Oncology Websites

COMPREHENSIVE

American Cancer Society (www.cancer.org)
National Cancer Institute, USA (www.cancer.gov)
National Cancer Institute, Egypt (www.nci.cu.edu.eg)
National Comprehensive Cancer Network (www.nccn.org)
Onco Link (www.oncolink.com)
PDQ: NCTs Comprehensive Cancer Database (www.cancer.gov/cancer topics/pdq)
Wikipedia, the free encyclopedia (en.wikipedia.org/wiki/Cancer)
A link for medical informatics (search.medscape.com)
Surveillance Epidemiology & End Results "SEER" (seer.cancer.gov/statistics/)

CANCER LITERATURE

American Association for Cancer Research (AACR) (www.aacr.org)
BioMed Central (includes RSS feed) (www.biomedcentral.com)
Cancernews (e-mail updates) (www.cancernews.com/
Medscape RSS news feed and e-mail alerts) (www.medscape.com/
Nation Cancer Institute Publications Locator (cissecure.nci.nih.gov/ncipubs)
PubMed (RSS and email updates) (www.pubmed.gov)
NIH "National Library of Medicine" (www.nlm.nih.gov/medlineplus/cancers.html) (gateway.nlm.nih.gov/gw/Cmd) (www.ncbi.nlm.nih.gov/pubmed/)

CLINICAL TRIALS

Center Watch (www.centerwatch.com)
Clinical Trials (NCI) (www.cancer.gov/clinical_trials)
Clinical Trials.gov (www.clinicaltrials.gov)

ORGANIZATIONS

AACR (www.aacr.org)
American Joint Committee on Cancer (www.cancertaging.org)
American Society of Clinical Oncology (www.asco.org)
Association of American Cancer Institutes (www.aaci-cancer.org)
American Society for Therapeutic Radiology and Oncology (www.astro.org)
International Union Against Cancer (www.uicc.org)
Oncology Nursing Society (www.ons.org)

CANCER COOPERATIVE GROUPS

American College of Surgeons Oncology Group (www.acosog.org)
Cancer and Leukemia Group B (www.calgb.org)
Children's Oncology Group (www.Childrensoncologygroup.org)
Coalition's Oncology Group (www.cancertrialshelp.org)
Eastern Cooperative Oncology Group (www.ecog.org)
Gynecologic Oncology Group (www.gog.org)
National Surgical Adjuvant Breast and Bowel Project (www.nsabp.pitt.edu)
North Central Cancer Treatment Group (ncctg.mayo.edu)
Radiation Therapy Oncology Group (www.rtog.org)

STATISTICS

American Cancer Society statistics (www.cancer.org/docroot/stt/stt_0.asp)
CANCER Modial Statistical Information System (international) (www-dep.iarc.fr)
National Cancer Data Base (www.facs.org/cancer/ncdb/index.html)
National Cancer for Health Statistics FastStats (www.cdc.gov/nuchs/fastats/cancer.htm)
National Program of Cancer Registries (www.cdc.gov/cancer/npcr)
North American Association of Central Cancer Registries (www.naaccr.org)

SEER (surveillance, Epidemiology, and End Results) (seer.cancer.gov)
State cancer profiles (stateconcerprrofiles.cancer.gov)

EVIDENCE-BASED RESOURCES

Centre for Evidence-Based Medicine (www.cebm.net)
Centre for Health Evidence (www.ccbe.net)
National Guideline Clearinghouse (www.guideline.gov)
Netting the Evidence (www.shef.ac.uk/scharr/ir/netting)
The Cochrane Collaboration (www.cochrane.org)

SITES FOR PATIENTS

Association of Cancer Online Resources (www.acor.org)
Cancer Care (includes Spanish language materials) (www.cancercare.org)
Cancer Information Service (NCI) (cis.nci.nih.gov)
Cancer Prevention and Control (CDC) (www.cdc.org/cancer)
Cancer.Net (www.cancer.net)
The Cancer Journey (www.thecancerjourney.org)
Cancerfacts.com (www.cancerfacts.com)
Healthfinder (www.healthfinder.gov)
Hospice Education Institute (hospiceworld.org)
MedlinePlus (medlineplus.gov)
National Hospice and Palliative Care Organization (www.nhpco.org)
WebMD (www.webmd.com)

CANCER RISK SITES

Breast Cancer Rish Assessment Tool (www.cancer.gov/bcrishtool)
Cancer Awareness and Risk Program (pennstatechershey.org/web/cpog/home/communityoutreach/risktet)
Cancer Risk Quiz (www.fcc.edu/cancer/risk-quiz.html)
Cancer Risk: Understanding the Puzzle (understandingrisk.cancer.gov)
Cancer Risk: What the Numbers Mean (www.mayoclinic.com/health/cancer/CA00053)
Lung Cancer Risk Assessment (www.mskcc.org/mskcc/html/12463.cfm)
Melanoma Risk Assessment Tool (www.cancer.gov/melanomariskrool)
Risk Assessment Quiz: Prostate Cancer (www.prostatecancer.ca/Prostate-Cancer/ Risk-Assessment-Quiz.aspx
Women's Cancer Network Cancer Risk Assessment Survey (www.wcn.org/risK_assessment)
Your Disease Risk (www.yourdiseaserisk.wustl.deu)

SPECIFIC CANCERS

Bladder

Bladder Cancer Advocacy Network (www.bcan.org)
Urology Channel (www.urologychannel.com)
UrologyHealth.org (www.urologyhealth.ogr)

Bone

Bone & Cancer Foundation (www.boneandcancerfoundation.org)
Bonetumor.org (www.bonetumor.org)

Brain

American Brain Tumor Association (hope.abta.org)
National Brain Tumor Society (www.braintumor.org)
Neuro-Oncology Branch (home.ccr.cancer.gov/nob/default.asp

Breast

American Breast Cancer Foundation (www.abcf.org)
Breast Cancer Online (www.bco.org)
BreastCancer.org (www.breastcancer.org)
FORCE: Facing Our Risk of Cancer Empowered (www.facingourrish.org)
Imagines (www.imaginis.com)
National Breast Cancer Coalition (www.natlbcc.org)
Program on Breast Cancer and Environmental Risk Factors (envirocancer.cornell.edu)
Susan G. Komen for the Cure (ww5.komen.org)
Breast Cancer Network of Strength (www.networkofstrength.org)

Colorectal

American Gastroenterological Association (www.gastro.org)
Colon Cancer Alliance (www.ccalliance.org)
Colorectal Cancer Coalition (www.fightcolorectalcancer.org)

Eye
Eye Cancer Network (www.eyecancer.com)

Gynecologic
American College of Obstetricians and Gynecologists (www.acog.org)
FORCE: Facing Our Risk of Cancer Empowered (www.facingourrisk.org)
Gynecologic Cancer Foundation (www/thegcf.org)
National Cervical Cancer Coalition (www.nccc-online.org)
National Ovarian Cancer Coalition (www.ovarian.org)
Women's Cancer Network (www.wcn.org)

Head and Neck (Including Mouth and Throat)
American Academy of Otolaryngology-Head and Neck Surgery (www.entnet.org)
International Association of Laryngectomies (www.theial.com/ial)
Let's Face It (www.dent.umich.edu/faceit)
National Institute of Dental and Craniofacial Research (www.nidcr.nih.gov)
Oral Cancer Foundation (www.oralcancerfoundation.org)
Support for People with Oral and Head and Neck Cancer (www.spohnc.org)

Kidney
Kidney Cancer Association (www.curekidneycancer.org)
National Kidney Foundation (www.kidney.org)

Leukemia and Lymphoma
Leukemia and Lymphoma Society (www.leukemia-lymphoma.org)
LymphomaInfo.net (www.lymphomainfo.net)
Lymphoma research Foundation (www.lymphoma.org

Liver
Liver Tumor (www.livertumor.org)

Lung
American Lung Association (www.lungusa.org
Lung Cancer.org (www.lungcancer.org)
Lung Cancer Alliance (www.lungcanceralliance.org)

Myeloma
International Myeloma Foundation (www.myeloma.org)
Multiple Myeloma Research Foundation (www.multiplemyeloma.org)

Pancreatic Cancer
Hirshberg Foundation for Pancreatic Cancer (www.pancreatic.org)
Pancreatic Cancer Action Network (www.pancan.org

Pediatric
Candle lighters Childhood Cancer Foundation (www.candlelighters.org)
Children's Hospice International (www.chionline.org)
Children's Oncology Group (www.childrensoncologygroup.org)
Children's Tumor Foundation (www.ctf.org)
National Children's Cancer Society (www.nationalchildrenscancersocitey.org)
Osteosarcoma (wwwcancer.iu.edu/osteosarcoma)

Prostate
Prostate Cancer Education Council (www.pcaw.com)
Prostate Cancer Foundation (www.prostatecancerfoundation.org)
Urology Health.org (www.urologyhealth.org)
Us TOO International (www.ustoo.org)

Skin
American Academy of Dermatology (www.aad.org)
Melanoma Education Foundation (www.skincheck.org)
Melanoma Patient's information Page (www.mpip.org)
Skin Cancer Foundation (www.skincancer.org)

PATHOLOGY SITES

International Academy of pathology (iaphomepage.org)
International Academy of pathology-Arab Division (www.iap-ad.org)

Journal access
(www.ovid.com)

(www.modpathol.com)
(www.oup.com/us/sample chamlers)

Pathology Educational Websites
(www.cedars-sinai.edu/Patients/Programs-and-Services/Pathol…)
(www.us.elsevierheath.com)
(www.arrazon.com)
(ebooks.cambridge.org)
(www.pathmax.com)
(books.google.com)

General Pathology sites
(www.pathologyoutlines.com)
(library.med.utah.edu/WebPath/ewbpath.html
(www.pathologyatlas.ro)
(www.brown.edu.Courses/Digital_path/
(www.path.uiowa.edu/virtualslideboc/
(iplab.net)
(alf3.urz.unibas.ch/pathopic/e/intro.htm)

Research
(www.humpath.com)
(pathweb.uchc.edu)
(surgpathcriteria.stanford.edu)
(www.pathmd.com)
(www.pathguy.com)
(www.pathmax.com)
(www.siumed.edu˜dking2/index.htm
(highwire.stanford.edu)

ANATOMIC PATHOLOGY SPECIALTY SITES

Autopsy and Forensics
(www.forensiconline.com/generallink.htm)

Breast
(www.hsc.stonybrook.edu/breast-atlas)

Dermatopathology
(dermatlas.med.jhmi.edu/derm)

Gastrointestinal Pathology
(www.pathology.pitt.edu/lectures/gi)

Gynecologic Pathology
(www.hsc.stonybrook.edu/gyn-atlas)

Neuropathology
(www.path.sunysb.edu/faculty/woz/NPERESS/webclasstitle.htm
(neuromuscular.wust.edu)
(moon.ouhsc.edu/kfung/ITY1/index.htm)

Renal Pathology
(www2.us.elsevierhealth.com/ajkd/atlas)
(www.uni-mainz.de/FB/Medizin/Anatomie/workshop/EM/EMAtlas.html)

Cytology
(www.cytopathology.org)
(pathology2.jhu.edu/cyto_tutorial)

Quick reference for online study and tutorials
(library.med.utah.edu/WebPath/webpath.html)
(path.upmc.edu/cases.html)
(moom.ouhsc.edu/kfung/JTYI/opaq)
(w3.ouhsc.edu/pathology/Learning_Ctr/LearnCenter_home.asp)
(pathed.upstate.edu:8080/bm_report/tutorial/p200/cases/cases_cv_ie.html)
(www.pathmd.com/index.htm)

