YOUR MEDICAL CARE AS IT RELATES TO ANATOMY, PHYSIOLOGY AND DISEASE STATES

Richard Wendel MD, MBA Moderator
An 8 week Fall OLLI online course
Wednesdays from 11am-12pm starting September 23rd.
Email address: rgwendel4@gmail.com
Each week we will focus on one of the body’s systems:
1. September 23: Nervous System
2. September 30: Endocrine glands
3. October 7: Skeletal, Muscles, skin
4. October 14: Digestive System
5. October 21: Immune system
6. October 28: Pulmonary system
7. November 4: Cardiovascular system
8. November 18: GenitoUrinary tract
There are approximately 150 PowerPoint slides that I will be using in this course. The file is too large to be emailed. If you want a file containing all the slides, I will be sending the file via the Internet through the OLLI office, but the best way for you to have a complete set is to send me a thumb or flash drive through the mail at my home and I will copy the file and send it back.

My home address is:
Richard Wendel
6722 Hammerstone Way
Cincinnati, Ohio 45227
Brain and Central Nervous System

Gross Anatomy

Anatomy of the Brain

Functional MRI as Research Tool
Arterial Blood Supply to the Brain
Neurotransmitters

- Dopamine (reward-motivation) Parkinson’s
- Serotonin (SSRIs) Depression
- Acetylcholine (alpha adrenergic-parasympathetic)
- Norepinephrine (blood pressure) (Beta adrenergic)
- Epinephrine/adrenalin
- GABA-(gamma-aminobutyric acid) is an inhibitory neurotransmitter
- Oxytocin (a hormone secreted by hypothalamus—’love hormone’)
- Glutamine (a protein—immune system)
Cranial Nerve Diagram

- Optic II
- Oculomotor III
- Trochlear IV
- Abducens VI
- Facial VII
- Vestibulocochlear VIII
- Glossopharyngeal IX
- Accessory XI
- Vagus X
- Hypoglossal XII
- Olfactory I
- Trigeminal V
Cursory Neurologic Exam when you go to see your Primary Care Physician

- Sensorium and memory
- Pupils (R&R&RLA)
- Funduscopic exam
- Eyes movements
- Check Reflexes with reflex hammer
- Strength evaluation and proprioception
- Balance
Optic Chiasm
Right Brained versus Left Brained People

• Right brained more adept at spatial and nonverbal concepts and being more creative and emotional (a scientist or musician)

• Left Brained are more analytical and methodical. They are better at things like reading, writing, and computations. (an accountant or author)
Autonomic Nervous System or Involuntary nervous system

- **Sympathetic nervous system**: the ‘fight or flight’ response to stress mediated by adrenaline/epinephrine or nor-epinephrine. The response to stress includes pupil dilation, increased sweating, increased heart rate, and increased blood pressure. The adrenal gland and solar plexus secrete adrenaline.

- **Parasympathetic nervous system**: involuntary functions of the body such as peristalsis, slowing of the heart, constriction of the pupil. Mediated by acetylcholine. The Vagus nerve, the tenth cranial nerve, is a parasympathetic nerve trunk.
<table>
<thead>
<tr>
<th>Medical Conditions of the CNS</th>
</tr>
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<tbody>
<tr>
<td>• Demyelinating Disorders; Multiple Sclerosis, Amyotrophic lateral sclerosis (ALS), Guillain-Barre Syndrome</td>
</tr>
<tr>
<td>• Brain Cancer: (meningioma, glioblastomas, acoustical neuroma)</td>
</tr>
<tr>
<td>• Psychosis and Neurosis</td>
</tr>
</tbody>
</table>
Meningitis, Encephalitis, and Brain Abscess

- Meningitis fairly common due to enteroviruses (85-95% and seasonal)
  Presents with stiff neck or nuchal rigidity
- Encephalitis can be caused by the Herpes simplex virus and is treated with acyclovir and dexamethasone.
- Lumbar puncture with examination of cerebrospinal fluid is diagnostic; MRI is better than CT scan for diagnostic purposes.
### Parkinson’s and Parkinsonism that has a broad range of presentations

