# Sandritter's Color Atlas & Textbook of MACROPATHOLOGY

FOURTH EDITION

Carlos Thomas Werner H. Kirsten

### Sandritter's Color Atlas & Textbook of

### MACROPATHOLOGY

FOURTH ENGLISH EDITION

### Professor Dr. C. Thomas

g. Director of the Medical Center for Pathology, University of Marburg

### Translated and Edited by

### W. H. Kirsten, M.D.

Professor and Chairman, Department of Pathology The University of Chicago

With 678 Figures, of which 637 are color photographs, and 14 Tables



YEAR BOOK MEDICAL PUBLISHERS, INC. CHICAGO

English-language text copyright © 1985 by Year Book Medical Publishers, Inc. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the publisher. Printed in the United States of America.

International Standard Book Number: 0-8151-8789-0

This book is an authorized translation from the German edition published and copyrighted © 1970, 1971, 1975, 1977, 1979, and 1983 by F. K. Schattauer Verlag GmbH, Stuttgart, Germany. Title of the German edition: Makropathologie. Lehrbuch und Atlas für Studierende und Ärzte.

0987654321

### Library of Congress Cataloging in Publication Data

Sandritter, Walter.

Sandritter's Color atlas & textbook of macropathology.

Translation of: Makropathologie.

Rev. ed. of: Color atlas & textbook of macropathology.

3rd English ed. c1979.

Bibliography: p.

Includes index.

1. Anatomy, Pathological—Atlases. I. Thomas, C.

(Carlos) II. Kirsten, W. H. (Werner H.) III. Sandritter,

Walter, Color atlas & textbook of macropathology.

IV. Title. V. Title: Sandritter's Color atlas and text-

book of macropathology. VI. Title: Color atlas & textbook of macropathology. VII. Title: Color atlas and textbook

of macropathology. [DNLM: 1. Pathology—atlases. QZ 17 S219c]

RB33.S2613 1984 616.07 84-12001

ISBN 0-8151-8789-0

Sponsoring Editor: Susan M. Harter Editing Supervisor: Frances M. Perveiler

## Sandritter's Color Atlas & Textbook of MACROPATHOLOGY

### Preface to the First German Edition

Textbooks should be enticing; this they are when the most serene and accessible aspects of knowledge and science are offered.—GOETHE

As a "bait" to learn, organ pathology is presented in this textbook in the form of a picture atlas. The accompanying text is brief and only the most basic information is given. The stimulus for learning is the photograph or schematic representation of a disease. The knowledge derived from this information should be deepened by the use of more extensive textbooks, handbooks or monographs.

Although brief accounts of histopathologic findings are presented, this *Color Atlas and Textbook of Macropathology* should be complemented by use of the third edition of the *Color Atlas and Textbook of Tissue and Cellular Pathology* by W. Sandritter and W. B. Wartman (Year Book Medical Publishers, 1969). The photographs in this textbook are presented on the left-hand pages and the corresponding text on the right-hand pages, as was done in the textbook on Tissue and Cellular Pathology. This format has resulted in presentation of the essentials in a brief, telegraphic style, to which there are advantages and disadvantages. It will be up to the reader to decide whether the "information" is still comprehensible!

The selection of photographs and the "art of omission" posed many problems. Instructive gross photographs are not obtained easily. However, the most prevalent human diseases are all included in this text. The technics used for the photographs varied somewhat. Some pictures had to be taken under water in order to reduce highlights. The color intensity is somewhat diminished under such conditions. The material was obtained from the autopsy services (approximately 16,000 autopsies) of the Departments of Pathology at the Universities of Giessen and Bonn, Germany. We should like to thank the many prosectors for their assistance. Some photographs were provided by colleagues (see below). We are grateful to Professor Uehlinger and Doctor Adler (Zürich) for advice and discussion on the chapter on bone diseases. Professor Noetzel (Freiburg) assisted with the chapter on diseases of the brain, Professor Otto (Erlangen) with the lung chapter and Professor Görttler helped write the chapter on cardiac malformations. Doctor Bertram has corrected the text and provided useful information. We are grateful to two medical students, Messrs. Rogg and Haberstroh, for drawing the schemes.