CLINICAL PATHOLOGY SPECIALTY SITES

Overakk CP
(www.aruplab.com/index.jsp)

Cytogenetics
(atlasgeneticsoncology.org)
(www.ncbi.nlm.nih.gov/sites/entrez?db=omim)
(www.genetests.org)

Hematology / Coagulation
(www.wfn.org/index.asp?lang=EN)
(image.bloodline.net)
(www.chronolab.com/hematology/general.htm)
(www.hematologyatlas.com/principalpage.htm)

Microbiology
(pathmicro.med.sc.edu/book/welcome.htm)
(pathmicro.med.sc.edu/book/welcome.htm)
(www.cdc.org)
(www.dpd.cdc.gov/dpdx/HTML/ImageLibrary/body_ImageLibrary.htm)

Transfusion Medicine
(www.bbguy.org)

Abbreviations

A

ACC adrenocortical carcinoma
ACTH adrenocorticotrophic hormone
AD autosomal dominant
AFP α-fetoprotein
AIHA autoimmune hemolytic anemia
AKT a serine/threonine protein kinase
ALAL acute leukemia of ambiguous lineage
ALCL anaplastic large cell lymphoma
ALL acute lymphoblastic leukemia
ALP alkaline phosphatase
AMKL acute megakaryoblastic leukemia
AML acute myeloid leukemia
AMP adenosine monophosphate
ANC absolute neutrophil count
AP-1 activating protein 1
APC adenomatous polyposis coli
APL acute promyelocytic leukemia
APrC antigen-presenting cell
AR autosomal recessive
ARMS alveolar rhabdomyosarcoma
ASR age-standardized annual incidence
AST aspartate transaminase
ATM ataxia telangiectasia mutated (gene)
ATP adenosine triphosphate
ATRA all-transretinoic acid
ATRT atypical teratoid rhabdoid tumor
AUC area under the curve

B

BAL bronchoalveolar lavage
BCC basal cell carcinomas
BCG bacillus Calmette-Guerin
BL Burkitt lymphoma
BM bone marrow
BMA bone marrow aspiration
BMD bone mineral density
BMT bone marrow transplant
BWS Beckwith-Wiedemann Syndrome
BX biopsy

C

CAMT congenital a megakaryocytic thrombocytopenia
CDK cyclin-dependent kinase
CEA carcinoembryonic antigen
CFS congenital fibrosarcoma
CGH comparative genomic hybridization
CI confidence interval
CIMF chronic idiopathic myelofibrosis
CLL chronic lymphocytic leukemia
CML chronic myeloid leukemia
CMML chronic myelomonocytic leukemia
CMN congenital mesoblastic nephroma
CMV cytomegalovirus
CNS central nervous system
CNSHA congenital non-spherocytic hemolytic anemia
CO cobalt
COX-2 cycloxygenase-2
CP chronic phase
CP cyclophosphamide
CPC choroid plexus carcinoma
CPP choroid plexus papilloma
CR complete remission
CRP C-reactive protein
CSF cerebrospinal fluid
CSF colony-stimulating factor
CT computed tomography
CTX chemotherapy
CXR chest X-ray

D

DFS disease-free survival
DI diabetes insipidus
DIC disseminated intravascular coagulation
DJXG disseminated juvenile xanthogranuloma
DLBCL diffuse large B-cell lymphoma
DLCL diffuse large cell lymphoma
DLI donor lymphocyte infusion
DLT dose-limiting toxicity
DNA deoxyribose nucleic acid
DNET dysembryoplastic neuroepithelial tumor
DS Down syndrome
DTC differentiated thyroid cancer
DUB dysfunctional uterine bleeding
DVT deep vein thrombosis

E

EA enzyme immunoassay
EBV Epstein-Barr virus
EFS event-free survival
EGF epidermal growth factor
ELISA enzyme-linked immunosorbent assay
EM electron microscopy
ENT Ear, Nose and Throat
EOE extraosseous Ewing sarcoma
EPO erythropoietin
ERK extracellular signaling regulator kinase
ES Ewing sarcoma
ESR erythrocyte sedimentation rate
ET essential thrombocythemia

F

FA Fanconi anemia
FCM flow cytometry

FDA food and drug administration (USA)
FDCS follicular dendritic cell sarcoma
FFS failure-free survival
FGF fibroblast growth factor
FH favorable histology
FISH fluorescent in-situ hybridization
FL follicular lymphoma
FNA fine needle aspiration
FSH follicle-stimulating hormone
FTC follicular thyroid cancer

G

G6PH glucose-6-phosphate dehydrogenase
GBM glioblastoma multiforme
GCT germ cell tumor
GDNF glial-derived neurotrophic factor
GDP guanosin diphosphate
GERD gastroesophageal reflux disease
GH growth hormone
GI gastrointestinal
GIST gastrointestinal stromal tumor
GIT gastrointestinal tract
GMCSF granulocyte macrophage colony stimulating factor
GN ganglioneuroma
GNB ganglioneuroblastoma
GnRH gonadotrophin releasing hormone
GTP guanosine triphosphate
GTR gross total resection
GTV gross tumor volume
GVHD graft-versus-host disease

H

H&E hematoxylin & eosin
HA hypoplastic anemia
Hb hemoglobin
HB hepatoblastoma
HbS sickle cell Hb
HBsAg hepatitis B surface antigen
HC hemorrhagic cystitis
HCC hepatocellular carcinoma
HCG human chorionic gonadotrophin
HCL hairy cell leukemia
HCV hepatitis C virus
HD Hodgkin disease
HGF hepatocyte growth factor
HHV6 human herpes virus type 6
HL Hodgkin lymphoma
HLA human leucocyte antigen
HLH hemophagocytic lymphohistiocytosis
HMPV human metapneumovirus
HNIG human normal immunoglobulin
HNPCC hereditary non polyposis colon cancer
HPA hypothalamic-pituitary axis
HR hormone replacement
HS hereditary spherocytosis
HS histiocytic sarcoma
HSC hemopoeitic stem cells
HSCT hemopoietic stem cell transplantation
HSV herpes simplex virus
HUS hemolytic-uremic syndrome
HVA homovanillic acid
HVOD hepatic veno-occlusive disease
HZV herpes zoster virus

I

IBMFS inherited bone marrow failure syndrome
ICH intracranial hemorrhage
ICP intracranial pressure
ID immunodeficiency
IDC interdigitating dendritic cell sarcoma
IF immunofluorescence
IG immunoglobulin
IGF insulin growth factor
IGF insulin-like growth factor
IM intramuscular
INSS international Neuroblastoma Staging System
IST immunosuppressive treatment
ITP immune thrombocytopenic purpura
IV intravenous
IVC inferior vena cava

J

JAK Janus kinase
JXG juvenile xanthogranuloma

K

KGF keratinocyte growth factor (=FGF-7)

L

LAE late adverse effect
LAF laminar air flow
LAIP leukemia-associated immunophenotype
LC langerhans cell
LCH Langerhans cell histiocytosis
LDH lactate dehydrogenase
LFT liver function tests
LH luteinizing hormone
LL lymphocytic lymphoma
LOH loss of heterozygosity
LP lumbar puncture
LPHD lymphocyte predominant Hodgkin disease
LPL lymphoplasmocytic lymphoma
LS langerhans cell sarcoma
LTFU long-term follow-up
LYG lymphomatoid granulomatosis

M

MAA moderate aplastic anemia
MAB monoclonal antibody
MALT mucosa-associated lymphoid tissue
MAPK mitogen-activated protein kinase
MBEN medulloblastoma with extensive nodularity
MBL medulloblastoma
MCL mantle cell lymphoma
MCS mast cell sarcoma
MCV mean corpuscular volume
MDR multidrug resistance
MDS myelodysplasia
MDS myelodysplastic syndrome
MDT multidisciplinary team
MEN multiple endocrine

neoplasia
MFB multifocal bone
MGCT malignant germ cell tumor
MM multiple myeloma
MMP matrix metalloproteinase
Mo monoclonal
moAb monoclonal antibody
MOF multi-organ failure
MPD myeloproliferative diseases
MPN myeloproliferative neoplasm
MPNST malignant peripheral nerve sheath tumor
MPO myeloperoxidase
MPV mean platelet volume
MRA magnetic resonance angiography
MRD minimal residual disease
MRI magnetic resonance imaging
MS multisystem
MSC mesenchymal stem cells
MSD matched sibling donor
MSH melanocyte stimulating hormone
MTC medullary carcinoma of the thyroid
MTX methotrexate
MUD matched unrelated donor
MW molecular weight
MZL mantle zone lymphoma

N

NB neuroblastoma
NDI nephrogenic diabetes insipidus
NF1 neurofibromatosis type 1
NFAT nuclear factor of activated T-cells
NF-κB nuclear factor KB
NGF nerve growth factor
NHL non-Hodgkin lymphoma
NK natural Killer
NPC nasopharyngeal carcinoma
NRSTSs non-rhabdo soft tissue sarcomas
NSE neuron-specific enolase
NT neurotrophins
NTM non-tuberculous mycobacterial

O

OCP oral contraceptive pill
OR odds ratio
OS overall survival

P

PA pernicious anemia
PAS periodic acid-Schiff
PBPC peripheral blood progenitor cell
PBSC peripheral blood stem cell
PCH paroxysmal cold hemoglobinuria
PCO polycystic ovary
PCP pneumocystis jiroveci pneumonia
PCR polymerase chain reaction
PCToma pheochromocytoma
PDGF Platelet derived growth factor
PE pulmonary embolism
PET positron emission tomography
PFS progression-free survival
PFT pulmonary function tests
Ph+ Philadelphia chromosome positive
PI-3K Phospho-inositide –3 kinase
PK pyruvate kinase
PKB Protein kinase B (=AKT)
PKC protein kinase C
PMF primary myelofibrosis
PML progressive multifocal leucoencepholopathy
PN parenteral nutrition
PNET primitive neuro-ectodermal tumor
PNH paroxysmal nocturnal hemoglobinuria
PPB pleuropulmonary blastoma
PPNET peripheral primitive neuroectodermal tumor
PT prothrombin time
PTCL Peripheral T-cell lymphoma
PTH parathyroid hormone
PTLD post-transplant lymphoproliferative disorders
PV polycythemia vera

R

RA refractory anemia
RA retinoic acid
RAEB refractory anemia with excess blasts
RAR retinoic acid receptor
RARS refractory anemia with excess ringed sideroblasts
RB retinol binding protein
Rb retinoblastoma
RC refractory cytopenia
RD related donor
RDD Rosai - Dorfman disease
RMS rhabdomyosarcoma
RR relapse rate
RR relative risk/risk ratio
RRT regimen-related toxicity
RT radiotherapy
RTA renal tubular acidosis

S

SAA severe aplastic anemia
SBB Sudan black B
SCC squamous cell carcinoma
SCD sickle cell disease
SCF stem cell factor
SCID severe combined immunodeficiency
SCT stem cell transplantation
SEGA sub-ependymal giant cell astrocytoma
SIADH syndrome of inappropriate antidiuretic hormone secretion
SLD sum of the largest diameter
SLE systemic lupus erythematosus
SLL small lymphocytic lymphoma
SMN second malignant neoplasm
SMR standardized mortality ratio
SMS superior mediastinal syndrome
SMZL splenic marginal zone lymphoma
SNP single nucleotide polymorphism
SNS sympathetic nervous system
SOS sinusoidal obstruction

syndrome
SS single system
SS synovial sarcoma
SSCP single strand conformational polymorphisms
STAT signal transducer and activator transcription factor
STI signal transduction inhibitor
STS soft tissue sarcoma
SVC superior vena cava
SVCS superior vena cava syndrome

