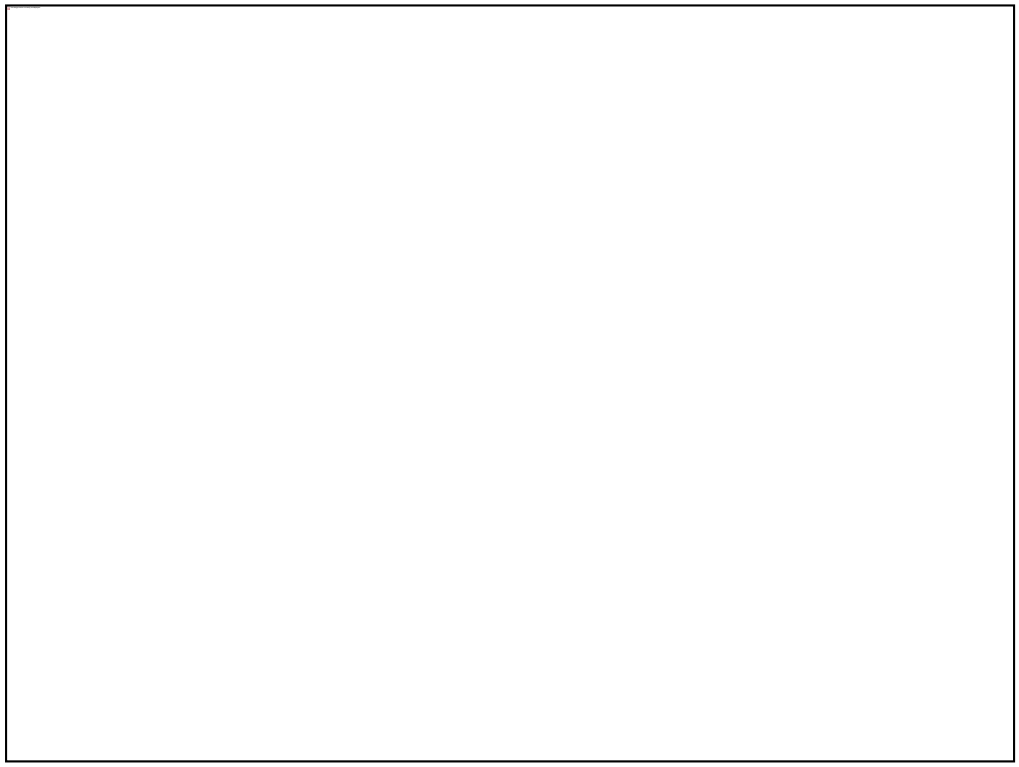


N/C too small?