The generous help and encouragement of Professor Matis and Mr. Reeg of Schattauer Verlag is greatly appreciated.

Freiburg, Summer 1970

W. SANDRITTER
C. THOMAS

### Preface to the Fourth English Edition

The German Edition of the *Color Atlas and Text Book of Macropathology* was published 1970. Professors Sandritter and Thomas from the University of Freiburg, had succeeded in presenting a succinct account of human pathology by combining color photographs of gross lesions with a brief text. I was asked by Professor Sandritter to translate the *Color Atlas* into English. The First English Edition appeared in 1976 and a Second Edition followed shortly thereafter. With the death of Professor Sandritter in 1980, his former co-worker, Dr. Charles Thomas, has revised the *Color Atlas* without changing the emphasis on combining observations—as exemplified by gross photographs—with a brief scientific background of a given disease. This approach, so successful with past editions, should aid students and residents to gain a better understanding of pathology as the study of human diseases.

I am grateful to the staff of Year Book Medical Publishers for their understanding, patience, and helpful advice and to Ms. Johnnie Berry for typing the manuscript.

W. H. KIRSTEN Chicago, Illinois

## Sandritter's Color Atlas & Textbook of MACROPATHOLOGY

### Contents

### 1 Introduction 1

### General Remarks 1

Diagnostic Criteria 2
Position and Shape of Organs 3
Size and Weight 3
Organ Color 5
Surfaces and Cavities 6
Consistency 8
Odor 8
Artifacts 8
Summary 8

### Autopsy Protocol and Diagnosis 9

### General Remarks Concerning Autopsy 13

### **Organ Systems**

### 2 Heart and Pericardium 17

Technic of Dissection 17
Malformations 19
Hypertrophy and Dilatation 23
Myocardial Infarction 27
Coronary Angiography 31
Endocarditis 35
Rheumatic Endocarditis, Valve Defects 37
Myocarditis 40
Pericarditis 43

### 3 Blood Vessels 45

Arteriosclerosis 45 Arterial Occlusive Diseases, Thromboangiitis Obliterans, Arteritis 50 Thrombosis 53

### 4 Upper Respiratory Tract, Lungs, Pleura 56

Technic of Dissection 56
Laryngeal Edema, Diseases of the Trachea 59
Tracheitis and Tumors of the Larynx 61
Atelectasis, Bronchitis, Bronchiectasis, Malformations 63
Pulmonary Emphysema 67
Lung Embolism 73
Hemorrhagic Lung Infarct 73
Congestion of the Lung, Pneumonia 77
Tuberculosis of the Lung 83
Sarcoidosis 89
Silicosis, Anthracosis, Lung Tumors 91
Pleura 99

### 5 Gastrointestinal Tract 100

Technic of Dissection 100
Tongue 101
Tonsils, Salivary Glands 103
Esophagus 105
Stomach 109
Gastric and Duodenal Ulcer 113
Tumors of the Stomach 117
Intestine 121

### **6** Liver 139

Dissection, Malformations, Postmortem Changes 139
Metabolic Changes 141
Congestion, Hemorrhage 145
Portal Vein Thrombosis, Periarteritis, Eclampsia, Endophlebitis 147
Liver Atrophy and Necrosis 149
Cirrhosis of the Liver 151
Hepatitis 155
Special Types of Cirrhosis and Fibrosis 157
Liver Abscesses 159
Parasites, Specific Inflammations 161
Tumors 163

### 7 Gallbladder—Bile Ducts 167

Malformations, Cholecystitis 167 Cholelithiasis 169 Tumors 171

### 8 Pancreas 173

Malformations, Fatty Infiltration, Inflammation 173
Necrosis of the Pancreas 175
Tumors 177
Diabetes Mellitus 179