T

TBI total body irradiation
TdT terminal deoxynucleotidyl transferase
TGF-β transforming growth factor beta
TK tyrosine kinase
TLI total lymphoid irradiation
TLI Thymidine labeling index
TLS tumor lysis syndrome
TNF tumor necrosis factor
TOF trachea-esophageal fistula
TS tumor suppressor
TSC tuberous sclerosis
TSH thyroid-stimulating hormone
TT thrombin time

U

UCB umbilical cord blood
UD unrelated donor
UH unfavourable histology
URD unrelated donors
US ultrasound
UTI urinary tract infection
UV ultraviolet

V

VCA viral capsid antigen
VEGF vascular endothelial growth factor
VEGFR vascular endothelial growth factor receptor
VHL von Hippel-Lindau disease
VIP vasoactive intestinal peptide
VMA vanyl mandelic acid
VP ventriculo-peritoneal
VSAA very severe aplastic anemia
VTE venous thrombo-embolism
VZV varicella-zoster virus
VZV/HZV varicella/herpes zoster virus

W

WAGR Wilms tumor, aniridia, genitourinary abnormalities
WAS Wiskott-Aldrich syndrome
WCC white cell count
WM Waldenstrom macroglobulinemia
WT Wilms tumor

X

XIAP X inhibitor of apoptosis protein
XLP X-linked lymphoproliferative disease

Glossary of Terms

A

Acetylation: A reaction that introduces a functional acetyl groups into an organic compound. Deacetylation is the removal of the acetyl group. Acetylation is a post-translational chemical modification of histones, tubulins, and the tumor suppressor gene TP53.

Alleles: Different forms of a gene that represent the same genetic locus on homologous chromosomes.

Allograft: Tissue that is transplanted between genetically different individuals of the same species.

Antibody: A glycoprotein molecule called immunoglobulin (Ig), produced by plasma cells in response to an antigen and capable of specifically binding to that antigen.

Antibody-dependent cell-mediated cytotoxicity (ADCC): A process by which natural killer (NK) cells are targeted to IgG-coated cells, resulting in the lysis of the antibody-coated cells.

Antigen processing: The intracellular conversion of protein antigens into peptides and loading of these peptides on to major histocompatibility complex molecules for display to T lymphocytes.

Antigen: An agent that is foreign (i.e., "nonself") to an animal and that is recognized by the immune system.

Autocrine: Refers to the production of substances (i.e., growth factors or hormones) that can influence the metabolism of the cell which produces them.

Autoradiography: A technique to identify where a radioactive isotope is localized in cells or subcellular components.

Autosome: Any chromosome other than the sex chromosomes.

B

B cell receptor (BCR) complex: A multiprotein of immunoglobulins expressed on the surface of B lymphocytes that recognizes antigen and transduces activating signals.

B cell: A lymphocyte that is a precursor for antibody-producing plasma cells, and that expresses an antibody molecule on its cell surface.

Bisulfite sequencing: The bisulfite treatment of DNA in order to determine its pattern of methylation. Treatment of DNA with bisulfite converts cytosine residues to uracil but leaves 5-methylcytosine residues unaffected.

C

Caretaker genes: These are tumor suppressor genes that protect the integrity of the genome (e.g. DNA repair genes).

cDNA: A DNA complementary to mRNA sequences transcribed from a given gene or genes. cDNA therefore will hybridize with these genes and, if radio-labeled will allow their detection in chromosomes "in situ hybridization".

Cellular Immunity: Immunological defense against foreign agents that is mediated by cells (e.g., various types of lymphocytes) rather than by antibodies.

Chromatin: The complex of DNA and protein that composes chromosomes. Chromatin packages DNA into a volume that fits into the nucleus, allows mitosis and meiosis, and controls gene expression. Changes in chromatin structure are affected by DNA methylation and histone modifications.

Chromosome: The structural unit containing the genetic material (DNA) within a cell. Human cells usually have 46 chromosomes consisting of 22 pairs of autosomes plus the sex chromosomes

(XX in females, XY in males).

Chromothripsis: A new phenomenon of multiple gene rearrangecuent observed in osteosarcoma and chordoma, resulting from 10-100 chromosomal breaks followed by their random fusion.

Clone: A family of cells all derived from one parent cell. A clonal marker (e.g., an abnormal chromosome or protein product) may identify all of the cells within a given clone. Most human tumors appear to arise from a single cell and hence are monoclonal.

Cloned Gene: A gene that has been isolated and inserted into a "vector," usually a plasmid or bacterial virus. The vector containing the gene can be produced in large amounts, thereby providing many copies of the gene suitable for assays and studies of its function. Cloned genes can be used to produce large quantities of pure protein products of cells (e.g., insulin, interferons).

Coding Region: The coding region is that part of the DNA that actually codes for a protein. The part of the DNA molecule that is initially transcribed into messenger RNA (mRNA) contains both introns and exons.

Codon: A group of three DNA or mRNA bases that code for a given amino acid. Codons thus form the "alphabet" of the genetic code.

Complement: A system of serum and cell surface proteins that interact with one another and with other molecules of the immune system to generate important effectors of innate and adaptive immune responses (e.g. ADCC).

CpG islands: Regions in DNA that contain many adjacent cytosine and guanine nucleotides. The "P" in CpG refers to the phosphodiester bond between the cytosine and the guanine. These islands occur in approximately 40% of the promoters of human genes.

D

Dedifferentiation: Progression of a low-grade malignant tumor to a higher grade, usually involving a geographic area of the initial tumor.

Deletion: Loss of DNA. Deletions can be small, Affecting only a small part of a single gene, or large, for example, a chromosomal deletion involving many genes.

Determination: The irreversible commitment of a cell to follow a specific developmental pathway.

Differentiation: The development by cells of specific characteristics that allow the normal function of tissues. Tumors may show varying degrees of differentiation depending on their similarity to the structure of the organ from which the tumor was derived. Also defined as the overall process by which stem/progenitor cells are activated to become more specialized cell types.

DNA methylation: The addition of a methyl group to DNA at the 5-carbon of the cytosine pyrimidine ring that precedes a guanine.

DNA Methyltransferases: Family of enzymes that catalyze the transfer of a methyl group to DNA, using S-adenosyl- methionine as the methyl donor.

Doubling Time: The time taken for an exponentially growing tumor (or cell population) to double its volume (or number of cells).

E

Enhancer: A DNA sequence that increases the activity of promotor sequences that are initiators of transcription (i.e., production of mRNA). Enhancers can be located anywhere in the noncoding regions of a gene.

Epigenetic: The regulation of gene expression without alteration of genetic structure. This is accomplished by interfering with the process of transcription rather than DNA base sequence.

Epigenome: The overall epigenetic state of a cell. It represents DNA which is not transcribed to mRNA and constitutes 90% of the human genome.

Episome: A circular form of DNA that replicates in cells independent of the chromosomes. Viral DNA may form episomes in cells. Plasmids used for gene cloning grow as episomes in bacteria.

Exons: The regions of a gene that contain the DNA sequences necessary to direct translation of the polypeptide gene product. These sequences are preserved in the processed mRNA.

G

Gatekeeper genes: These are tumor suppressor genes that control cell division and survival (e.g. Rb and P53).

Gene: A sequence of DNA that codes for a single polypeptide. This sequence includes coding and noncoding regions as well as regulatory regions.

Genomic imprinting: The epigenetic marking of a locus on the basis of parental origin, which results in monoallelic gene expression.

Germline mutation: An inherited mutation in one of tumor suppressor gene alleles, resulting into a heterozygous state of increased cancer risk.

Granzyne: A serine protease enzyme found in the granules of cytotoxic T lymphocytes and natural killer cells that is released by exocytosis, enters target cells through perforin-created holes in cell membrane and activates caspases to induce apoptosis.

H

Hedgehog signaling: Promotes the proliferation of adult stem cells, expressed in embryonal cells and several cancers.

Histone deacetylase: A class of enzymes that remove acetyl groups from an N-acetyl-lysine amino acid on a histone.

Histone: The main protein components of chromatin. The core histones-H2A, H2B, H3, and H4-assemble to form the nucleosome; each nucleosome winds around 146 base pairs of DNA. The liker histone H1 locks the DNA into place and allows the formation of a higher-order structure.

Homozygosity (Homozygous): The two alleles of a gene on chromosomes are identical.

Humoral Immunity: Immunological defenses that are determined by antibodies.

Hybridization: (a) The fusion of two somatic cells to form a single cell, (b) The binding of complementary (homologous) sequences of DNA or RNA.

Hybridoma: The term is most commonly used to describe a population of hybrid cells that produces monoclonal antibodies. Such a cell is produced by fusing an antibody-secreting myeloma tumor cell.

I

Idiotope: A unique determinant on an antibody or T cell receptor molecule, usually formed by one or more of the hypervariable regions. Idiotopes may be recognized as foreign.

Immune Surveillance: A proposed mechanism whereby the immune response recognizes the development of malignant cells at an early stage and inactivates them before they can develop into tumors.

Immunoglobulin: An antibody molecule.

Initiation: The first stage in the process of carcinogenesis. It involves interaction of the carcinogen with the DNA of the target cells to produce, after DNA replication, a permanent lesion.

Integration: The process by which viral DNA, or DNA copies of the RNA of a retrovirus, are incorporated into the chromosomal DNA of a cell.

Integrins: cell surface proteins which functions as adhesive molecules to endothelial cells and extracellular matrix proteins.

Interferon-α (IFN-α): a cytokine produced by T lymphocytes and natural killer cells whose principal function is to activate macrophages in their immune responses.

Interferon: A protein produced by cells in response to viral infection. Several types of interferon have been identified and they have multiple effects on the host immune response, as well as more general effects on cell growth and differentiation. Interferons are examples of biological response modifiers.

Interleukin: A cytokine that acts on leukocytes

(originally used to describe a cytokine made by leukocytes).

Intron: A noncoding region of a gene. These regions are spliced out during processing of the initial mRNA transcript.

Isotype: A type of antibody determined by which of the 5 different forms of heavy chain is present. Antibody isotypes include: IgM, IgD, IgG, IgA and IgE.

Isozyme (Isoenzyme): One of several chemical forms of an enzyme that have the same biological function. Tumors often produce one particular isozyme, frequently that which is associated with fetal tissue.

K

Karyotype: The chromosome content of a particular cell. The karyotype is usually displayed by photographing the chromosomes in a metaphase cell, cutting the individual chromosomes out of the photograph and ordering them according to a standard notation.

Kinase (protein kinase): An enzyme that adds phosphate groups to proteins leading to their activation. They are involved in signal transduction and the activation of transcription factors.

L

Labeling Index: The proportion of cells in any tissue that are synthesizing DNA.

Langerhans cells: Immature dendritic cells mainly formed in the epidermis of skin. Their major function is to trap and transport protein antigens to draining lymph nodes.

Loss of heterozygosity (LOH): A mechanism that explains the genesis of hereditary forms of cancer based on loss of tumor suppressor gene (TSG) function through two mutational nits: The first germline and second a somatic mutation.

Lymphokine: A substance usually produced by lymphocytes (or monocytes) having an effect of other lymphocytes. An example is interleukin 2 (IL -2) also known as T-cell growth factor, which is required for the growth of T lymphocytes. Lymphokines are examples of biological response modifiers.