- **Cause:** Due to loss of Dopamine producing cells in the basal ganglia
- **Symptoms:** tremors, rigidity, gait, mask face, mood change, hallucinations
- **Early symptoms of anosmia, sleep disorders, constipation, depression, restlessness, anxiety, orthostatic hypotension** (may occur many years before)
- **Treatment:** directed at increasing dopamine. Levodopa the mainstay but a whole array of meds prescribed by neurologists. Deep brains stimulation of basal ganglia-do not know why this works.
Dementia and Geriatric Syndromes

- Alzheimer's disease: (60%, Amyloid, Tau Protein with tangles)—cause unknown (APOE-e4 genetic link). No effective treatment although there is a new blood test for Tau protein that is 96% accurate in diagnosing Alzheimer’s: anticholinergics may temporarily delay the need for NH placement.
- Arteriosclerotic; multiple mini-strokes, TIA
- Temporal Frontal Lobe Dementia; usually starts with difficulty in speech.
- Lewy Body Dementia; more behavioral problems and shorter course
Stroke; ischemic and hemorrhagic

- Unlike heart attack do not give aspirin because of possible intracranial bleeding
- Cincinnati Criteria: Facial droop, Arm drift, Slurred Speech: All three present = 87% chance of stroke.
- Emergency CT scan to differentiate
- Window of 3-4.5 hours from when symptoms first started (with new angiography techniques can estimate amount of viable brain beyond stroke (flair and penumbra) and possible large vessel disease and in some cases extract the clot to retrain maximal function up to 24 hours.)
- IV anticoagulant and fibrinolytic: plasminogen activator (tPA) and Alteplase. Cannot give after 4.5 hours.
- Carotid bruit
<table>
<thead>
<tr>
<th>BRAIN DEATH IN ORGAN DONATION</th>
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<tbody>
<tr>
<td>1. Comatose and unresponsive</td>
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<tr>
<td>2. EEG for brain wave activity</td>
</tr>
<tr>
<td>3. Now have a nuclear scan that reveals total brain blackout. No longer need to rely on clinical findings and expert opinions, but still by law need multiple expert opinions.</td>
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</table>
Multiple Sclerosis; autoimmune inflammatory demyelinating disease three to four times more often in females versus males.

- Variable symptoms beginning between the ages of 20 and 40: slurred speech, fatigue, dizziness, tingling, altered sexual, bowel and bladder function, cognitive.
- Common disorder affecting about 720,000 cases in the US with no diagnostic lab test (MRI).
- FDA has approved 15 or more drugs for treatment (average cost per year $80,000)-these drugs alter the immune response of lymphocytes.
Peripheral Segmental Nerves

Cervical 1-7, Thoracic 1-12, Lumbar 1-5
Peripheral Nerve Testing

- Tendon Reflexes: ankle, knee, elbow
- Sensory for vibration with a tuning fork
- Pain pin prick
- Hot, Cold and light touch
- Proprioception: finger to nose with eyes closed
- EMG
<table>
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<tr>
<th>Medical conditions of peripheral nerves</th>
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<tr>
<td>• Peripheral neuritis (age, diabetes, alcohol risk factors)</td>
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<tr>
<td>• Carpal Tunnel syndrome</td>
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<td>• Sciatica</td>
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<tr>
<td>• Herniated disc disease</td>
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<tr>
<td>• Paraplegia and Quadriplegia</td>
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<tr>
<td>• Herpes Zoster</td>
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Update on the Covid-19 virus pandemic

- Slow response has resulted in dismal statistics for the US as compare to other developed countries.
- Case fatality rates for Covid-19 is 3.1 % overall in U.S. Much greater than the flu at 0.1-0.2%
- >age 80--25 percent mortality rate, >70--15 %, 60-70—5.6%, 50-60—1%
- Multisystem virus with long term effects.
- Herd Immunity target 60%; at <10% currently
Treatments: no effective Rx yet

- Remdesivir is an antiviral that costs 3000 per course and shortens hospital stays but shows no difference in outcomes or survival rates.
- Steroids—mainly dexamethasone improves outcomes especially in very ill patients on a ventilator.
- Tocilizumab—monoclonal antibody that increases time off the ventilator.
- Convalescent serum—benefits if given early in the course before need for oxygen and ventilator.
‘Warp Speed’ Vaccines