### 9 Spleen, Lymph Nodes, Blood 181

Splenomegaly 181 Amyloidosis 183 Follicle Necrosis, Tuberculosis 185 Hodgkin's Disease 187 Tumors of Lymph Nodes 189 Leukemia 193

### 10 Cartilage, Bone and Soft Tissues 195

Chondrodystrophy, Rickets, Osteogenesis Imperfecta 195
Osteoporosis, Osteomalaria, Osteodystrophy 197
Bone Necrosis, Fracture, Pseudarthrosis 199
Inflammations of Bone 201
Paget's Disease of Bone, Fibrous Dysplasia 202
Tumors of Cartilage and Bone 205
Spine 213
Joints 215
Connective and Fat Tissue 219
Collagen Diseases 221

### 11 Skin and Mammary Gland 225

Keratoacanthoma, Seborrheic and Solar Keratosis 225 Skin Tumors 227 Breast 229

### 12 Endocrine Organs 231

Pituitary Gland 231 Pineal Gland, Thymus 233 Thyroid Gland 235
Parathyroid Glands 239
Adrenal Glands 243

### 13 Kidneys and Urinary System 249

Congenital Malformations Vascular Diseases of the Kidney 251 Noninflammatory Kidney Diseases (so-called Nephroses) 259 Glomerulonephritis (GN) 263 Uremia 266 Focal Glomerulonephritis 269 Pyelonephritis 269 Interstitial Nephritis 271 Anuria 271 Papillary Necrosis, Tuberculosis, Hydronephrosis 273 Diseases of the Urinary Tract 275 Urolithiasis 277 Tumors of the Kidney 279

### 14 Male Sex Organs 285

Prostate Gland 285 Testis 287

Urinary Bladder 281

### 15 Female Sex Organs 291

Uterus 291 Tubes and Ovaries 297

### 16 Pregnancy; Fetal and Neonatal Pathology 300

Pregnancy 300 Fetal and Neonatal Pathology 304

### 17 Nervous System 309

Edema of the Brain, CO Poisoning, Thrombosis 309
Hemorrhages 311
Circulatory Disorders 315
Cerebral Infarcts 317
Hydrocephalus 319
Demyelinating Diseases, Atrophy 321
Inflammatory Diseases 323
Tumors 327
Metastases 331

### **18** Malformations 332

Definitions 332 Double Malformations 335 Single Malformations 337

Index 343

### 1. Introduction

### General Remarks

It is the purpose of gross examinations to evaluate organ changes by inspection and palpation. The first step of a pathologic-anatomic diagnosis is an autopsy or the gross examination of a resected organ. Neither should be underestimated by the pathologist as a diagnostic aid or by the student as a didactic help. The macroscopic diagnosis is the basis of all surgical disciplines and is used by the pathologist as part of the routine examination of tissues. The quality of histopathologic examinations depends in large measure on a careful gross examination that determines the selection of representative sections for histology.

1. The autopsy is one of the most important tasks of a pathologist, even today. It completes the diagnostic activity of a physician and is, at the same time, a control procedure. Answers to multiple questions are sought with an autopsy, most of which could not be resolved during life. Was the diagnosis correct? Can the autopsy provide new insights into the pathogenesis, diagnosis, and therapy? Are certain autopsy findings important to the relatives of the deceased (presence of an infectious disease, unrecognized genetic disorder, or medical-legal problems)? The autopsy often reveals a clinically silent, secondary disease. For instance, tuberculosis can be reactivated during the terminal stages of a malignant tumor. The tuberculous process in such cases is commonly exudative and proceeds without major clinical findings, but it is highly contagious. By definition, *latent malignant tumors* are found during an autopsy or a surgical procedure.

**Autopsy technique:** During an autopsy, organs are removed *in toto*. The first step is to examine the topographic relationship during the removal of individual organs; this is followed by a gross examination, a description, and eventually the diagnosis. In most institutions, organs are returned to the body cavities after histologic sections are taken. However, the removal of individual organs often destroys special topographic relationships that may be of importance to the pathologist, surgeon, or student.

