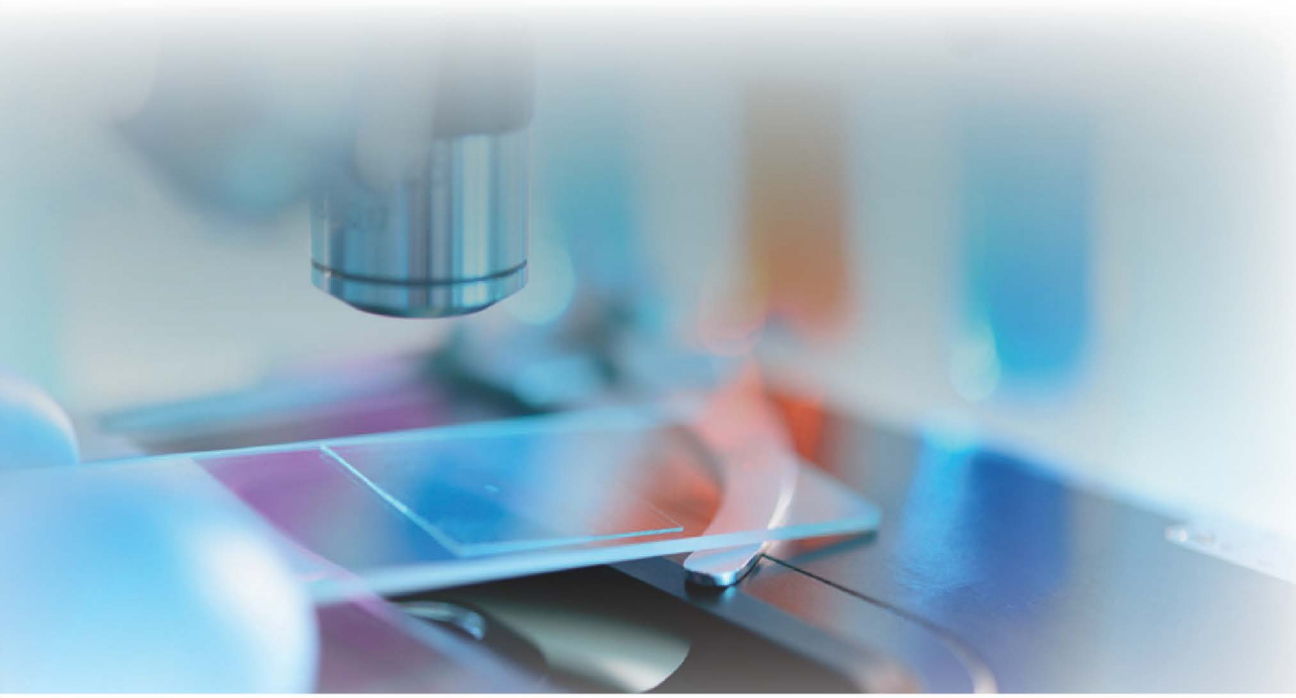
ur website **www.jaypeebrothers.com,** for detailed information on nursing books, visit our website **www.jaypeebrothers.com**

Textbook of Pathology and Genetics

for BSc Nursing Students



Chaitra K
Suma K

Forewords
Leena Chatterjee
Nagarajappa AH

JAYPEE

Contents

Section 1 Pathology

1. Introduction 3

Etiology 3; Pathogenesis 3; Morphologic Changes 3
Functional Derangements and Clinical Manifestations 3; Cellular and Tissue Changes 4
Cell Injury 5; Inflammation and Repair 6; Granulomatous Inflammation 9
Morphology 10; Cutaneous Wound Healing 10; Factors Influencing Wound Healing 12

2. Neoplasia 13

History of Malignant Tumors 14; Differentiation and Anaplasia 14
Dysplasia 14; Invasion 15; Metastasis 15; Pathways of Spread 16

3. Disturbances in the Fluid and Electrolyte Balance 17

Water Balance 18; Sodium Balance 18; Potassium Balance 18; Hypovolemia 18
Hyponatremia 19; Hypernatremia 19; Hypokalemia 20; Hyperkalemia 21

4. Respiratory System 22

Anatomy 22; Histology 22; Pulmonary Tuberculosis 22; Pneumonia 25
Lung Abscess 27; Bronchiectasis 27; Chronic Obstructive Pulmonary Disease 28
Emphysema/Pink Puffers 28; Chronic Bronchitis 28; Bronchial Asthma 30
Tumors of Lung 30; Pleura 31; Empyema 32