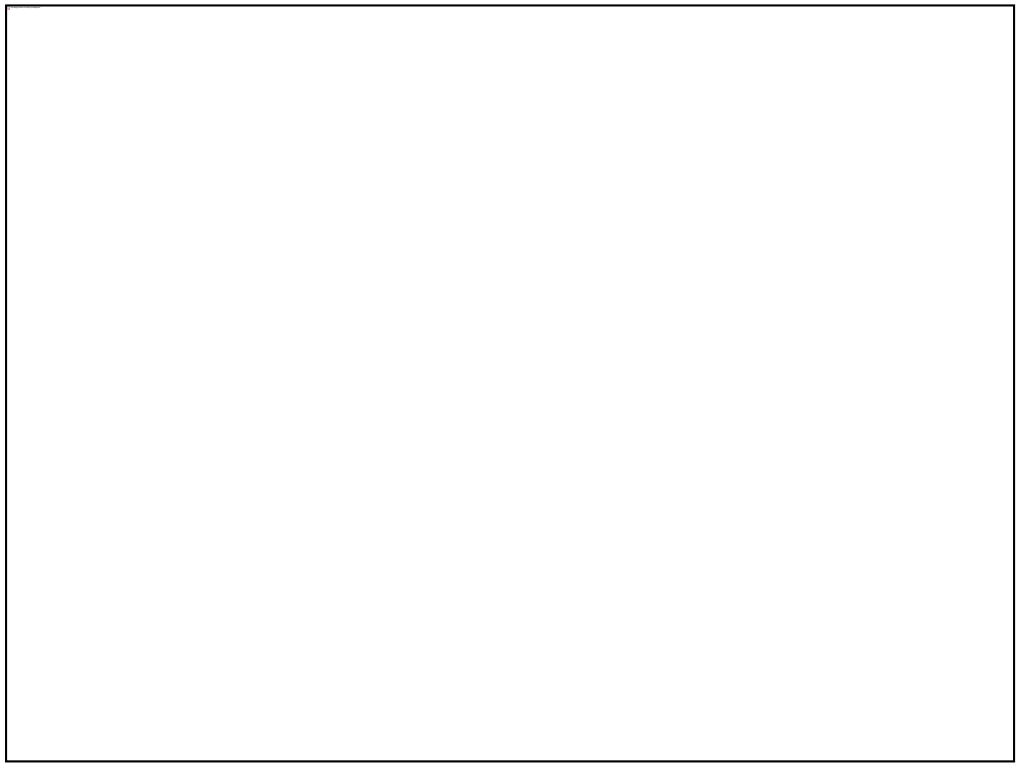


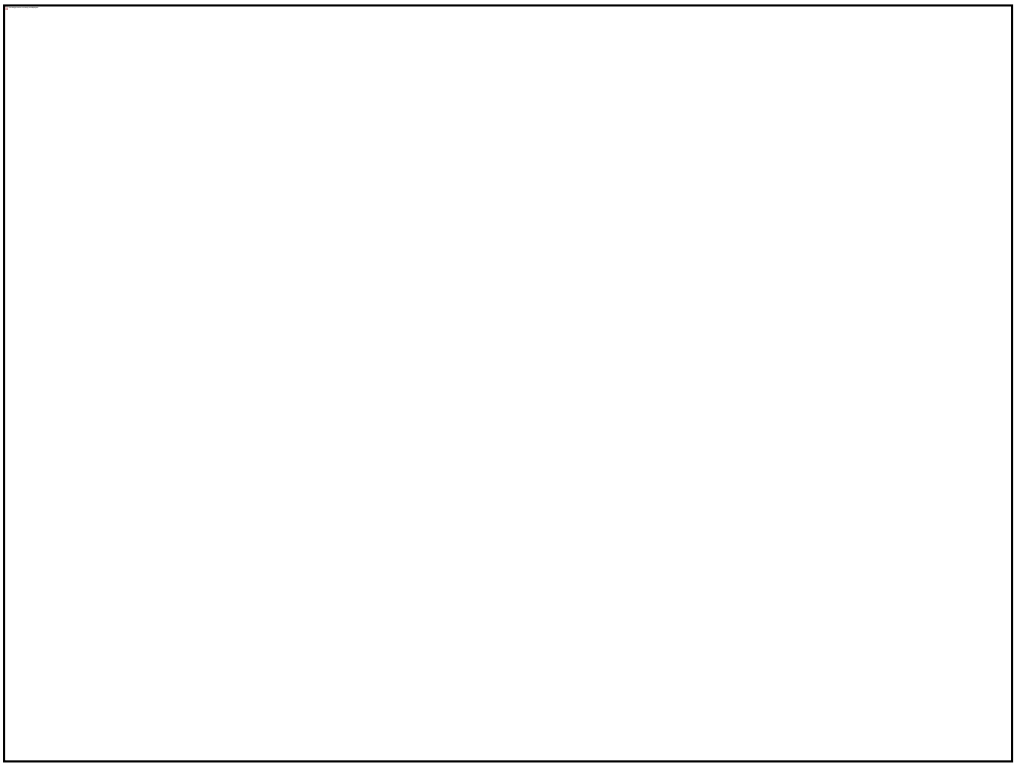