- Those in phase III trials (2 doses and results over a six month period from 37,000 enrollees after proving safety and efficacy.
  1. Moderna-mRNA vaccine—two doses and must be stored at -20C.
  2. Pfizer—two doses, stored -20C, on hold due to a case of transverse myelitis
  3. AstraZeneca—viral vector vaccine using Chimpanzee adenovirus—stored -2-7 C.
  4. Can Sin Bio—adenovirus
A 50 percent effective threshold target rate, and first doses will be reserved for high risk populations.
My Infectious disease expert’s (SB) opinion about what we have to look forward to: he predicts we will still be wearing masks and distancing at this time next year.
## Endocrine Glands

- Hypothalamus
- Pineal
- Pituitary gland
- Thyroid gland
- Parathyroid gland
- Adrenal gland
- Pancreas
- Testicles and ovaries
The Pituitary Gland; Master Gland
Pituitary Hormones

- Growth Hormone (GH)
- Thyroid stimulating hormone (TSH)
- Adrenocorticotropic hormone (ACTH)
- Anti-Diuretic hormone or vasopressin (ADH)
- Oxytocin (love and uterine contractions)
- Prolactin (lactation)
- Gonadotropic hormones; Luteinizing hormone (LH), ICSH, Follicle Stimulating hormone (FSH)
- Melanocyte Stimulating Hormone (MSH)
Pituitary Dysfunction

- Acromegaly, Gigantism, Dwarfism
- Hyperthyroidism (Graves Disease), Hypothyroidism
- Cushing’s disease or Addison’s disease
- Hypogonadism
- Infertility
Thyroid and Parathyroid Glands
Feedback Mechanisms

THYROID STIMULATING HORMONE (TSH) TESTING

WHAT IS TSH?

TRH
Thyroid Releasing Hormone

TSH
Thyroid Stimulating Hormone

T3
Trilodothyronine hormone

T4
Thyroxine hormone

TSH

Negative feedback inhibition

PITUITARY GLAND

HYPOTHALAMUS

THYROID GLAND

T3

T4

C
Calcitonin

GET REAL.
About Hypothyroidism.

Nature-Thyroid
You, improved.

WP Thyroid
Westroid Pure
Parathormone has the opposite effect.
The Adrenal Glands
The Effects of Prednisone

Effects of cortisol

- Raise or lower the mood depending on the situation.
- Production of cortisol is controlled via the hypothalamus and the pituitary gland.
- Stimulates gluconeogenesis in the liver.
- Increases blood sugar, blood pressure increase, inhibitory effect on the immune system.
- Digestion is slowed down.
- Reduces allergic reactions, anti-inflammatory, dampens pain sensation, body starts to sweat.
- Permanently increased dosage favors osteoporosis and muscle weakness.

Moon Facies Cushionoid

ACTH
Addison's and Cushing's Disease

- **Adrenal Insufficiency** is usually caused by autoimmune adrenalitis (many other causes as well) and gives symptoms related to the three hormones the adrenal gland secretes—ADH, Cortisone and Sex Hormones. These include weakness, fatigue, low BP, weight loss. Treatment is hormone replacement.

- **Cushing’s Disease** is due to an excess of steroids often due to pituitary adenoma or long term corticosteroid treatment. Symptoms of diabetes, HPT, moon facies, obesity, buffalo hump.
The Pancreas
Functions of the Pancreas

- Secretion of insulin, which acts to lower blood sugar, and glucagon, which acts to raise blood sugar.
- Digestive enzymes Lipase, Amylase, Trypsin
- New glimmers of hope for pancreatic cancer
Parathyroid Disease

• Four pea sized glands in the neck behind the thyroid gland that secrete Parathormone, a hormone, that regulates calcium levels through bone, GI absorption and renal excretion.

• Adenomas of the parathyroid glands may cause hypercalcemia as can various cancers.
The Epidemic of Adult Onset of Diabetes

- FBS and Hgb A1C
- Why: heredity, inactivity, obesity, diet
- Pancreatic hormones; insulin and glucagon

**Medications to Treat Diabetes**
- Metformin (Glucophaghe). Generally, metformin is the first medication prescribed for type 2 diabetes. ...
- Sulfonylureas. Least expensive; activate B cells
- GLP-1 receptor agonists. ...
- SGLT2 inhibitors: prevent reabsorption of glucose in the kidney.
- Insulin.
Skeleton, Muscles and Skin
Terminology

- Tendon
- Ligament
- Vertebral Discs
- Cartilage
- Synovia and synovial Fluid
- Structure of bones: cortical bone and cancellous bone, bone marrow, periosteum
Types of Joints