Lymphotoxin (LT, TNF-β): A cytokine produced by T cells, which is homologous to, and binds to the same receptors as these for tumor necrosis factor (TNF). It has proinflammatory effects.

M

Micro-RNA (miRNA): Small RNA strands (about 22 nucleotides only) that combines with m-RNA causing its inhibition with arrest of protein supthesis (post-transcriptional gene silencing).

Mitogen-activated protein (MAP) kinase cascade: A signal transduction cascade initiated by the active form of Ras protein.

Mitotic Index: The proportion of cells in a tissue that are in mitosis at any given time.

Monoclonal Antibody: An antibody of a single defined specificity, most commonly obtained from a single clone of antibody-producing cells or from a hybridoma.

Multipotent stem cells: Cells that self-renew and differentiate into several different specialized cell types, often within a tissue (e.g. hematopoietic stem cells).

Mutation: A change in one or more of the DNA bases in a gene. Changes can include insertion of extra bases or deletion of a base (s). Mutations in coding exons lead to altered protein products; mutations in noncoding regions can lead to altered amounts of protein.

N

Natural killer (NK) cells: A subset of lymphocytes that function in innate (nonspecific) immunity (without previous sensitization) .

Northern Blot Analysis: A technique for determining the presence of specific mRNA sequences in cells. Messenger RNA molecules are separated by electrophoresis and then blotted onto nitrocellulose paper. A radiolabeled probe containing DNA sequences (cDNA) complementary to the RNA that is to be detected is applied to the blot and allowed to hybridize. The labeled xDNA is then detected by autoradiography.

Notch: transmembrane receptor which promotes

proliferation of stem cells and inhibits differentiation. Overexpressed in embryonic cells and several cancers.

Nuclear factor-kappa B (NF-κB): A family of transcription factors involved in many genes of the immune responses, as well as, up regulates genes of proliferation, invasion and angiogenesis. It plays a role in the genesis of Hodgkin lymphoma.

Nude Mouse: A mouse that congenitally lacks a thymus and hence mature T cells. Xenografts of human tumors will often grow in such animals.

O

Oncofetal Antigen: A protein produced by fetal tissue that is usually present at very low levels in the adult. Many tumors produce oncofetal antigens (e.g., carcinoembryonic antigen) that have been used as markers of tumor bulk.

Oncogene: A gene whose protein product may be involved in processes leading to transformation of a normal cell to a malignant state.

P

Paraneoplastic Syndrome: Signs or symptoms that may occur in a patients with cancer but that are not due directly to the local effects of the tumor cells.

Perforin: A pore-forming protein produced by cytotoxic T lymphocytes (CTL) and natural kidder (NK) cells. The pores formed in cell membrane serve as channels for the influx of cytotoxic enzymes (e.g. granzyme) into target cells.

Phenotype: Characteristics of a cell or tissue resulting from the expression of specific genes.

Plasmid: A circular piece of DNA that may reproduce separately from chromosomal DNA within cells, bacteria, or other organisms.

Plasticity: The ability of an adulk stem cell from one tissue to develop into differentiated cell types from a different tissue: this remains largely unproven as an in vivo physiological process, but can be done under laboratory conditions in vitro.

Pluripotent stem cells: Cells capable of self-renewing and differentiating into any of the three germ layers (endoderm, ectoderm, and mesoderm): unlike totipotent cells, they do not give rise to embryonic components of the trophoblast and placenta.

Polymerase Chain Reaction (PCR): A method by which a given segment of DNA is amplified multiple times by the continued synthesis of complementary strands.

Potential: Term that describes what cells are able become.

Probe: A cloned gene or fragment of a cloned gene that can be made radioactive and used to detect homologous DNA (Southern blot or in situ hybridization) or RNA (northern blot).

Progenitor cell: An undifferentiated precursor cell with the capacity to undergo differentiation into specialized cell types: unlike putative stem cells, they do not retain the capacity for self-renewal.

Progression: The tendency of tumors to become more malignant as they grow.

Promoter (or Promotor): (a) A compound that may not itself be carcinogenic but that stimulates the proliferation of initiated cells to form a cancer.

Protein Kinase: An enzyme that catalyzes the phosphorylations of proteins. Phosphorylation and dephosphorylation of proteins appear to be major mechanisms that control their function. Many oncogenes code for protein kinases.

Proto-oncogene: A gene, in a normal cell, homologous to a viral transforming gene. Some proto-oncogenes encode proteins that influence the control of cellular proliferation and differentiation. Mutations, amplifications, rearrangements, etc., of proto-oncogenes may allow them to function as oncogenes,

Provirus: The DNA copy of the RNA of a retrovirus that is integrated into the chromosomal DNA of a cell.

R

Rearrangement: Changes in the sequence of genes or of DNA sequences within genes that lead to alteration in their protein products. Rear-

rangement of genes is important in such processes as the generation of diversity of antibody molecules. Abnormal rearrangements between different genes (mutations) appear to be important in malignant transformation.

Restriction Enzymes: Enzymes obtained from bacteria that make cuts at specific sequences of 4-8 bases in double-stranded DNA.

Restriction-Fragment-Length Polymorphism (RFLP) Analysis: A method that may be used to identify unique DNA sequences within a cell.

Retrovirus: A virus in which the genome comprises RNA.

Reverse Transcriptase: An enzyme found mostly in retroviruses that catalyzes the production of a complementary DNA (cDNA) strand from an RNA strand.

S

Segregation: The process by which the chromosomes are separated during meiosis.

Self-renewal: A defining property of stem cells that allows them to undergo repeated mitotic cell divisions to create at least one daughter cell equivalent to the mother cell that retains latent capacity for differentiation.

Sequencing: Determination of the sequence of nucleotides in a piece of DNA.

Signal transduction: The transmission of signals from cell microenvironment to the nucleus resulting in differentiation, proliferation, survival or apoptosis reactions.

Somatic mutation: A mutation acquired during postnatal life.

Southern Blot Analysis: A technique used for detecting specific DNA sequences in cells.

Stem Cell: A cell that has the capacity to repopulate cells within a tissue. Through differentiation and at the same time has the capacity of self- renewal, hence immortality.

Synchronized Cells: A population of cells in which most of them are at a given stage of the growth cycle at any one time and move through the cell cycle as a cohort.

Synergy: An interaction between two agents that is greater than would be predicted from the activity of either alone.

T

Tolerance: A term used in immunology to indicate the process whereby specific antigens fail to elicit an immunological response.

Topoisomerases: Enzymes that allow breakage of one or both DNA strands, unwinding of DNA, and resealing of the strands. The enzymes are required for DNA and RNA synthesis and are important for the action of some anticancer drugs.

Totipotent stem cells: Cells derived from the first few divisions of the fertilized egg: these cells have the potential to give rise to all the differentiated cells of the fully developed organism.

Transfection: The direct transfer of DNA molecules into a cell.

Transgenic Mice: Mice produced from germ line cells into which a specific gene has been introduced. All cells of the mice carry this gene.

Translation: The process by which mRNA directs the synthesis of protein.

Transposons: Sequences of DNA that can move around within the genome of a single cell. In this process, called transposition, the sequences can cause mutations and change the organization of DNA in the genome.

Tumor Suppressor Gene: A gene whose mutation or loss may lead to cellular transformation and to the development of cancer. Loss of both alleles are required for cancer development.

Two-hit theory (Knutson, 1960): This explains the origin of hereditary forms of cancer. The first is an inherited germline mutation of a tumor suppresser gene and the second is a somatic mutation in postnatal life (loss of heterozygosity LOH) leading to loss of tumor suppresser gene function and development of cancer.

W

Western Blot Analysis: A procedure analogous to Southern and northern blot analyses that allows the detection of specific proteins. Proteins are separated by electrophoresis and blotted on to nitrocellulose paper. They are usually identified by autoradiography.

X

Xenograft: Tissue that is transplanted from one species of animal into another. Most commonly this refers to the transplantation of a human tumor into a nude or immune-deficient mouse.

Self Assessment MCQs

Chapter 1: The Scientific Basis of Oncology

Match the following scientists with their achievements:

1. Morgagni
2. Galileo
3. Halsted
4. Descartes
5. Watson & Crick
6. Schwann
7. Adolph Hanover

a. First to do experiments and quantitative observations.
b. Stated that knowledge is reached after observation not something to start with.
c. Invented a skeptical approach to scientific thinking.
d. The first surgeon to accept the concept of
e. performing frozen section before radical operations.
f. Described specific diagnostic features of malignant cells.
g. Launched the cell theory.
h. The discovery of DNA structure
i. Founder of gross pathology and clinico-pathological correlations

8. Which of the following molecular genetic method is used for separation of double stranded DNA fragments by electrophoresis

a. Sequencing
b. Reverse transcriptase
c. Southern blotting
d. Northern blotting

9. All of the following are proteomic analysis techniques EXCEPT

a. Fluorescent flow immunocytometry
b. Bioinformatics
c. Methylation analysis
d. Mass spectrometry

10. The following is a chromosomal analysis method used for visualization of chromosomal aberrations using fluorescent microscope

a. FISH
b. Conventional karyotyping
c. Comparative genomic hybridization
d. Flow cytometry

Chapter 2: The Epidemiology of Cancer

11. Regarding measures of epidemiology, the following is correct EXCEPT

a. Incidence rate is expressed as the number of new cases per 100000 persons per year
b. For comparative reasons, age-standardized incidence is used instead of crude incidence
c. Prevalence rate is the number of persons alive with cander at a particular point of time (both new and old cases)
d. Case fatality ratio is the ratio of mortality to survival in a given cancer

12. Concerning the global incidence of cancer, the following is correct EXCEPT

a. The global incidence is increasing
b. Lung cancer incidence is decreasing the developed countries and increasing in the less developed countries due to change in smoking habit prevalence in these countries
c. Cancer cervix is prevalent in areas where HPV infection is endemic
d. Bladder cancer is decreasing in Egypt as a result of irrigation system changes

13. The following policies are aiming at cancer prevention EXCEPT

a. Tobacco restriction
b. Occupational legislation
c. Urbanization
d. Immunization programs

14. Regarding cancer in the Western countries, the following is correct EXCEPT

a. Caner colon is prevalent because of dietary habits
b. Lung cancer is decreasing because of tobacco selling and smoking restriction
c. Cancer survival is now 67% due to advancement in early diagnosis and treatment
d. Pediatric cancer is about 8% of all cancers

15. Concerning regional cancer profile, the follow-

ing are true EXCEPT
- a. Breast cancer is the most common cancer in the Arab countries
- b. Liver, prostate, lymphomas and bladder cancers are common cancers in the Arab world
- c. In Egypt, pediatric cancer is about 8.5%
- d. Cancer prostate incidence is decreasing in the last decade

Chapter 3: The Etiology and Prevention of Cancer

16. All of the following are characteristics of retinoblastoma protein Rb1 EXCEPT
- a. Binds to E2F transcription factor
- b. A central regulator for cell cycle
- c. Involved in maintaining the integrity of retina
- d. Undergoes phosphorylation during cell cycle

17. Hereditary nonpolyposis colon cancer syndrome is associated with all of the following EXCEPT
- a. Increased risk of stomach, ovarian and kidney cancers
- b. Presence of multiple polyps preceding the diagnosis of cancer colon
- c. Younger age at diagnosis than patients with sporadic colon cancers
- d. Overall incidence of 1 in 400