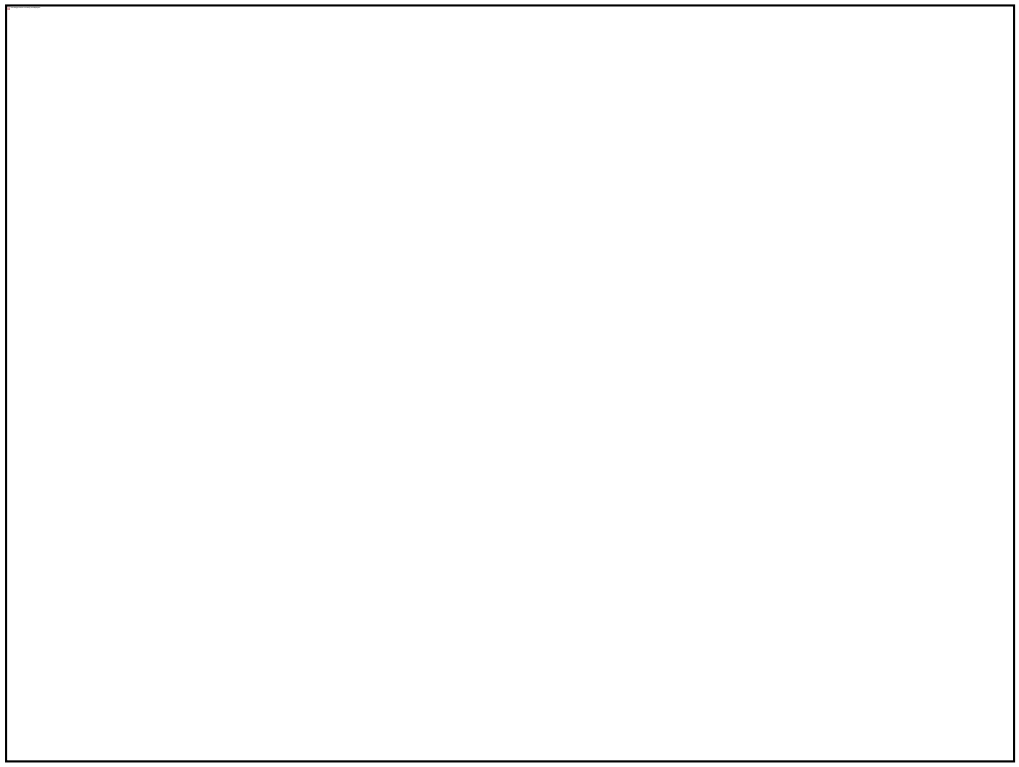


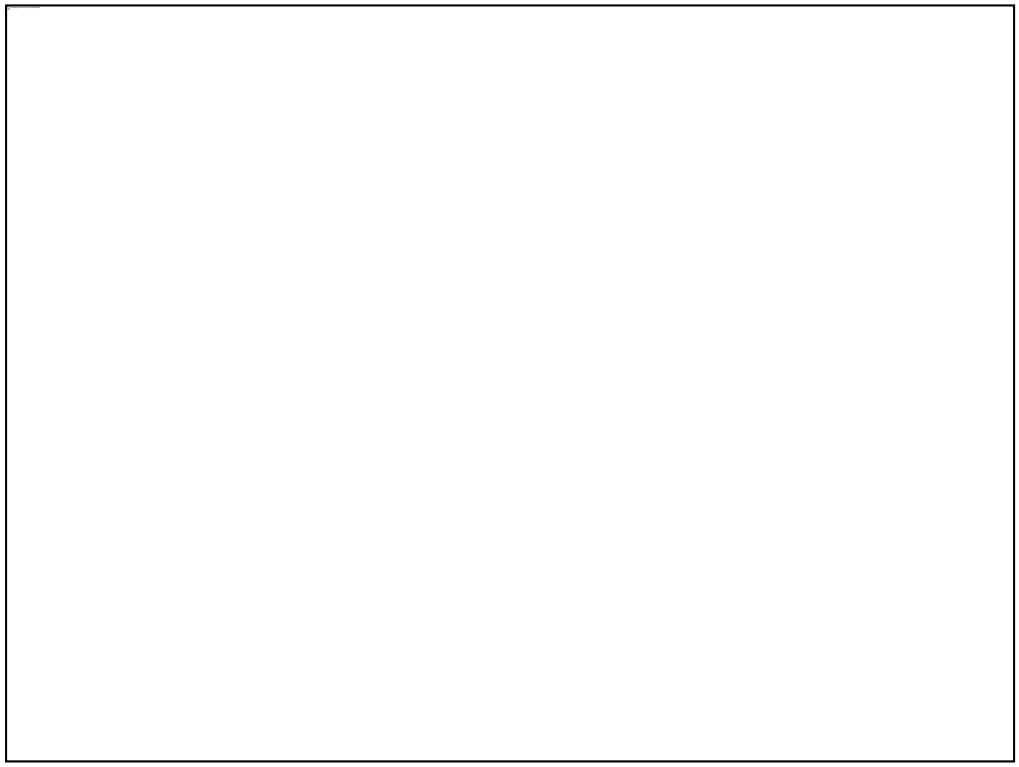


Atypical cell shape? Is score too high?

