



An Introduction to the Theory and Use of the Microscope

C. R. Marshall

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AN INTRODUCTION TO The Theory and Use of the Microscope BY C. R. MARSHALL, M. A., M. D., LL. D. Professor of Materia Medico, and Therapeutics in the University of Aberdeen. AND H. D. GRIFFITH, B. A. Carnegie Teaching Fellow in Natural Philosophy in the University of Aberdeen. WITH TWENTY-NINE FIGURES IN THE TEXT AND THREE PLATES LONDON GEORGE ROUTLEDGE SONS, LTD. BROADWAY HOUSE 68-74 CARTER LANE, E. G. PRINTED IN GREAT BRITUN BY W. JOLLY AND SONS, LTD., ABERDEEN. FOREWORD. THE inspiration of this brochure was the institution of lectures and practical work on Microscopy as part of the class of Medical Physics in the University of Aberdeen. It was felt that a small textbook covering the work of the systematic lectures would be helpful . to the student and might aid him to realize the capabilities, limitations and proper method of use of the instrument. A chapter on the elementary mathematical treat ment of certain problems discussed in the text has been added. It is hoped that the work will prove of value to all students who require a microscope in their studies as well as to those amateur microscopists who wish to understand the fundamental principles on which Microscopy is based. C. R. M. H. D. G. January, 1928. CONTENTS. PAGE. INTRODUCTION i 10 The Simple Convex Lens Formation of the Image The Influence of the Eye Visibility of Objects The Simple Microscope The Compound Microscope. THE LENSES OF THE MICROSCOPE . . . n 32 Chromatic Aberration Spherical Aberration. OBJECTIVES. Achromatic, Semi-apochromatic, Apochromatic Focal Length Numerical Aperture Depth of Focus Working Distance Flatness of Field. EYEPIECES. Huyghenian Positive-Ramsden Disc Magnifying Power. CONDENSERS. Abbe Achromatic - Critical Illumination Focal Length Dark Ground Condensers Ultra Microscopy. RESOLUTION 33 36 Limit of Microscopic Vision Ultra-Violet Microscopy Abbes Diffraction Theory. THE STAND 37 44 The Foot The Stage The Substage The Body The Nose Piece The Limb Choice of Stand Choice of Objectives Choice of Eyepieces Testing Objectives. ILLUMINANTS 45 49 Illumination of Transparent Objects Dark Ground Effects Oblique Illumination Illu ination of Opaque Objects, vili. CONTENTS ADJUSTMENT 50 56 Adjustment of Mirror Focusing of Condenser Centering of Condenser Adjustment of Iris Diaphragm Adjustment of Tube Length Changing Objectives Changing Eyepieces Care of the Microscope. , MICROMETRY 57 62 Stage and Eyepiece Micrometers Photo-Micrography Measurement of Magnification Drawing Eyepieces Measurement of Thick ness. SPECTROSCOPY 6364 SPECIAL MICROSCOPES 65 72 The Metallurgical Microscope The Petro logical Microscope. Binocular Microscopes Greenough Wenham, Compound Prism Abbes Stereoscopic Eye piece Binocular Vision Binocular Rivalry. PHYSICAL PROOFS 73 84 Magnification Numerical Aperture Depth of Focus Ramsden Circle Chromatic Correction Sine Condition and Aplanatism Resolution. INDEX , 85 90 PLATES to face pp. 6, 28, 36 AN INTRODUCTION TO THE THEORY AND USE OF THE MICROSCOPE. THE function of the microscope is to reveal detail of the structure of objects too small to be visible to the unaided eye. This end is attained by the use of a series of lenses which make the object appear magnified to the observer. The magnification to be of value must extend to the finest detail of the object and each successive stage of magnification should reveal structure invisible without its aid. So-called c resolution J of detail in an object does not of necessity result from mere optical magnification. Magnification is necessary to attain it, but other factors are involved. It is the aim of this brochure to explain the principles of microscopy and the manipulations by which resolution is obtained. For these purposes it is essential to consider first certain properties of the simple convex lens, and some of the conditions governing the visibility of objects. THE SIMPLE CONVEX LENS...

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