Match the following syndromes with the associated cancers
18. MEN-2 syndrome
19. Von-Hipple-Lindau syndrome
20. Xeroderma pigmentosa syndrome
21. Fanconi syndrome
22. Lynch-1 syndrome
23. Lynch-2 syndrome
- a. Acute myeloid leukemia
- b. Nephroblastoma
- c. Skin cancers
- d. Cancer colon, breast cancer, endometrial cancer and urothelial cancer
- e. Thyroid medullary carcinoma
- f. Renal cell carcinoma
- g. Cancer colon

24. p53 protein is characterized by all of the following EXCEPT
- a. It is a DNA-binding transcription factor
- b. Is activated in response to cellular stress
- c. Mutations of p53 are common in hereditary cancer syndromes but rare in sporadic cancers
- d. Germline mutations of p53 are the cause of Li-Fraumeni syndrome

25. The following type of HPV has a strong association with cervical cancer
- a. HPV-6
- b. HPV-11
- c. HPV-16
- d. HPV-18

Chapter 4: Classifications of Tumors

26. Stem cells are characterized by all of the following EXCEPT
- a. High capacity of cell renewal
- b. Long life span and high telomerase activity
- c. Inability for mobilization or trafficking the tissues
- d. Ability to adopt a phenotype and functional properties different from original phenotype (transdifferentiation)

Match the following stem cell type with its definition
27. Embryonic stem cell
28. Fetal stem cell
29. Cord blood stem cell
30. Adult stem cell
- a. Circulating stem cells obtained from umbilical cord following labor
- b. Isolated from inner cell mass of blastocyte
- c. Present in adult tissue in the (GO) phase
- d. Obtained from aborted fetal gonadal tissue

Match the following diagnostic electron microscopic features with their tumors
31. Very long microvilli
32. Complex curved cell membrane
33. Birbeck granules
34. Numerous mitochondria
35. Short microvilli
- a. Langerhans cell histiocytosis
- b. Mesothelioma
- c. Adenocarcinoma
- d. Oncocytoma
- e. Neuroendocrine tumors
- f. Meningioma

36. Some malignant tumors are highly aggressive and lethal to 80-100% of patients despite treatment. All the following cancers belong to this lethal group EXCEPT
   a. Glioblastoma multiforme
   b. Small cell lung cancer
   c. Rhabdoid tumor
   d. Ocular melanoma
   e. Anaplastic thyroid carcinoma
   f. Pancreatic ductal carcinoma

Chapter 5: Criteria of Malignancy and Pitfall

37. Which of the following findings is considered an indirect criteria of malignancy
   a. Atypia
   b. Necrosis
   c. Increased mitotic activity
   d. Abnormal mitosis

38. Which if the following mechanisms results in abnormal mitosis
   a. Asymmetrical separation of chromosomes in anaphase due to chromosomal sticking resulting in a hypoploid and hyperploids cells
   b. Chromosomal lagging in anaphase resulting in polar chromosomes in daughter cells and hypoploidy
   c. Chromosomal bridge occurs when two chromosomes break and heal by translocation forming a dicentric chromosome
   d. All of the above

39. All of the following is considered population changes in malignancy criteria EXCEPT
   a. Hypercellularity
   b. Abnormal mitosis
   c. Invasion
   d. Disorganized pattern

40. The following is a biochemical change associated with cancer
   a. Shift in glucose metabolism from aerobic to anaerobic
   b. Increase of lytic enzymes with matrix invasion
   c. Oncofetal proteins production
   d. All of the above

Chapter 6: Molecular Oncogenesis

41. All of the following is true regarding genetic mutations in cancer EXCEPT:
   a. Oncogenes are generally dominant at cellular level.
   b. Tumor repressor genes are generally recessive at cellular level
   c. One percent of total number of genes may contribute to some form of cancers
   d. 90% of germline mutations in familial cancer syndromes are in tumor suppressor genes

42. Which of the following proteins has an inhibitory activity on the cell cycle
   a. Cyclin D1
   b. E2F
   c. p16INK4a
   d. cyclin-dependent kinase 4

43. All of the following represent epigenetic mechanisms EXCEPT
   a. Histone de-acylation
   b. Hypermethylation
   c. Gene amplification
   d. Hypomethylation

44. Which of the following is example of gene amplification
   a. N-myc in neuroblastoma
   b. C-myc in small cell lung cancer
   c. Her-2/neu in breast cancer
   d. All of the above

45. All of the following are examples for DNA repair defects except
   a. Von Hippel-Lindau syndrome
   b. Xeroderma pigmentosa
   c. Hereditary nonpolyposis colon cancer
   d. Hereditary breast cancer

46. All of the following are primary angiogenic factors except
   a. Granulocyte-colony stimulating factor
   b. Notch-signaling receptors
   c. VEGF
   d. Angiopoietins

47. DNA damage activates and stabilizes
   a. p53
   b. pRb
   c. CDK4 and CDK6
   d. APC/C

48. All of the following represent targeted therapies EXCEPT
    a. Glevec
    b. Rituxan
    c. Herceptin
    d. Vincristine

49. Osteoblastic bone metastases are characteristic of which type of cancer
    a. Breast
    b. Prostate
    c. Lung
    d. Renal

50. All of the following are characteristics of oncogenes EXCEPT
    a. They are normal present
    b. They are dominant genes
    c. They keep E2f protein in bounded form
    d. They inhibit tumor cell apoptosis

Chapter 7: Growth and Spread of Cancer

51. All of the following are positive regulators of cell cycle EXCEPT
    a. β-catenin
    b. RAS
    c. p53
    d. c-myc

Match the following method of measurement with their corresponding growth parameters
52. DNA flow
53. MIB-1
54. Cyclin A
55. Cyclin D
56. Cyclin D1
57. Thymidine labeling
58. PCNA
    a. Growth fraction
    b. S-phase and growth fraction
    c. G1-phase
    d. M-phase
    e. Volume doubling time
    f. S-phase

59. All of the following is correct regarding angiogenesis EXCEPT
    a. Newly formed vessels can be assessed by manual or automated microscopic count using immunohistochemical techniques.
    b. Vascular density is directly proportional to level of VEGF
    c. High vascular density is considered a low risk factor
    d. All of the above

60. Tumor turn over index requires all of the following EXCEPT
    a. Proportion of tumor necrosis
    b. Mean vascular density
    c. Proliferation index
    d. Proportion of tumor apoptosis

Chapter 8: Tumor Host Relation

61. All of the following are oncologic emergencies of tumor metabolic effect EXCEPT
    a. Tumor lysis syndrome
    b. Superior vena cava syndrome
    c. Hemolytic uremic syndrome
    d. Hyponatremia

Match the following paraneoplastic syndrome with their associated cancers
62. Polycythemia
63. Cushing syndrome
64. Acanthosis nigricans
65. Precocious puberty
    a. Small cell lung cancer
    b. Renal cell carcinoma
    c. Hepatoblastoma
    d. Gastric cancer

Match the following cell surface receptor with their corresponding immune cells
66. FC receptor
67. MHC-I
68. TCR
    a. Langerhans/dendritic cells
    b. Follicular dendritic cells
    c. Cytotoxic T lymphocyte

69. all of the following are approved monoclonal antibodies used in targeted therapy of cancer EXCEPT
    a. Rituximab
    b. Cetuximab
    c. Tamoxifen
    d. Trastuzumab

70. All of the following are examples of immunogen therapy EXCEPT
    a. Gene vaccine

b. Cancer vaccine
c. Recombinant gene fusion
d. T cell modification

Chapter 9: Tumors of Upper Respiratory Tract

71. Which of the following occupational groups are at increased risk of developing squamous cell carcinoma of the nose or paranasal sinuses
a. Battery and ammunition workers
b. Coal workers
c. Nickel refiners
d. Wood workers

72. Which of the following tumors shows the strongest association with Epstein-Barr virus
a. Keratinizing nasopharyngeal carcinoma
b. Non-keratinizing nasopharyngeal carcinoma
c. Lethal midline granuloma
d. Olfactory neuroblastoma

73. In the progression development of squamous cell carcinoma of the head and neck which of the following is the least event
a. Loss of 9p
b. Loss of 3p
c. Loss of 17p
d. Loss of 11q

74. All of the following regarding laryngeal carcinoma is correct EXCEPT
a. Carcinoma in situ of the larynx may present as a papillary lesion
b. Carcinoma in situ is more common in males than in females
c. Smoking, alcohol use and human papillomavirus infection all predispose to laryngeal carcinoma
d. Glottic carcinomas account for approximately two thirds of all laryngeal carcinoma

75. Which of the following regarding sinonasal carcinoma is correct
a. Sinonasal carcinoma usually arise from inverted papiloma
b. Sinonasal carcinomas are most often of the transitional type
c. Sinonasal adenocarcinoma of the tubulopapillary type most often originate from the surface mucous glands
d. Sinonasal adenocarcinoma is subdivided into intestinal and non-intestinal types

76. Which of the following laryngeal tumors has the lowest metastatic potential
a. Basaloid squamous cell carcinoma
b. Carcinoma with neuroendocrine differentiation
c. Salivary gland type carcinoma
d. Verrucous carcinoma

77. A transglottic cancer of the larynx is a tumor that
a. Arises from the true cord
b. Arises from pyriform sinus
c. Crosses the ventricle vertically
d. Involves the false cord

78. Which of the following concerning olfactory neuroblastoma is correct
a. Like conventional neuroblastoma, olfactory neuroblastoma is a pediatric tumor
b. Histologically olfactory neuroblastoma often presents as small blue round cell tumor
c. Similar to peripheral neuroectodermal tumors (PNETs), olfactory neuroblastoma typically harbours a EWS/FLI gene translocation t(11;22)
d. Early lymphatic metastases is the rule in olfactory neuroblastoma

79. All of the following regarding sinonasal lymphoma is correct EXCEPT
a. Angiocentric lymphomas in the sinonasal region are immunophenotypically B-cell lymphomas
b. Natural killer/T-cell cell lymphoma of the sinonasal region is an Epstein-Barr virus associated lymphoma and may present with a hemophagocytic syndrome.
c. The most common type of non-Hodgkin lymphoma of sinonasal region in the western world is diffuse large B-cell lymphoma
d. Non of the above

80. Which of the following concerning nasopharyngeal angiofibroma is correct
a. It typically occurs in female adolescents and young adults
b. Usually regress spontaneously after puberty
c. It is considered a benign tumor, however characterized by local aggressive growth
d. Non of the above

Chapter 10: Tumors of Lower Respiratory Tract

81. All of the following regarding mesothelioma is correct EXCEPT
    a. Presence of extracellular mucin, which stains positively for Alcian Blue, excludes the diagnosis mesothelioma.
    b. Immunohistochemically, mesothelioma stains positively for claretinine, WT-1, CK5/6 and D2-40.
    c. Immunohistochemically, mesothelioma stains negatively for Leu-M1, MOC-31, CEA and TTF-1.
    d. The interval between asbestos exposure and the development of mesothelioma is measured in decades.

82. Solitary fibrous tumor is characterized by
    a. It is poorly circumscribed, composed of bland spindle cells that express β catenin
    b. May be associated with hyperglycemia or hypertrophic pulmonary osteoarthropathy
    c. It stains positively for CK, bcl-2 and S-100.
    d. It is characterized by t(x; 18).