5. Cardiovascular System 33

Anatomy 33; Pericardial Disease 34; Rheumatic Fever and Rheumatic Heart Disease 35
Chronic Rheumatic Heart Disease 36; Infective Endocarditis 37; Arteriosclerosis 38
Ischemic Heart Disease 40; Aneurysms 43

6. Gastrointestinal Tract 46

Normal Anatomy 46; Histology 46; Pathology 46; Etiology and Pathogenesis 47
Typhoid (Enteric Fever) 47; Carcinoma Esophagus 48; Squamous Cell Carcinoma 48
Adenocarcinoma 49; Carcinoma Stomach 49; Carcinoma Colon 51

7. Liver, Gallbladder and Pancreas 52

Liver 52; Gallbladder 53; Pancreas 53; Viral Hepatitis 54
Cirrhosis of Liver 57; Liver Abscess 58; Gallbladder 59; Tumors of Liver 59
Tumors of the Gallbladder 61; Tumors of the Exocrine Pancreas 61

8. Kidney and Urinary Tract 62

Kidney 62; Pathology 62; Acute Proliferative Glomerulonephritis 62
Pyelonephritis 64; Renal Calculi/Urolithiasis (Stones) 65
Renal Cell Carcinoma 66; Cystitis 67

9. Male Genital System and Prostate **69**
Testis: Normal Structure 69; Prostate: Normal Structure 70
Penis: Normal Structure 70; Cryptorchidism 70
Testicular Atrophy 71; Testicular Tumors 71; Prostate 72
Carcinoma Prostate 73; Carcinoma Penis 74

10. Female Genital System and Breast **75**
Anatomy 75; Fibroid/Leiomyoma 75; Carcinoma of the Endometrium 76
Carcinoma of the Cervix 77; Ectopic Gestation 78
Hydatidiform Mole (Vesicular Mole) 79; Choriocarcinoma 81; Ovarian Tumors 81
Serous Tumors 82; Mucinous Tumors 83; Germ Cell Tumors 83
Teratoma 84; Breast 84; Carcinoma of Breast 85

11. Central Nervous System **88**
Normal Structure 88; Hydrocephalus 88; Meningitis 89
Encephalitis 90; Cerebrovascular Diseases 91; Tumors of the CNS 93

12. Skeletal System **96**
Normal Structure 96; Normal Histology 96; Osteomyelitis 97
Tuberculous Osteomyelitis 97; Osteoporosis 98; Fracture Healing 98
Bone Tumors 99; Osteoid Osteoma and Osteoblastoma 100
Osteosarcoma 100; Chondrosarcoma 101
Giant Cell Tumor (Osteoclastoma) 102; Ewing's Sarcoma 102; Joints 103

13. Hematology **106**
Collection of Blood 106; Methods of Collection of Blood for Various Tests 106
Methods of Estimation of Hemoglobin 107
Sahli's Method of Estimation of Hemoglobin 107; Hemocytometer 108
The Red Blood Cell Count 109; Total White Blood Cell Count 109
Differential White Blood Cell Count 110; Blood Grouping and Typing 110
Cross Matching 111; Tests for Hemostasis 112
Examination of Bone Marrow 113; Blood Culture 116

14. Examination of Body Cavity Fluids, Transudates and Exudates **117**
Cerebrospinal Fluid Analysis 117; Cavity Fluid Examination 118
Sputum Examination 118; Gastric Analysis 119; Semen Analysis 120

15. Examination of Urine and Feces **122**
Formation of Urine 122; Collection of Urine 122; Examination of Feces 127

Section 2 Genetics

16. Introduction **131**
Genetics is the Study of Genes 131; Impact of Genetic Condition on Families 131
Review of Cellular Division 131; Characteristics and Structure of Genes 132
Chromosomal Aberration 132

17. Maternal, Prenatal and Genetic Influences on Development of Defects and Diseases **136**
Conditions Affecting the Mother: Genetic and Infections 136
Connective Tissue Disorders (Marfan Syndrome and Ehlers-Danlos Syndrome) 136
Congenital Heart Disease 138; Consanguinity 138; Infertility 142

18. Genetic Testing in Neonates and Children **144**
Screening for Congenital Abnormalities 144
Developmental Delay 144; Dysmorphism 145