In contrast, the removal of organ packages involves the dissection of neck, chest, abdominal, and pelvic organs. Anatomic continuity is preserved, although the diagnosis is sometimes made difficult because of the size of such organ packages. A compromise solution is to dissect according to body cavities, as follows:

- 1. Brain with meninges and pituitary gland. After removal of these organs, the bony skull, the nasal cavities, the large vessels, and the middle ear are examined.
- 2. Organs of the neck and chest: Tongue, tonsils, thyroid and parathyroid glands, esophagus, larynx, trachea, lungs, visceral pleura, heart, and large vessels are removed together and examined.
- 3. Gastrointestinal tract: The small and large intestines, mesentery, mesocolon, and large omentum form an anatomic unit and are removed together.
- 4. *Upper gastrointestinal tract:* Stomach, duodenum, liver, gallbladder, pancreas, and spleen are removed by block dissection and separated from the remaining abdominal organs.
- 5. *Pelvic organs:* The large vessels (aorta and inferior vena cava) together with the kidneys, adrenal glands, ureters, urinary bladder, rectum, and genital organs are dissected.
- 6. Other organs such as bones (femur and sternum), skin, spinal cord, and eyes are removed if clinically indicated.

An autopsy should be complete; that is, all organs are examined. The occasional omission of a brain examination is an acceptable compromise if specified by relatives. A partial autopsy more often raises questions than provides answers to clinical problems.

Gross Evaluation of Biopsies: A biopsy is the operative removal of a tissue piece or organ for diagnostic purposes. Biopsies must be submitted for histologic examination, which not only complements the clinical diagnosis but also confirms that certain operative procedures have been carried out in the past. Symptoms of an acute appendicitis in a patient with a previous appendectomy or signs of a pregnancy in a sterilized patient are occasionally observed.

The description of a lesion or an organ change eventually leads to a pathologic-anatomic diagnosis, just as various symptoms make a clinical diagnosis. In this book, we have attempted to provide a guide for this approach. Changes in organ size, form, or other abnormalities are described. The diagnosis of an organ lesion is supplemented by key information concerning frequency, age, sex differential diagnosis, pathogenesis, complications, and prognosis. Remarks concerning histopathologic findings are added. Clinical symptoms and therapeutic considerations are mentioned briefly when indicated.

Each chapter is arranged according to groups of diseases, namely,

- 1. Remarks on anatomy, autopsy technic, and postmortem changes.
- 2. Malformations.
- 3. Changes in the size and shape of an organ.
- 4. Circulatory diseases.
- 5. Metabolic diseases.
- 6. Inflammations.
- 7. Tumors.

Certain abbreviations are used throughout this book in order to accommodate maximal information:

- 1. Definition: The essential information necessary for the understanding of the disease.
- 2. Mi refers to the microscopic findings.
- 3. The frequency (F), age distribution (A), and sex incidence  $(S: \delta, \varphi)$  are given.
- Pg refers to the pathogenesis, which includes the development and causation of a disease.
- Complications (CO) from a principal disease and the location (Lo) of lesions are discussed.
- 6. Differential diagnosis (DD).
- 7. Clinical symptoms (Cl).
- 8. Prognosis (Pr).
- 9. Therapy (Th).
- 10. > = more than, < = less than.

All percentages (%) refer to autopsy statistics unless otherwise stated.

### Diagnostic Criteria

Several general problems arise in arriving at a pathologic-anatomic diagnosis. Multiple impressions of changes in organ color, shape, and consistency are perceived during an autopsy. How are these impressions translated into consciousness? A large number of impressions are perceived but only some are "important." To select, retain, and convert the important impressions into a diagnosis is an art that is acquired by experience only. The examiner should pay attention to every detail and be prepared to recognize the important findings from knowledge.