83. All of the following regarding pulmonary squamous cell carcinoma is correct EXCEPT
    a. Mutation of p53 is common in pulmonary squamous cell carcinoma
    b. Central cavitation with necrosis is a characteristic feature of squamous cell carcinoma
    c. It stains positively for CK5/6, CK34βE12 and CEA.
    d. Basaloid variant carries a favorable prognosis

84. Small cell carcinoma is characterized by
    a. It is the most common type of lung cancer
    b. Mutations of p53 and inactivation Rb gene are found in >90% of small cell carcinoma
    c. Abnormalities of p16 are common in small cell carcinoma
    d. The diagnostic feature of small cell carcinoma is vesicular nuclei with prominent nucleoli.

85. All of the following is correct regarding pulmonary carcinoid EXCEPT
    a. Regional lymph nodes metastases are seen in 5% of typical carcinoid tumors
    b. Atypical carcinoid tumors are distinguished from typical carcinoid tumors by a higher mitotic rate and/or necrosis but maintainence of neuroendocrine architecture and staining
    c. Pulmonary carcinoids are TTF-1 negative, CK7 negative and CK20 positive.
    d. Dense-core secretory granules seen on electron microscopy are a distinctive feature of pulmonary carcinoids and small cell carcinoma.

86. Which of the following is not true
    a. KRAS mutation is more common in small cell carcinoma than in non-small cell carcinomas
    b. Chromosome 3p allele loss is one of the most common events in lung cancer pathogenesis
    c. Mucinous bronchoalveolar carcinoma shows an abrupt transition of tall mucinous tumor cells to cuboid cells and normal alveolar epithelium in the tumor periphery.
    d. Mucinous bronchoalveolar carcinoma is CK20 and TTF-1 positive.

Match the following pulmonary lesions with their characteristic features
87. Inflammatory myofibroblastic tumor
88. Mucoepidermoid carcinoma
89. Pleuropulmonary blastoma
90. Pulmonary blastomas
    a. Least common salivary gland type tumors of the lung
    b. Typical pediatric tumor
    c. Most common gland type tumors of the lung
    d. Commonly associated with rearrangement of ALK-1 gene.
    e. Occurs in adults

Chapter 11: Tumors of the Mediastinum

91. All of the following concerning thymoma is false EXCEPT
    a. Most thymomas are benign tumors which however may recur after excision
    b. Myasthenia gravis is virtually always associated with thymoma
    c. The lymphoid cells of thymoma have a CD3/CD1a/CD99 phenotype
    d. Non of the above

Match the following tumors with their corresponding preferable compartment of mediastinum

92. Thymoma
93. Teratoma
94. Pericardial mesothelioma
95. Neural tumors
    a. Posterior mediastinum
    b. Anterior mediastinum
    c. Middle mediastinum

Match the following types of thymoma with their corresponding definitions
96. Type A thymoma
97. Type AB thymoma
98. Type B1 thymoma
99. Type B2 thymoma
100. Type B3 thymoma
    a. Composed of a mixture of a lymphocyte-poor type A thymoma component and a more lymphocyte-rich type B-like component.
    b. Composed of bland spindle/oval epithelial tumor cells with few or no lymphocytes.
    c. Composed predominantly of areas resembling cortex with epithelial cells scattered in a prominent population of immature lymphocytes, and areas of medullary differentiation, with or without Hassall's corpuscles, similar to normal thymic medulla
    d. Composed of medium–sized round or polygonal cells with slight atypia. The epithelial cells are mixed with a minor component of intraepithelial lymphocytes, resulting in a sheet-like growth of epithelial cells.
    e. Composed of large, tumor cells arranged in a loose network, closely resembling the predominant epithelial cells of the normal thymic cortex. A background population of immature T cells is always present and usually outnumbers the neoplastic epithelial cells

Chapter 12: Tumors of The Oral Cavity

101. Which of the following salivary gland tumors has the highest prevalence in males and is bilateral/multifocal in 10% of cases
    a. Acinic cell tumor
    b. Adenoid cystic carcinoma
    c. Mucoepidermoid carcinoma
    d. Warthin tumor

102. Which of the following is the most common malignant tumor of salivary gland
    a. Acinic cell carcinoma
    b. Adenoid cystic carcinoma
    c. Mucoepidermoid carcinoma
    d. Malignant mixed tumor

103. All of the following regarding pleomorphic adenoma is correct EXCEPT
    a. The recurrence rate of benign mixed tumors is dependent on the type of chromosomal rearrangement
    b. It can metastasize
    c. Malignant transformation of benign mixed tumor of the parotid gland is less common than other major salivary glands.
    d. Malignant transformation of benign mixed tumor can occur in either the epithelial or the stromal component

104. Which of the following regarding mucoepidermoid carcinoma is correct
    a. It represents the most common salivary gland tumor in children
    b. It consists of two major cell types mucin secreting and epidermnoid cells
    c. Low grade mucoepidermoid carcinoma consists of well differentiated squamous elements
    d. The most important prognostic factor is the tumor stage

105. All of the following regarding ameloblastic tumors is correct EXCEPT
    a. Ameloblastoma is the most common of the epithelial odontogenic tumors and typically arises in the mandible
    b. Ameloblastoma typically occurs in late adolescence, coincident with the eruption of the wisdom tooth
    c. Ameloblastoma is an invasive tumor with a tendency to recur locally, but is classified as a borderline malignant tumor owing its low propensity for metastases
    d. Ameloblastic carcinoma is similar in microscopic appearance to ameloblastoma save for atypical cytologic features

Chapter 13: Tumors of GIT

106. All the following regarding esophageal squamous cell carcinoma is correct EXCEPT
    a. It has a widely variable incidence around

the world, with hot spots, most likely a function of lifestyle, dietary habits and environmental causes
b. Most commonly affects upper third
c. In situ carcinoma is increasingly recognized as the precursor lesion to invasive carcinoma ccccin areas with high incidence of esophageal cancer
d. Superficial carcinoma and microinvasive carcinoma are terms that refer to the same entity regarding esophageal lesions

107. One of the following histopathologic types of esophageal cancer has an extremely aggressive behavior
a. Adenosquamous carcinoma
b. Basaloid carcinoma
c. Verrucous carcinoma
d. Non of the above

108. Which of the following is true concerning esophageal adenocarcinoma
a. Has a better prognosis than squamous cell carcinoma
b. Majority of cases develop on top of Barrett esophagus
c. Majority of cases develop in the gastroesophageal junction
d. Non of the above

109. All of the following concerning gastric adenocarcinoma is correct EXCEPT
a. The diffuse type signet ring cancer is less associated with environmental factors
b. The diffuse type mainly affects a younger age group
c. Mutations of E-cadherin gene are associated with the diffuse type signet ring carcinoma
d. The involvement of the APC mutation in the adenoma carcinoma sequence is the same in the stomach as it is in the colon

110. Which of the following is the MOST important prognostic factor in gastric adenocarcinoma
a. CA19-9 level
b. CEA level
c. Pathologic stage
d. Patient age

111. A gastric endocrine tumor occurring in the fundus and assoiated with achlorhydra and hypergastrinemia will most likely to secrete or contain
a. ACTH
b. Enterochromaffin-like (ECL) cells
c. Histamine
d. Serotonin

112. Mutinous colorectal adenocarcinoma is associated with ONE of the following
a. A near 100% likelihood of hereditary non-polyposis colorectal cancer (HNPCC)
b. A near 100% likelihood of high microsatellite instability (MSI-H)
c. An excellent response to chemotherapy
d. A better prognosis compared to signet ring cell carcinoma

113. Which of the following is/are required for classification of a tumor as a signet ring adenocarcinoma
a. More than 50% of the tumor is comprised of mucin
b. More than 50% of the tumor cells are signet ring cells
c. High microsatellite instability (MSI-H)
d. A family pedigree consistent with HNPCC

114. According to WHO 2010 prognostic groups of GIST, all of the following are classified as benign tumors EXCEPT
a. Tumor size <2 cm with mitosis >5/50HPF
b. Tumor size <2 cm with mitosis <5/50HPF
c. Tumor size >2 <5 cm with mitosis <5/50HPF
d. Tumor size >5<10 cm with mitosis <5/50HPF

115. Which of the following is true about carcinoid of the appendix
a. Frequently associated with carcinoid syndrome
b. Goblet cell type is consistently negative for chromogranin
c. Insular type is associated with poor prognosis
d. Represents an incidental finding in about 1 of 300 appendices

Chapter 14: Tumors of Hepatobiliary System

116. Which of the following are considered precursor lesions for hepatocellular carcinoma
a. High grade dysplastic nodule

b. Focal nodular hyperplasia
c. Small cell change
d. a and c

117. An increased risk for developing hepatocellular carcinoma is associated with all of the following EXCEPT
a. Wilson disease
b. Hemochromatosis
c. Alpha-1-antitrypsin deficiency
d. Primary biliary cirrhosis

118. Which of the following concerning fibrolamellar carcinoma is true
a. Is associated with hepatitis B infection
b. Is strongly associated with the use of oral contraceptives
c. Occurs primarily in young adults
d. Occurs in the cirrhotic liver

119. Which of the following morphological or immunohistochemical features is MOST significant in diagnosing hepatocellular carcinoma
a. Bile formation
b. CAM5.2 immunoreactivity
c. Cytoplasmic CEA immunoreactivity
d. Sinusoidal pattern

120. Which of the following are important prognostic factors for hepatocellular carcinoma
a. Overall TNM stage
b. Microvascular invasion
c. Associated cirrhosis
d. All of the above

121. All of the following are correct concerning hepatoblastoma EXCEPT
a. May be associated with a variety of congenital anomalies and even with other tumors such as Wilms tumor
b. Most are composed of spindle cells arranged into rosettes
c. Approximately 25% contain not only immature liver cells but also mesenchymal components such as bone or cartilage
d. None of the above

122. Which of the following concerning hepatoblastoma is true
a. Most common hepatic tumor occurring in teenagers
b. Is broadly divided into epithelial and mixed epithelial/mesenchymal subtypes on the basis of histologic appearance
c. The small cell subtype is associated with a better prognosis
d. It is staged using an AJCC/UICC TNM staging system

123. Which of the following concerning hepatic sarcoma is true
a. Leiomyosarcoma is the most common primary hepatic sarcoma
b. The most common hepatic sarcoma in children is embryonal or undifferentiated sarcoma
c. Gastrointestinal stromal tumor (GIST) rarely occurs primarily in the liver
d. b and c

124. Intrahepatic cholangiocarcinoma are associated with which of the following conditions
a. Primary sclerosing cholangitis
b. Liver flukes
c. Recurrent bacterial cholangitis
d. All of the above

125. Which of the following concerning gall bladder cancer is true
a. Gall bladder carcinoma is commonly associated with diffuse calcification of the wall
b. Most gall bladder tumors are sarcomas
c. Epithelial dysplasia is considered a precursor lesion for carcinoma
d. Non of the above

Chapter 15: Tumors of Urinary System

126. Which of the following is incorrect concerning molecular pathogenesis of urothelial cancer of the urinary bladder
a. Chromosome 9 deletions are common and occur on both short and long arms
b. p53 mutations are associated with carcinoma in situ and aggressive disease
c. pRb alterations are observed and correlate with poor prognosis
d. activating FGFR3 mutations are most common in metastatic lesions

127. According to AJCC 7th edition guidelines, what is the correct classification of a urothelial carcinoma with deep muscularis propria invasion with extension into prostatic urethral without prostatic stromal invasion
a. T2a

b. T2b
c. T3a
d. T4a

128. Regarding urinary bladder tumors which of the following is INCORRECT
a. 90% are squamous carcinomas
b. Painless hematuria is the commonest presentation
c. Cigarette smoking is an important etiological factor
d. Superficial tumors are often well controlled by transurethral resection

129. The following are carcinogens important in urinary bladder cancer
a. Auramine
b. Benzidine
c. Beta-naphthylamine
d. All of the above

130. Which of the following regarding urothelial carcinoma is true
a. Detection of muscularis propria invasion is more important for prognosis than invasion of lamina propria
b. Prominent muscle fascicles always indicate muscularis propria in urinary bladder biopsies
c. Identification of tumor adjacent to fat cells indicates invasion into perivesical tissue
d. The term carcinoma in situ is used for all papillary transitional cell carcinomas not invading lamina propria

131. All of the following regarding renal cell carcinoma is correct EXCEPT
a. It is the most common malignancy in patients who have Von Hippel-Lindau disease
b. Clear cell carcinomas are more often bilateral and multicentric than papillary carcinomas
c. Papillary carcinomas have a better prognosis than conventional clear cell type
d. Collecting duct carcinomas are centered in the medulla, have tubulopapillary architecture and evoke strong desmoplastic reaction.