19. Genetic Conditions of Adolescents and Adults **147**
Cancer Genetics: Familial Cancer 147; Colorectal Cancer 148
Presymptomatic Genetic Testing in Familial Cancer 148
Genetic Inheritance Patterns 150; Genetic Hematological Disorders 150
Hemophilia 152; Genetic Hemochromatosis 153; Mental Illness 155

20. Service Related to Genetics **156**
Genetic Testing 156; Human Genome Project 156; Gene Therapy 157

Index *161*

CHAPTER 2

Neoplasia

Neoplasia means "new growth". *Oncology* (In Greek, *oncos* = tumor) is the study of tumors or neoplasms. Cancer is the common term for all malignant tumors.

The eminent British oncologist Sir Rupert Willis has given the definition:
"A neoplasm is an abnormal mass of tissue, the growth of which exceeds and is uncoordinated with that of the normal tissues and persists in the same excessive manner after cessation of the stimuli which evoked the change."

All tumors have two basic components:
1. Proliferating neoplastic cells that constitute their parenchyma.
2. Supportive stroma made up of connective tissue and blood vessels.

Sometimes the parenchymal cells stimulate the formation of an abundant collagenous stroma, referred to as desmoplasia.

Benign tumors are designated by attaching the suffix—*oma* to the cell of origin. For example, a benign tumor arising from fibroblastic cells is called a fibroma, a cartilaginous tumor is a chondroma.

Adenoma is the term applied to a benign epithelial neoplasm that forms glandular patterns as well as tumors derived from glands (Fig. 2.1). Benign epithelial neoplasms producing microscopically or macroscopically visible finger-like or warty projections from epithelial surfaces are referred to as papillomas.

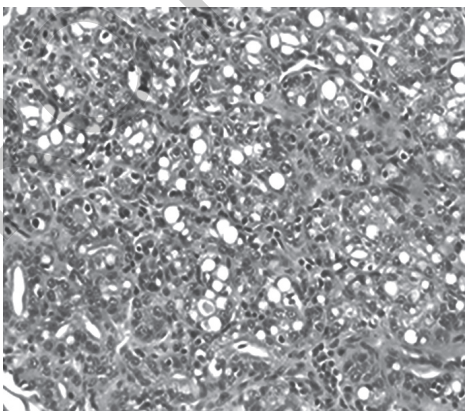


FIGURE 2.1 Adenoma

When a neoplasm, benign or malignant, produces a macroscopically visible projection above a mucosal surface, it is termed a polyp.

Malignant tumors arising in mesenchymal tissue are usually called sarcomas (In Greek *sar* = fleshy), e.g. fibrosarcoma, liposarcoma. Malignant neoplasms of epithelial origin, derived from any of the three germ layers, are called carcinomas. One with glandular pattern microscopically is termed an adenocarcinoma (Fig. 2.2). One producing recognizable squamous cells is termed a squamous cell carcinoma (Fig. 2.3).

Divergent differentiation of a single line of parenchymal cells into another tissue creates

JAYPEE BROTHERS

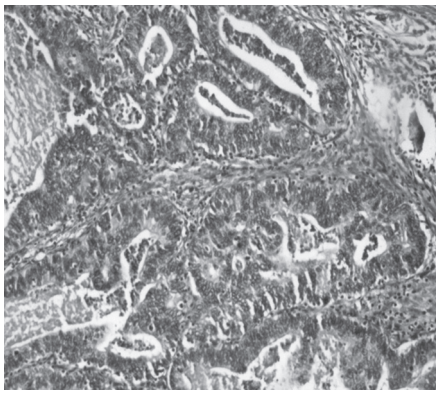


FIGURE 2.2 Adenocarcinoma

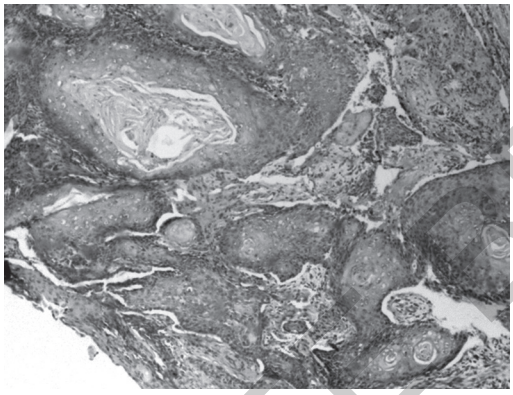


FIGURE 2.3 Squamous cell carcinoma

mixed tumors, e.g. pleomorphic adenoma. Teratomas, are made up of a variety of parenchymal cell types representative of more than one germ layer, usually all three, e.g. ovarian cystic teratoma. Differences between benign and malignant tumors based on their characteristics is given in Table 2.1

HISTORY OF MALIGNANT TUMORS

It has four phases:

1. Malignant change in the target cell referred to as transformation.
2. Growth of transformed cells.
3. Local invasion.
4. Distant metastases.