### Position and Shape of Organs

The position and relationship of various organs are examined in situ instead of removing organ packages as soon as the body cavities have been opened. Positional organ changes are best diagnosed in situ. A pelvic kidney, diaphragmatic hernia (gut displaced into the



Fig 1-1.—A collection of fruits and fruit stones used in the past to describe pathologic lesions. Walnut, almond stone, cherry stones, plum stone (above). Apple seeds, rice corns, millet seeds, lentils (below).

thoracic cavity?), volvulus, or situs inversus should be recognized immediately. Likewise, fibrous adhesions or bands are determined in relation to other organs before the organs are removed.

The shape of a diseased organ is compared with the "normal" shape or form. Deviations from the norm are common (e.g., congenital abnormal lobulation of the lung, spleen or kidney). Acquired organ deformities frequently are caused by external factors compressing an organ. For example, the finding of a saber trachea should direct the examiner's attention to the presence of a goiter. Pulmonary atelectasis points to various types of pneumothorax, etc.

### Size and Weight

The size of an organ is determined by comparison with normal organ size. Although measurements of length, width, and height will suffice in most cases, even these values are only approximations of the many possible shapes of diseased organs. In fact, exact measurements of organ size can be obtained only be measuring the volume of an organ, that is, the measurement of the quantity of displaced water. The density of an organ

$$\left(\frac{\text{weight}}{\text{volume}} = \text{density}\right)$$
 also can be derived from knowing its volume. A fatty liver, for

TABLE 1-1.—Size (cm), Weight (kg), and Organ Weight (Gm) as a Function of Age and Sex

	BRAIN	0+	365	360	096	950	1050	1230	1260	1260	1250	1250	1250	1240	1200	1150
		*0	385	300	096	970	1200	1250	1340	1400	1400	1390	1380	1340	1300	1250
ΕX	OVAR- IES	O+	0.25	0.3	1.0	1.0	1.8	4.0	8.0	9.5	11.0	11.0	9.0	0.9	5.4	4.0
AGE AND SEX	TESTES	40	1.1	1.5	1.9	2.0	2.8	4.0	20.0	42.0	45.0	42.0	40.0	35.0	33.0	30.0
OF AG	ADRENAL GLANDS	O+	5.2	2.0	5.4	5.5	0.9	8.0	11.0	12.0	13.0	13.0	13.5	12.5	12.0	12.0
TEIGHT (AB), AND ORDER WEIGHT (OILL) AS A FUNCTION OF		*0	6.2	3.2	5.6	0.9	9.9	0.6	13.0	13.5	14.0	14.0	14.0	13.0	13.0	12.5
A LUE	SPLEEN	0+	10	12	25	30	52	70	110	130	130	130	130	115	105	90
IIII) AS		40	=	14	30	35	55	80	120	155	170	170	150	145	130	110
2	KIDNEYS	0+	23	28	09	72	105	125	185	240	260	240	240	235	235	220
M EIG		₩	24	31	70	77	105	150	200	270	280	285	275	270	270	260
OROAL	LIVER	0+	134	140	330	350	450	800	930	1370	1370	1370	1400	1430	1380	1250
, AND		₩	135	160	380	420	009	950	1270	1560	1580	1580	1590	1600	1520	1400
(NE)	*SOUT	O+	47	09	170	180	266	310	500	620	620	620	099	620	620	620
		\$	20	09	170	190	270	360	550	700	770	800	800	800	800	770
	HEART	O+	21	25	55	28	06	120	200	260	265	270	285	305	310	300
(ciii),		40	23	28	09	9	100	130	240	280	310	315	320	340	330	320
	BODY WEIGHT	0+	3.3	7.26	7.6	12.2	18.7	31.8	51.4	56.2	9.99	58.5	61.2	64.8	67.1	67.5
		60	3.4	7.5	10.0	12.5	19.4	32.6	54.8	62.0	65.0	0.89	71.0	72.0	73.0	72.0
	HEIGHT	0+	50.2	65.2	74.2	9.98	109.7	138.6	161.1	165.0	165.0	165.0	165.0	165.0	165.0	165.0
		60	50.6	66.4	75.2	87.5	111.3	140.3	167.8	170.0	170.0	170.0	170.0	170.0	170.0	170.0
	AGE		Birth	6 то.	1 yr.	2 yr.	5 yr.	10 yr.	15 yr.	20 yr.	25 yr.	30 yr.	40 yr.	50 yr.	60 yr.	70 yr.