132. A feature of chromophobe renal cell carcinoma is
a. Associated with tuberous sclerosis
b. Good prognosis
c. High prevalence of 3p deletion
d. Mean age of 25 years

Match the following renal tumors with thier corresponding characteristic features
133. Renal medullary carcinoma
134. Collecting duct carcinoma
135. Clear cell renal cell carcinoma
a. Loss of INI-1 expression
b. Associated with sickle cell trait (Hb-AS or Hb-SC) or, rarely, sickle cell anemia (Hb-SS)
c. Positive for CD10 and vimentin
d. Positive for HMCK, EMA, CK7 and INI-1

Chapter 16: Tumors of Male Genital System

136. Which of the following histopathologic features favor the diagnosis of prostatic adenocarcinoma over hyperplasia
a. Conspicuous nucleoli
b. Cystic dilatation of glands
c. Lymphocytic infiltration
d. Prominent papillary infoldings

137. Besides age, which of the following is a well-recognized factor influencing the incidence of prostatic carcinoma
a. Exposure to environmental toxins
b. Fat consumption
c. Nodular hyperplasia
d. Race

138. Regarding prostate cancer screening which of the following is true
a. Complex form of prostatic specific antigen (PSA) is released predominantly by prostatic hyperplasia
b. False-negative rate of core biopsies is approximately 25%
c. Free form of PSA is released predominantly by prostatic cancer
d. Transrectal ultrasonography (TRUS) has a 95% sensitivity

139. Which of the following features will differentiate low grade from high grade prostatic intraepithelial neoplasia (PIN)
a. Negative immunostaining for basal cell-specific markers
b. Arxhitectureal features

c. Macronucleoli
d. Mitotoic figures

140. Which germ cell tumor is associated with widespread hematogenous metastases and high levels of HCG
a. Pure choriocarcinoma
b. Yolk sac tumor
c. Embryonal carcinoma
d. Seminoma

141. Which immunohistochemical markers are expressed in seminoma
a. CD117
b. CD30
c. PLAP
d. a and c

142. Intratubular germ cell neoplasia (IGCNU) is considered a precursor for all germ cell neoplasia EXCEPT
a. Choricarcinoma
b. Classic seminama
c. Embryonal carcinoma
d. Spermatocytic seminoma

143. Which of the following histologic patterns is most characteristic of sertoli cell tumor
a. Glandular arrangement
b. Mixture of cytotrophoblasta and syncytiotrophoblasts
c. Tubules reminiscent of immature seminiferous tubules
d. Round nests between lymphocyte-rich septa

144. All of the following regarding adenomatoid tumor of the epididymis is correct EXCEPT
a. It is the most common tumor of the epididymis
b. It shows positive reaction for MOC-31, CEA and Leu M1
c. It is large but well circumscribed and encapsulated benign tumor
d. It frequently shows vacuolization of the cytoplasm and may simulate vascular tumors

145. Which of the following is considered a grade 1 immature teratoma
a. Amount of immature neuroectoderm occupies <1 low-power (4x objective) magnification field
b. Amount of immature neuroectoderm occupies >1 but <3 low-power magnification fields
c. Amount of immature neuroectoderm occupies >3 low-power (4x objective) magnification fields
d. Non of the above

Chapter 17: Gynecologic Tumors

146. Which of the following increases the risk of developing ovarian cancer
a. Use of oral contraceptives for >5 consecutive years
b. Nulliparity
c. Breast feeding
d. Tubal ligation

147. Which of the following regarding juvenile granulosa cell tumor is correct
a. It is never diagnosed in adults
b. Always positive for EMA
c. Recurrence frequency occur more than five years after initial diagnosis
d. 98% of cases are unilateral.

148. All of the following regarding endometrial adenocarcinoma is correct EXCEPT
a. Endometrioid (type I) carcinoma has a prognosis twice as good as serous or clear (type II) carcinomas.
b. Type I carcinomas commonly found to have p53 mutations.
c. Benign and borderline clear cell tumors are very rare
d. Her-2/neu amplification is a common feature of type II carcinomas

149. FIGO grading system for endometrioid adenocarcinoma is based mostly on
a. Architectural features
b. Hormone receptor status
c. Mitotic rate and nuclear atypia
d. Nuclear atypia and architectural features

150. Which of the following applies to uterine leiomyosarcoma
a. Arise from malignant transformation of benign leiomyomas
b. Invade locally but rarely metastasize
c. Occur exclusively in postmenopausal women
d. Non of the above

Match the following histologic features with their corresponding smooth muscle tumor

151. Slight increased cellularity with inimal cytologic atypia and mitosis less than 5/10HP
152. Marked atypia with mitotic rate >10/10HPF including abnormal forms as well as coagulative necrosis
153. Cellularity and cytology of normal myometrium with mitotic figures >5/10HPF with no abnormal forms or coagulative necrosis
154. Cellularity and cytology of normal myometrium with no mitotic figures
155. Minimal atypia, slight increased cellularity with mitotic rate <10/10HPF without abnormal forms
    a. Leiomyosarcoma
    b. Leiomyoma
    c. Cellular leiomyoma
    d. Mitotically active leiomyoma
    e. Smooth muscle tumor of uncertain malignant potential (STUMP)

Chapter 18: Breast Cancer

Match the following hormone receptor status and proliferation index patterns with their corresponding breast cancer subtype

156. ER positive, PR positive, Her-2/neu negative and Ki-67 positive.
157. ER negative, PR negative and Her-2/neu positive
158. ER negative, PR negative and Her-2/neu negative CK5/6 negative
159. ER positive, PR positive, Her-2/neu negative and Ki-67 negative.
160. ER negative, PR negative and Her-2/neu negative CK5/6 positive
    a. Luminal A
    b. Luminal B (Her-2/neu positive)
    c. Luminal B (Her-2/neu negative)
    d. Her-2/neu enriched
    e. Basal-like
    f. TNP nonbasal

161. Which of the following pathologic subtypes of breast cancer is associated with more favorable prognosis
    a. Metaplastic
    b. Scirrhous
    c. Tubular
    d. Medullary

162. Factors that increase risk for developing breast cancer include all of the following EXCEPT
    a. Early menarche or late menopause
    b. Age >30 years at time of first pregnancy
    c. Nulliparity
    d. First or second trimester abortion

163. All of the following is correct regarding BRCA1 EXCEPT
    a. Located on chromosome 17.
    b. Contributes to multiple functions, including cell cycle checkpoint control.
    c. Shares functional but not sequence similarity with BRCA2
    d. It is not a classic tumor suppressor gene because both alleles must be lost or mutated to confer an increased risk of cancer.

Match the following lesions with their relative risk for subsequent malignant transformation

164. Atypical ductal hyperplasia
165. Ductal carcinoma insitu
    a. 4 to 5 times
    b. 8 to 10 times
    c. 1.5 times

Chapter 19: Tumors of Endocrine and Neuroendocrine

166. Which of the following variants of papillary thyroid carcinoma is associated with the worst prognosis
    a. Diffuse sclerosing
    b. Encapsulated
    c. Microcarcinoma
    d. Tall cell variant

167. The following is MOST useful in distinguishing follicular adenoma from follicular carcinoma
    a. Determining MIB-1 labeling index
    b. Estimation of p27 and galectin-3 expression
    c. Measurement of the main nodule diameter
    d. Microscopic examination of the entire capsule

168. Insular carcinoma of the thyroid gland is most probably
    a. Atypical carcinoid of the thyroid
    b. Equivalent to anaplastic carcinoma

c. Poorly differentiated follicular or papillary carcinoma
d. Salivary gland-like neoplasm

169. All of the following is true regarding Hurthel cell carcinoma EXCEPT
a. It is a variant of papillary carcinoma
b. It is also known as oxyphil cell carcinoma
c. It has a worse prognosis than papillary or follicular carcinoma
d. It is less iodine-avid than papillary or follicular carcinoma

170. All of the following is correct regarding adrenocortical tumors EXCEPT
a. Mitotic activity and venous invasion correlate best with recurrence or metastases
b. An adrenocortical tumor strongly positive for vimentin and weakly positive or negative for CK is likely to be carcinoma
c. The presence of aneuploidy strongly favors malignancy over a benign adrenocortical tumor
d. Chromogranin and CK are most useful in distinguishing adrenocortical tumors from adrenomedullary tumors

171. All of the following are considered to be part of MEN1, EXCEPT
a. Pituitary adenoma
b. Carcinoids
c. Medullary thyroid carcinoma
d. Benign adrenal tumors

172. Which of the following are considered malignant features in pheochromocytoma
a. Increased mitotic figures with abnormal forms
b. Necrosis
c. Distant metastases
d. All of the above

173. The majority of medullary thyroid carcinomas associated with MEN2A and MEN2B contain mutations in which proto-oncogene
a. RAS
b. PTEN
c. RET
d. P53

174. All of the following regarding pituitary adenoma are true EXCEPT
a. Serum levels of prolactin (PRL) above 200ng/ml are considered diagnostic for PRL-producing adenomas
b. Endocrine amyeloid is not an uncommon feature of PRL-producing adenomas
c. All ACTH cell adenomas are functional
d. Adenomas of TSH cell type are the least common pituitary tumor type

175. All of the following are considered favorable histology according to International Neuroblastoma Pathology Committee (INPC) EXCEPT
a. Poorly differentiated neuroblastoma, schwannian stroma poor with low or intermediate MKI in 1 years old child.
b. Undifferentiated neuroblastoma, schwannian stroma poor with low MKI in a patient 1 years old child.
c. Differentiating neuroblastoma, schwannian stroma poor with low or intermediate MKI in a 1 years old child.
d. Differentiating neuroblastoma, schwannian stroma poor with low or intermediate MKI in a 3 years old child.

Chapter 20: Bone Sarcomas

176. Which of the following conditions is responsible for most cases of osteosarcoma arising in patients older than 45 years
a. Fibrous dysplasia
b. Infections
c. Paget's disease
d. Prior radiation

Match the following variants of osteosarcoma with its expected behavior
177. Parosteal osteosarcoma
178. Conventional osteoblastic osteosarcoma
179. Periosteal osteosarcoma
180. Paget's associated osteosarcoma
a. Favorable
b. Unfavorable

181. Which of the following is true concerning osteosarcoma
a. Conventional osteosarcomas have a characteristic 11;22 translocation which is important for the diagnosis
b. Small cell osteosarcoma is characterized by a chromosomal translocation t(11;22)(q24;q12)
c. Periosteal osteosarcoma is a synonymous

with parosteal osteosarcoma
d. Post-chemotherapy tumor necrosis is the single most important prognostic parameter in conventional osteosarcoma.