TABLE 2.1 Classification criteria

Characteristics	*Benign tumor*	*Malignant tumor*
Growth pattern	Cohesive and expansile	Infiltrative
Rate of growth	Slow	Fast
Differentiation	Well	Poor
Metastasis	Absent	Present

DIFFERENTIATION AND ANAPLASIA

Differentiation refers to the extent to which neoplastic cells resemble comparable normal cells, both morphologically and functionally.

Anaplasia is lack of differentiation which is a hallmark of malignant transformation.

Morphological Changes in a Malignant Tumor

- *Pleomorphism*: Variation in the size and shape of cells and the nuclei.
- *Abnormal nuclear morphology:* Nuclei of the tumor cells are larger, hyperchromatic with irregular nuclear membrane. The chromatin is coarsely clumped. The nuclei have prominent nucleoli.
- *Mitoses*: Increased in number and is atypical (Fig. 2.4).
- *Loss of polarity:* The orientation of anaplastic cells is markedly disturbed (i.e. they lose normal polarity). Sheets or large masses of tumor cells grow in an anarchic, disorganized fashion.
- *Other changes:* Tumor giant cells and ischemic necrosis (Fig. 2.5).

DYSPLASIA

Dysplasia means disordered growth. It is characterized by a loss in the uniformity of the individual cells as well as in their architectural orientation. Dysplastic cells exhibit pleomorphism, hyperchromatic nuclei,

JAYPEE BROTHERS

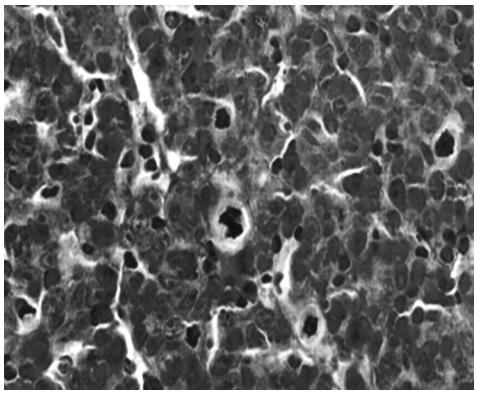


FIGURE 2.4 Atypical mitotic cell

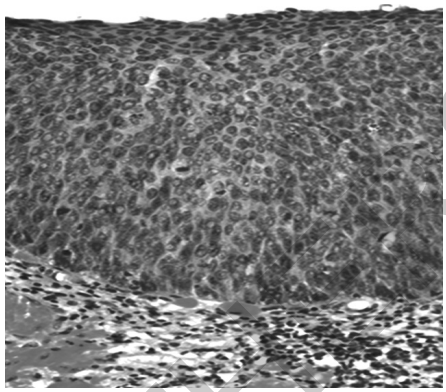


FIGURE 2.6 Carcinoma *in situ*

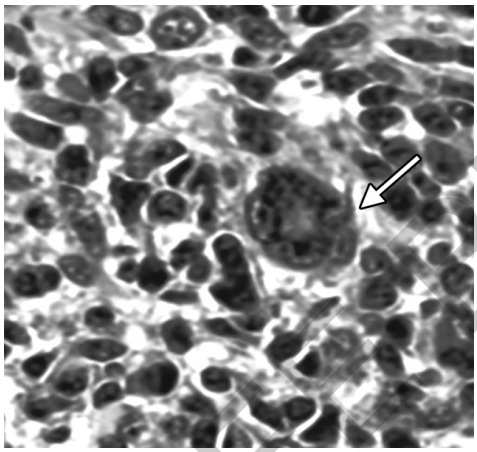


FIGURE 2.5 Tumor giant cell



FIGURE 2.7 Basal cell carcinoma showing invasion

abundant mitotic figures, mitoses in abnormal locations within the epithelium.

