



Light Microscopy

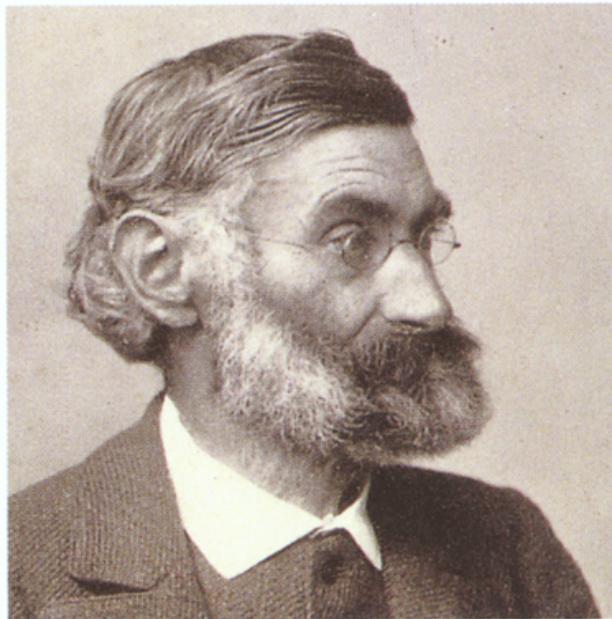
Pathology 464

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Introduction

The beautiful images I see in the light microscope have inspired me to try to understand how they are created. These chapters of notes and appendices are an attempt to express my understanding in a manner valuable to students. For in-depth descriptions of the topics in my notes, I refer you to the very readable books by Maksymilian Pluta.

Figure I1



Ernst Abbe

The person in Figure I1 is Ernst Abbe. I can not study light microscopy without marveling at the genius of those people who perfected the microscope. I mention many of them in the course of these notes. 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.

The light microscope that I refer to in this course is one from any manufacturer that can be aligned for Köhler illumination. It must have both a field iris and an aperture iris. Most laboratory grade microscopes manufactured during the past 40 years should qualify. You should have this kind of microscope available if you wish to make the best of these notes. I have included exercises that have helped me understand more fully how the microscope works. I believe you will learn much by trying these exercises.

Robert Bagnell, January 2012.