Match the following syndromes with their corresponding associated bony lesions
182. Gardner syndrome
183. Maffucci syndrome
184. McCune-Albright syndrome
185. Ollier syndrome
a. Multiple enchondromas
b. Multiple osteomas
c. Multiple enchondromas with soft tissue angiomas
d. Fibrous dysplasia

Chapter 21: Tumors of Soft Tissue

186. Which of the following molecular genetics results using florescence in-situ hybridization (FISH) would be consistent with the diagnosis of synovial sarcoma
a. Demonstration of SS18-SSX1 or SS18-SSX2 fusion gene
b. Demonstration of EWSR1-FLI1 fusion gene
c. Demonstration of FUS-DDIT3 fusion gene
d. Demonstration of EWSR1-NR4A3 fusion gene

187. Which of the following types of rhabdomyosarcoma has the worst prognosis
a. Alveolar
b. Emberyonal
c. Pleomorphic
d. All have equally poor prognosis

188. All the following is correct concerning liposarcoma EXCEPT
a. Myxoid and round cell liposarcoma belong to the same genetic entity and the former is considered a poorly differentiated variant of the latter
b. Atypical lipomatous tumor category encompasses atypical lipoma and well-differentiated liposarcoma
c. Dedifferentiated liposarcoma is the term used for the emergence of a non-lipogenic undifferentiated solid component within an atypical lipomatous tumor
d. Lipoblastoma is distinguished from myxoid liposarcoma by the virtue of the young age of the patient, distinct lobulation, and absence of giant cells or pleomorphic nuclei

189. Which of the following vascular lesions is thought to arise as a florid form of organized and recanalized thrombus
a. Capillary heamangioma
b. Intravascular papillary endothelial hyperplasia
c. Malignant endovascular papillary angioendothelioma
d. Symplastic heamangioma

190. All of the following are predisposing factors for development of soft tissue sarcomas EXCEPT
a. Prior radiation exposure
b. Chronic lympheodema
c. Multiple endocrine neoplasia (MEN) type 1
d. Neurofibromatosis type 1

Match the following cytogenetic abnormality with its corresponding sarcoma
191. t(11;22) (q24;q12)
192. t(12;16) (q13;p11)
193. t(x;18) (p11;q11)
194. t(2;13)(q35;q14)
a. Synovial sarcoma
b. Alveolar rhabdomyosarcoma
c. Myxoid liposarcoma
d. Ewing sarcoma

195. Which of the following is not true concerning soft tissue sarcomas
a. Histologic subtype is an important determinant of prognosis, natural history and therapy
b. Nodal metastases are common
c. Histologic tumor grade is the most prognostic factor
d. Immunohistochemical status frequently yields evidence used to define the histologic subtype

Chapter 22: Tumors of Skin

196. The immunohistochemical staining most helpful in differentiating dermatofibroma from dermatofibrosarcoma is
a. Actin
b. HMB-45
c. CD34

d. Vimentin

197. Besides HIV which of the following viruses is implicated in the pathogenesis of Kaposi sarcoma developing in patients with AIDS
a. Cytomegalovirus
b. Herpes virus type 8
c. Human papilloma virus type 16
d. Human papilloma virus type 18

198. Risk factors for cutaneous melanoma include all the following EXCEPT
a. Prior scalp radiation
b. Inherited mutation of p16 (CDKN2A)
c. Higher socioeconomic status
d. Pregnancy

Match the following Clark level of melanoma with its corresponding microscopic description
199. Clark's level I
200. Clark's level II
201. Clark's level III
202. Clark's level IV
203. Clark's level V
a. Melanoma involving subcutis
b. Melanoma involving upper part of papillary dermis
c. Melanoma involving epidermis
d. Melanoma involving reticular dermis
e. Melanoma involving the whole papillary dermis

204. All the following are true concerning sebaceous tumors EXCEPT
a. Sebaceous adenomas are associated with tuberous sclerosis
b. Sebaceous carcinoma of eye lid is more aggressive than those occurring elsewhere in the skin.
c. Sebaceous adenomas and carcinomas both show expression og EMA and androgen receptors
d. Sebaceous tumors may be a component of Muir-Torre syndrome

205. All of the following is correct regarding cutaneous squamous cell carcinoma EXCEPT
a. It may occure as a compliation of xeroderma pigmentosa
b. Verrucous type is an extremely well differentiated subtype of squamous cell carcinoma
c. Acantholytic type is the cutaneous equivalent of mucoepidermoid carcinoma of salivary glands
d. It may be composed of spindle cells on histology

Chapter 23: Tumors of CNS

206. All of the following regarding pilocytic astrocytoma is correct EXCEPT
a. Shows predilection for the anterior optic pathway
b. Classically associated with Rosenthal fibers and esinophilic granular bodies
c. Frequently displays extensive infiltration of adjacent subarachnoid space and leptomeninges
d. Not frequently exhibit malignant degeneration if left untreated.

207. All of the following regarding medulloblastoma is correct EXCEPT
a. At least 75% of childhood medulloblastoma arise in the lateral cerebellar hemisphere.
b. The pale islands of desmoplastic medulloblastoma constitute loci of concentrated immunoreactivity for synaptophysin.
c. The most common genetic alteration associated with classic medulloblastoma is isochromosome 17q formation.
d. Skeletal deposits, often widespread, account for over 90% of systemic metastases.

208. Which of the following regarding meningioma is correct
a. Males are more commonly affected than females
b. Overlying bone invasion (hyperostosis) is indicative for a more aggressive course.
c. Transitional meningioma is so called because it is a hybrid of meningiothelial and fibrous types.
d. Papillary variant is considered a WHO grade I tumor.

Match the following CNS tumors with their corresponding associated syndromes
209. Subependymal giant cell astrocytoma (SEGA)
210. Hemangioblastoma
211. Astrocytoma
212. Medulloblastoma
213. Malignant peripheral nerve sheath tumor
a. Turcot (glioma-polyposis syndrome)

b. Neurofibromatosis 1.
c. Li-Fraumeni syndrome.
d. Von Hipple-Lindau syndrome.
e. Tuberous sclerosis.
f. Gorlin syndrome.

214. All of the following regarding ependymoma is correct EXCEPT
a. It tends to be diffusely infiltrating on radiologic study.
b. CAM5.2 immunohistochemistry is useful in distinguishing papillary ependymoma from choroid plexus papilloma.
c. Myxopapillay type restricted to the region of conus medullaris and filum terminale
d. Tanycytic ependymoma are typically encountered at spinal levels.

215. Primary (de novo) glioblastoma multiforme (GBM) is commonly associated with all of the following EXCEPT
a. PTEN inactivation
b. p53 mutation
c. CDKN2A deletion
d. Median age <60 years

Chapter 24: Tumors of Special Senses

216. Which of the following feature is the most significant in the prognosis of retinoblastoma
a. Extent of necrosis
b. Extent of optic nerve invasion
c. Mitotic activity
d. Presence of calcification

217. Which of the following statements is wrong
a. Retinoblastoma is a hereditary and acquired disease
b. Retinoblatoma gene is incorporated in the pathogenesis of osteosarcoma
c. Familial retinoblastoma can be bilateral
d. Familial retinoblastoma is a sex-linked disease

218. Concerning glomus jagulare, the following are wrong except
a. Glomus jagulare is histogenetically related to glomus tumor of the stomach
b. Glomus jagulare is a benign paraganglioma
c. Glomus jagulare is a non-invasive tumor
d. Glomus jagulare is positive for chromogranin

219. Tumors of the ocular adenxa include the following except
a. Mixed tumor
b. Lymphoma
c. Adenoid cystic carcinoma
d. Yolk sac tumor

220. White pupil in an infant could mean the following except
a. Retinoblastoma
b. Congenital cataract
c. Retinal detachment
d. Non of the above

Chapter 25: Hematolymphoid Malignancies

221. Which of the following lesions characteristically has the highest proliferation index (Ki-67)
a. Mantle cell lymphoma
b. Small lymphoytic lymphoma/chronic lymphocytic leukemia
c. Marginal zone lymphoma
d. Hairy cell leukemia

Match the following immunostaining patterns of large B-cell lymphoma with their corresponding subgroup
222. CD10 positive, Bcl-6 positive and MUM-1 negative
223. CD10 negative, Bcl-6 positive and MUM-1 negative
224. CD10 negative, Bcl-6 positive and MUM-1 positive
225. CD10 negative, Bcl-6 negative and MUM-1 positive
a. Non-germinal center-like group (non-GCB)
b. Germinal center-like group (non-GCB)

Match the following types of non-Hodgkin lymphoma with their proliferation index (Ki-67)
226. Blastoid mantel cell lymphoma
227. Burkitt lymphoma
228. Pleomorphic mantel cell lymphoma
229. Usual mantle cell lymphoma
230. Diffuse large B-cell lymphoma
a. <10%
b. 40%-70%
c. 100%
d. 10%-30%
e. >30%
f. < 2%

231. The following are true regarding childhood Hodgkin lymphoma (HL) EXCEPT
    a. Occurs mostly in children aged >10 years, mostly localized.
    b. Mediastinal involvement is common in nodular sclerosis type
    c. EBV is detected in 40% of pediatric HL.
    d. Nodular lymphocyte predominant HL (NLPHL) is usually disseminated.

232. All of the following is true regarding nodular lymphocyte predominant HL (NLPHL) EXCEPT
    a. Large cells are LCA positive, CD20 positive, CD15 and CD30 negative
    b. Does not transform to large B-cell lymphoma
    c. Background cells are germinal center derived.
    d. Background T-cells are CD8 negative.

Match the following types of small cell non-Hodgkin lymphoma with the correct immunohistochemical panel
233. Follicle center cell lymphoma (follicular lymphoma)
234. Small lymphoytic lymphoma/chronic lymphocytic leukemia
235. Mantle cell lymphoma
    a. CD20 +, CD5 +, CD23+, CD10 –, cyclin D1 -
    b. CD20 +, CD5 -, CD10+, Bcl-2 +, Bcl-6 +
    c. CD20 +, CD5 +, CD23-, CD10 –, cyclin D1 +
    d. CD20+, CD5-, CD23-, cyclin D1 -, IgM +

Chapter 26: Histiocytic and Dendretic Tumors

Match the following histocytic tumors with teir cell of origin
236. Juvenile xanthogranuloma
237. Rosai Dorfnam disease
238. Follicular dendritic cell sarcoma
239. Langerhans cell histiocytosis
240. Histiocytic sarcoma
    a. Dendritic cell
    b. Macrophages
    c. Other cells

Match the following histiocytic tumors with their corresponding diagnostic immunohistochemical markers
241. Langerhans cell disease
242. Follicular dendritic cell sarcoma
243. Histiocytic sarcoma
    a. CD163, CD68
    b. CD207, S-100, CD1a
    c. CD21

Match the following histiocytic cells with their histogenic cell of origin
244. Follicular dendritic cell sarcoma
245. Langerhans and histiocytic tumors
    a. Hematopoietic (Myeloid) cell
    b. Mesenchymal stem cell
    c. Other cell

Answers of MCQs

Chapter 1
1. h
2. a
3. d
4. c
5. g
6. f
7. e
8. c
9. c
10. a

Chapter 2
11. d
12. d
13. c
14. d
15. d

Chapter 3
16. c
17. b
18. e
19. f
20. c
21. a
22. g
23. d
24. c
25. d

Chapter 4
26. c
27. b
28. d
29. a
30. c
31. b
32. f
33. a
34. d
35. c
36. d

Chapter 5
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