When dysplastic changes are marked and involve the entire thickness of epithelium, the lesion remains confined to the normal tissue and the basement membrane is intact, it is called carcinoma *in situ*, a preinvasive neoplasm (Fig. 2.6).

INVASION

Nearly all benign tumors grow as cohesive expansile masses that remain localized to their site of origin. They develop a rim of compressed connective tissue, sometimes called a fibrous capsule which separates them from host tissue. But the growth of malignant tumors is accompanied by progressive infiltration, invasion and destruction of surrounding tissue (Fig. 2.7).

Next to metastases, invasiveness is the most reliable feature that differentiates malignant from benign tumors.

METASTASIS

Metastases are tumor implants discontinuous with the primary tumor.

If the tumors are more aggressive, more rapidly growing, and larger in size, greater the likelihood that it will metastasize.

JAYPEE BROTHERS

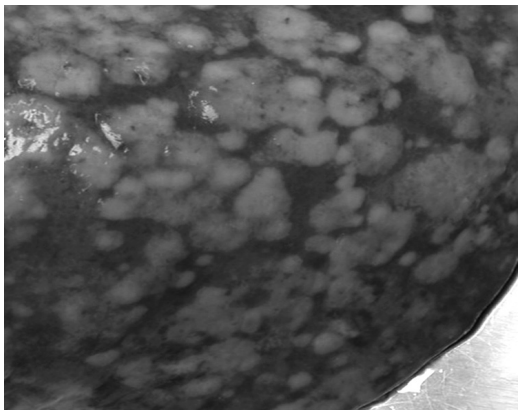


FIGURE 2.8 Metastasis to the liver

PATHWAYS OF SPREAD

- Direct seeding of body cavities or surfaces, e.g. pseudomyxoma peritonei.
- Lymphatic spread is most common for carcinomas and it follows the natural routes of drainage.
  Sentinel lymph node is the first node in a regional lymphatic basin that receives lymph from primary tumor (In breast-axillary lymph node—sentinel lymph node).
- Hematogenous spread is typical for sarcomas but also seen with carcinomas. Liver and lungs are most frequently involved (Fig. 2.8).

JAYPEE BROTHERS

for detailed information on nursing books, visit our website **www.jaypeebrothers.com,** for detailed information on nursing

Textbook of
Pathology and Genetics
for BSc Nursing Students

Salient Features

- It is a comprehensive and simple book
- Presents the topics in a very systematic approach
- Discusses all topics in accordance with the syllabus prescribed by the Indian Nursing Council (INC)
- Explains every topic in detail with etiology, pathogenesis and morphological description of various diseases
- Every chapter has self-explanatory line diagrams which have been digitized for easy interpretation
- Includes many gross and microscopic photographs, wherever necessary
- Helpful for young nursing students to understand more about the human body and the related pathology.



Chaitra K completed her MBBS from MS Ramaiah Medical College and postgraduation in pathology from Kempegowda Institute of Medical Sciences, Bengaluru, Karnataka, India with first rank in Pathology in the Rajiv Gandhi University of Health Sciences (RGUHS). She worked at Bangalore Medical College and Research Institute for three and half years. Presently, she is Consultant Pathologist and Laboratory Head, SRL Diagnostics Ltd, Fortis Hospital, Nagarbhavi, Bengaluru, Karnataka, India since 3 years. She is well versed in reporting hematology, cytology, serology and biochemistry reports. She is the primary author of a paper, *Abnormal Granulation of Blood Granulocytes in Mucopolysaccharidosis VI: A Case Report,* published in the international journal—Annals of Diagnostic Pathology. She is on the editorial board of the Scientific Newsletter at Fortis Hospital, Nagarbhavi.



Suma K has completed her MBBS in Sri Siddhartha Medical College, Tumkur and Diploma in Clinical Pathology (DCP) with 5th rank in the State from Bangalore Medical College and Research Institute, Bengaluru and has worked as a Tutor in the same institution. She has published a paper in the international journal—Annals of Diagnostic Pathology and presented a poster in Karnataka Chapter of Indian Association of Pathologists and Microbiologists (KCIAPM) State Conference. Presently, she is working as Consultant Pathologist at Bengaluru, Karnataka, India.

Available at all medical bookstores
or buy online at www.jaypeebrothers.com

JAYPEE BROTHERS
Medical Publishers (P) Ltd.
www.jaypeebrothers.com

Join us on facebook.com/JaypeeMedicalPublishers

ISBN 978-93-5152-817-3
9 789351 528173