\*Lung weights are falsified by pulmonary edema. In cases of acute electric death (e.g., execution), the lung weight is said to be 200 Gm.

example, appears larger than a normal liver of the same weight because the density of fat is less than the density of proteins. This also is true for excessive carbohydrates in an organ, e.g., glycogen storage disease of the liver. Examples of specific gravity are: granulocytes 1.070, erythrocytes 1.096, blood 1.059, blood plasma 1.027, fat 0.900.

The specific gravity of fluids is measured by the use of a urinometer. Exudates, i.e., inflammatory fluids, have a relatively high protein content; their specific gravity is 1.018 or greater. the specific gravity of transudates is 1.018 or lower.

The size of focal organ lesions should always be given in centimeters. Although it is customary to measure the size of a focal lesion on cut surface  $(6 \times 4 \text{ cm})$ , the depth of such a lesion should be given as well (e.g., a metastasis measures  $6 \times 4 \times 4 \text{ cm}$ ). The size of focal lesions, stones or organs has been compared to fruits and fruit stones. A collection of various fruits and stones is given in Figure 1–1. These comparisons are inaccurate and should be avoided. The size of apples, tomatoes or eggs varies considerably from season to season and from country to country. Likewise, descriptive terms such as the "size of a baby's head" or the "fist of a male" should be avoided.

The *organ size* is given in weight, which is a reliable measurement despite the above-mentioned variations due to specific gravity or density. The most important organ weights are expressed as a function of age, body weight and body height in Table 1–1. The values given in Table 1–1 are subject to variations as well. Organ weights may fluctuate by as much as 10%, especially in childhood. The organ weights of females are, in general, 20% lower than those of males. It obviously is impossible and also useless to remember all these weights. When needed, they always can be found in textbooks. However, some average weights of adults should be remembered (boldface values in Table 1–1). The following memory help has proved of some value: The heart weighs 350 Gm; the double value of the heart weight is the weight of the lungs (700 Gm); the half value of the heart weight is approximately the weight of the spleen (150 Gm) or one kidney. The liver weight can be determined by multiplying the spleen weight by 10 (1,500 Gm). The brain weighs approximately the same (minus spleen weight = 1,350 Gm).

### Organ Color

The characterization of a natural phenomenon by the eye is the single most important diagnostic aid. The eye sees more than color. *Form, transparency, luster* (dry, moist), *surface appearance* (smooth, irregular), and the *consistency* of an organ are all perceived by the eye.

The *characterization of a color* often is critical in making a diagnosis from the descriptive part of an autopsy protocol. It is important to know which organic substances determine a given color and which substrate is responsible for color changes in pathology. Detailed information, unfortunately, is missing and only some hints can be given here.

In general, the *blood content*, that is, the red of hemoglobin, determines organ color. Oxygenated blood (e.g., active, arterial hyperemia) is responsible for a bright red organ or skin color, whereas blood poor in  $O_2$  but rich in  $CO_2$  imparts a dark blue-red or dusky red color to an organ. Examples are the congested kidney and the black-red, hemorrhagic lung infarction. The blood and organs are cherry red or bright red in carbon monoxide poisoning (see Fig 17–3).

Breakdown products of hemoglobin such as *bilirubin* (red-yellow) and *biliverdin* (green-yellow) determine the discoloration of all organs in jaundice. With time, areas of hemorrhage change their color from red-yellow to green-yellow to yellow. These color changes reflect breakdown of hemoglobin in biliverdin.