Various types of synovial **joints:**
1. Hinge joints as in knees, elbows and ankles
2. Ball and socket joints as in the hip and shoulder (which is multiaxial)
3. Pivotal as in the spine, elbow
Clinical Conditions of Skeleton

- Degenerative arthritis and joint replacements
- Metastatic Cancer (Prostate, breast, and lung most common)
- Osteoporosis and Falls/hip fractures
- Spinal Stenosis
- Shin Splint
- Many diseases cause arthritis
- Anterior Cruciate Ligament (ACL) and PCL tears
- Multiple Myeloma and Leukemia (bone marrow biopsies)
Gout; Podagra; the Devils Grip

- 50 percent of 1st episodes in foot but can involve many joints
- Elevated serum uric acid >6 as a marker
- Uric acid kidney stones (low purine diet, allopurinol and alkalization of urine with sodium bicarb.)
- Prevention; lower purine diet, alkalinize the urine
- Acute episodes; NSAIDS, steroids, Colchicine, and titrate uric acid level with Allopurinol (A xanthine oxidase inhibitor) to less than 6
- Acute attacks 5-7 days
### What is osteopenia and osteoporosis

- Decreased density and mineralization of the bone predisposing to fractures.
- Mainly post-menopausal women (testosterone is protective)
- The meaning of T scores on the DEXA scan----T-0 is the mean or average. Osteoporosis is minus 2.5 or greater, osteopenia is minus 1 to minus 2.5.
- When to treat with bisphosphonates, Vitamin D and Ca supplementation?
Muscular system

Muscular System

- Anterior view
- Posterior view

- Muscles labeled including:
  - Flexor carpi group
  - Orbicularis oculi
  - Zygomaticus
  - Masseter
  - Orbicularis oris
  - Sternocleidomastoid
  - Trapezius
  - Latissimus dorsi
  - External oblique
  - Rectus abdominis
  - Sartorius
  - Quadriceps femoris group
  - Peroneus longus
  - Tibialis anterior
  - Extensor digitorum longus

- Other muscles labeled:
  - Hamstring group
  - Gastrocnemius
  - Achilles tendon
  - Gluteus medius
  - Gluteus maximus
Chewing Muscles

- Temporalsis Muscle
- Masseter Muscle
Muscular Disorders

- Rotator Cuff, ACL, PCL problems
- Tennis elbow
- Sarcopenia
- Muscle tears
- Pulled Hamstring, torn Achilles tendon
- Sarcomas
- Plantar Fasciitis
The Rotator Cuff (external rotation)
Elbow Joint
Muscle Evaluation

- A physical exam, tendon reflexes,
- Muscle strength tests: muscle atrophy
- Electromyography (EMG)
- A muscle biopsy (muscular dystrophy, dermatomyositis, trichinosis, ALS and a few others)
Skin

- Hair shaft
- Pore of sweat gland duct
- Epidermis
- Dermis
- Hypodermis
- Eccrine sweat gland
- Pacinian corpuscle
- Cutaneous vascular plexus
- Arrector pili muscle
- Hair follicle
- Sebaceous (oil) gland
- Hair root
- Hair follicle receptor
- Adipose tissue
- Sensory nerve fiber
Disorders of the Skin

• Seborrheic Keratosis and Liver Spots
• Wrinkles (genetic and farmer’s skin)
• Actinic keratosis
• Psoriasis is a papulosquamous eruption: extensor surfaces, scalp, T cell malfunction
• Eczema and atopic dermatitis (asthma & hayfever)
• Basal Cell and Squamous Cell cancers
• Acne
• Burns (1\text{st} degree, 2\text{nd} degree, 3\text{rd} degree)
• Hives
• Furuncle and Carbuncle
More Disorders of the Skin

- Vitiligo
- Contact Dermatitis and Poison Ivy
- Warts
- Ringworm and Tinea Versicolor
- Melanoma
- Sebaceous Cysts
Burns: 1\textsuperscript{st}, 2\textsuperscript{nd}, 3\textsuperscript{rd} and 4\textsuperscript{th} Degree