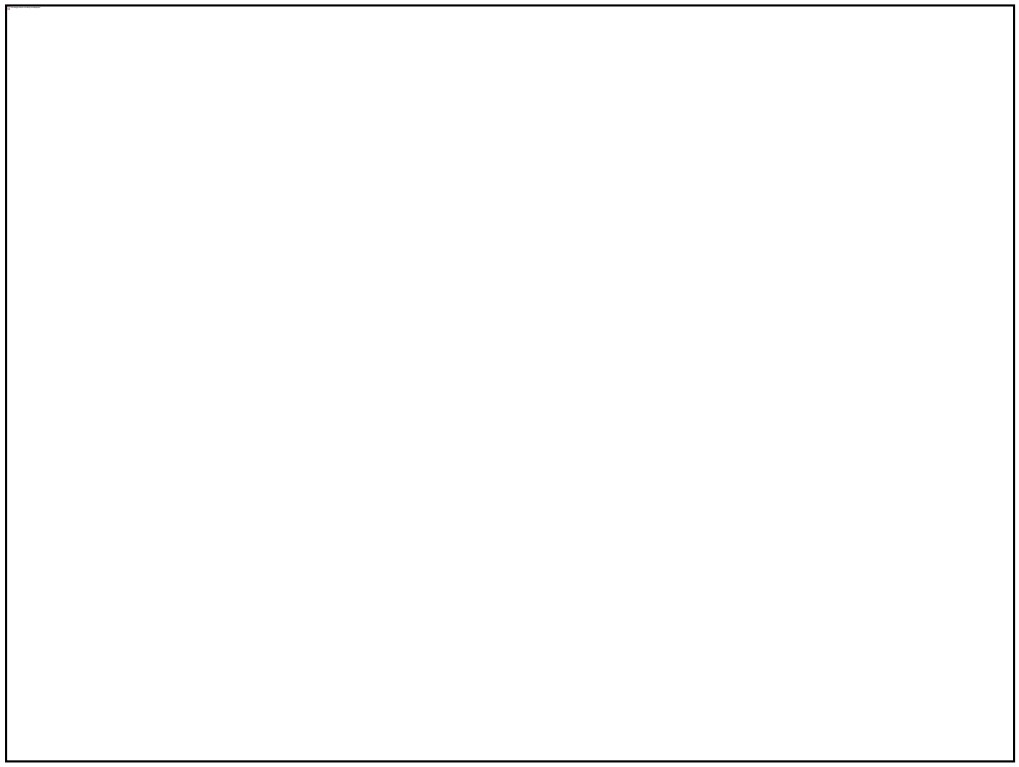


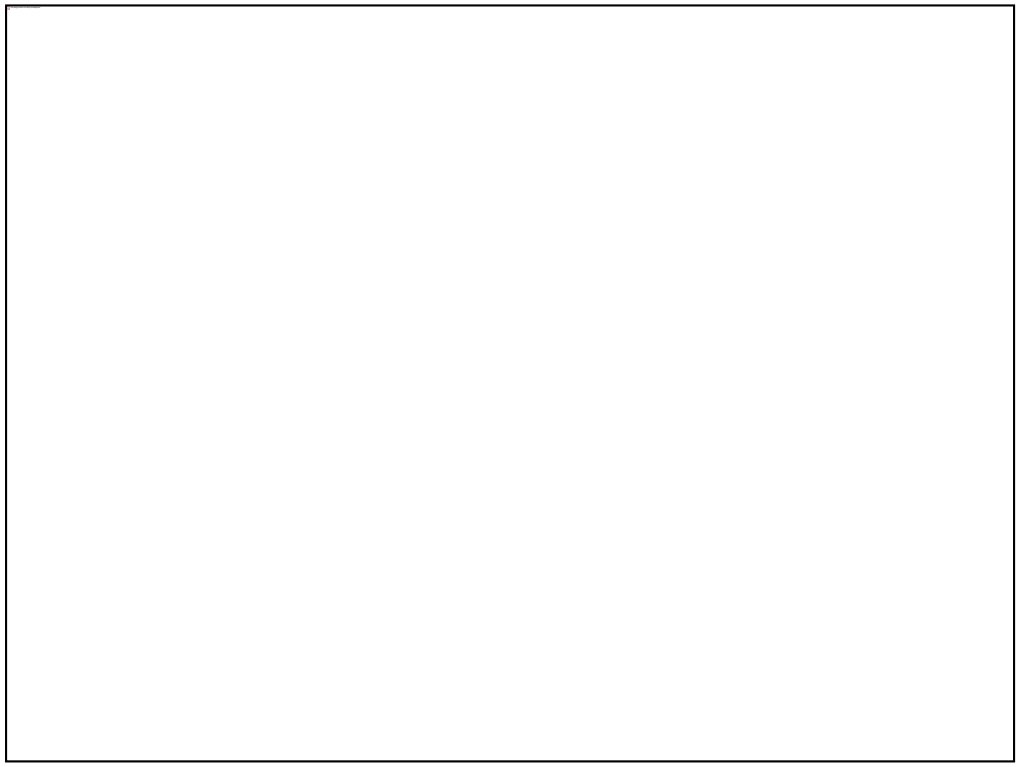


