

## **Light Microscopy**

Pathology 464 © C. Robert Bagnell, Jr., Ph.D., 2013

## Introduction

The beautiful images I see in the light microscope have inspired me to try to understand how they are created. This course is an attempt to express my understanding in a manner valuable to students. In-depth descriptions of the topics I cover are included in the reference material.



The person in Figure I1 is Ernst Abbe. I cannot study light microscopy without marveling at the genius of those people who perfected the microscope. I mention many of them in the course. Ernst Abbe is special. Working in the mid 1800's he brought the light microscope to a high level of perfection with his inventions of the apochromatic

objective, oil immersion lenses, the compensating eyepiece, parfocal objective sets, and the Abbe condenser. But Abbe's greatest contribution was his discovery of the fundamental nature of how the light microscopic image is formed and what limits its resolution. From this came his definition of numerical aperture and the diffraction theory of image formation. A practical understanding of this theory is possible and is necessary for understanding how the microscope resolves fine structure and how the various contrast techniques work. It is also necessary for understanding how resolution beyond the diffraction limit is achieved in light microscopy.

With your good will, we will venture through the world of light microscopy sampling some of the oldest and some of the newest methods that reveal an exciting world that is below the power of our gaze.

Robert Bagnell, January 2013.