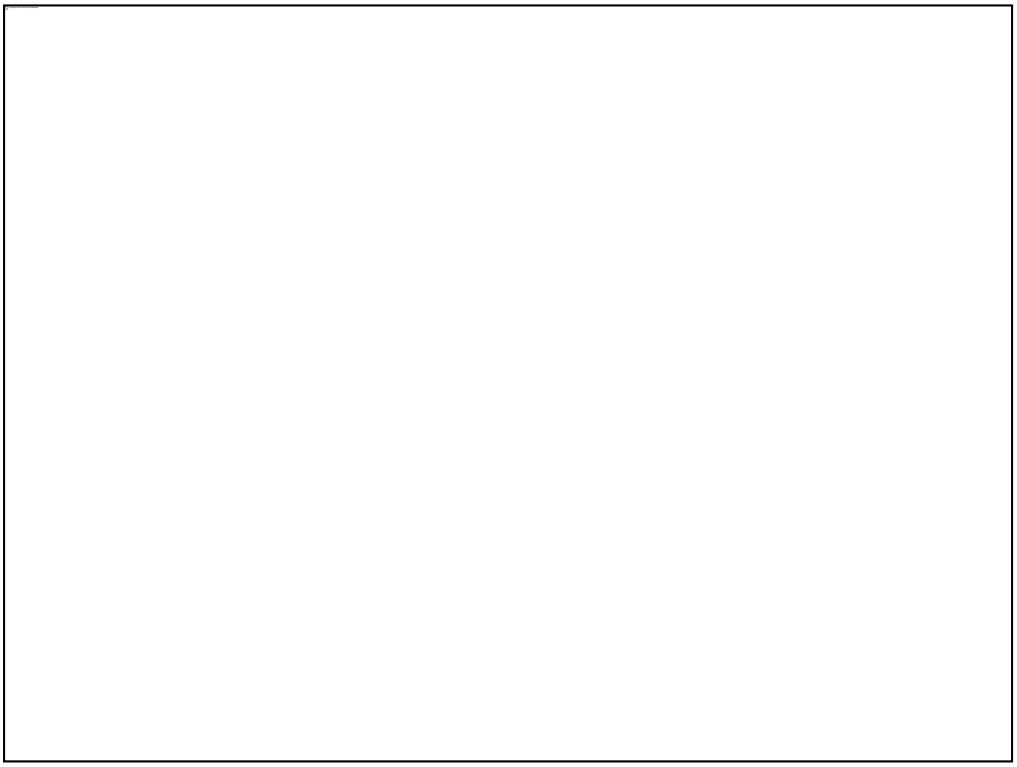


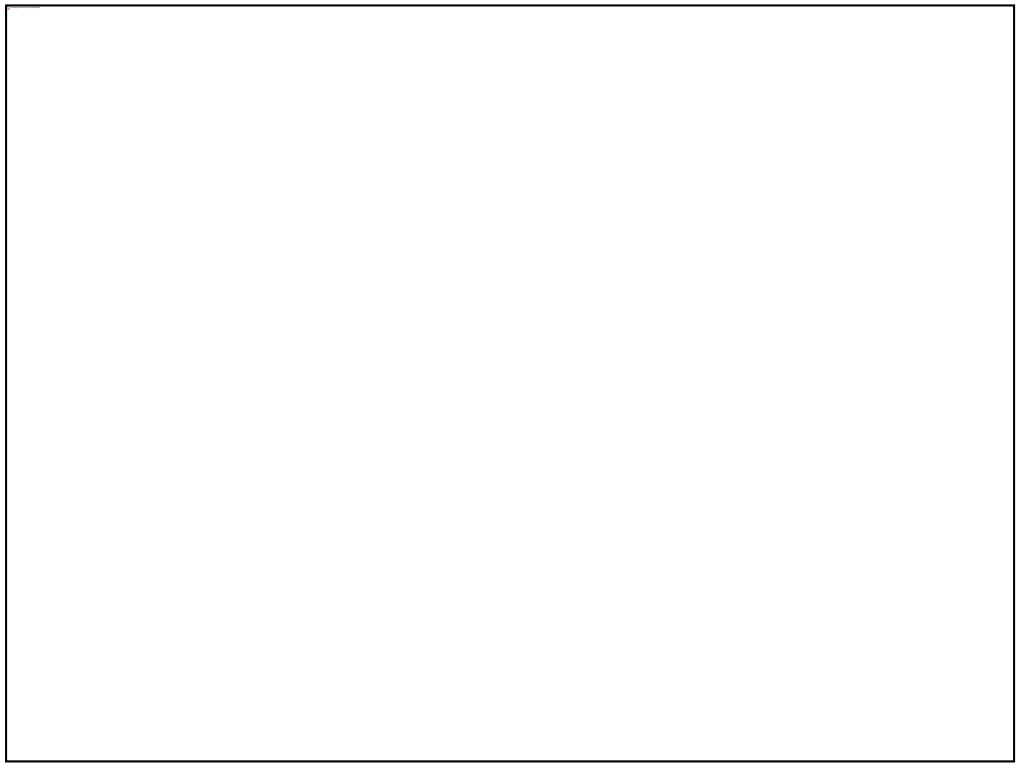


Atypical cell shape? Jason gave this an 85









A bit atypical cell shape