**First-Degree Burns**
Superficial burns that only affect the skin surface

**Second-Degree Burns**
Burns that affect the outermost and second skin layer

**Third-Degree Burns**
Burns that have killed the skin all the way to the fatty tissue
• With a 3\textsuperscript{rd} degree burn about a 2cm defect will close/heal spontaneously over time.
• Split and full thickness grafts
• Skin substitutes; cadaver, pig, synthetic
The Digestive System
The Digestive System

- mouth
- teeth
- tongue
- epiglottis
- salivary glands
- pharynx
- esophagus
- liver
- gallbladder
- pancreas
- large intestine
- small intestine
- appendix
- rectum
- anus

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<table>
<thead>
<tr>
<th>Names of the <strong>upper GI organs</strong> and Terminology</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Salivary Glands (parotid gland and submaxillary glands)</td>
</tr>
<tr>
<td>• Esophagus (cardiac sphincter)</td>
</tr>
<tr>
<td>• Stomach (hiatal hernia)</td>
</tr>
<tr>
<td>• Duodenum (duodenal ulcer) <em>Helicobacter pylori</em></td>
</tr>
<tr>
<td>• Ilium</td>
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<tr>
<td>• Jejunum</td>
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</tbody>
</table>
There are four main regions in the stomach: the cardia, fundus, body, and pylorus.
Gastro-esophageal Reflex Disease (GERD) and Hiatal Hernia

Old fashion gastro indigestion, heart burn.
Rx:
1. Weight Loss, stop smoking, decrease drinking, overeating, earlier dining
2. Antacids
3. PPI (protein pump inhibitors) that suppress stomach acid. Frequently prescribed but chronic use can have long term side effects such as changes in microbiome (c difficil), osteoporosis, macrocytic anemia, low Mg
Gastric and Duodenal Ulcers

- A person has a higher risk of developing a peptic ulcer if they have an overgrowth of *Helicobacter pylori* (*H. pylori*) bacteria in the digestive tract. A few are due to malignancy.
- Some medication such as steroids and anticoagulants can cause, alcohol not associated.
- Treatment is very effective:
  - Proton pump inhibitors (PPIs)
  - H2-receptor antagonists
  - Protectants, such as sucralfate
  - Antacids
<table>
<thead>
<tr>
<th>Marijuana; not legalized nationally but 50% have tried it by age 20: excellent safety profile</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Seventy Cannabinoids but main active ingredient is THC and CBD. (newer plants genetically engineered to increase THC and the product comes in many forms)</td>
</tr>
<tr>
<td>• It is both an inhibitor and stimulant.</td>
</tr>
<tr>
<td>• Approved medical uses mainly for nausea and vomiting and pain associated with cancer chemotherapy.</td>
</tr>
<tr>
<td>• Many other medical uses including epilepsy, mental illness, PTSD, muscle spasms</td>
</tr>
<tr>
<td>• Half life 20-30 hours, eliminated 60% in stool, 30% in urine.</td>
</tr>
<tr>
<td>• Chronic Use can cause Cannabinoid Hyperemesis Syndrome (CHS)</td>
</tr>
</tbody>
</table>
The Lower GI Track--Colon and Omentum

- Caecum and Appendix
- Ascending Colon
- Transverse Colon
- Descending Colon
- Sigmoid Colon
- Rectum
- Anus
- Retroperitoneal and peritoneal space
The omentum is a fatty blanket that hangs down in front of all of the intestines.
Liver, Duodenum and Pancreas
Arterial Blood Supply to upper GI track
The Portal System
Functions of the Liver: a Thousand Metabolic Processes occur in the Liver

- Produces most of the proteins the body needs (albumin/oncotic pressure)
- Prevents shortages of nutrients by storing certain vitamins, minerals, and sugar (glycogen)
- Produces bile, a substance that helps digest fat and absorb fat soluble vitamins A, D, E, and K
- Produces substances that help with the blood clotting cascade (Prothrombin, Fibrinogen, Factors V, VII, VIII, IX, X, XI, XII, XIII)
- Helps your body fight infection by removing bacteria from the blood
- Metabolizes and removes potentially harmful substances from medications and foods
Types of Liver Disease

- **Hepatitis**: Inflammation of the liver, usually caused by viruses like hepatitis A, B, and C.
- **Cirrhosis**: Long-term damage to the liver from any cause can lead to permanent scarring, called cirrhosis. (Alcohol and Malnutrition)
- **Fatty Liver**
- **Cancer**: The most common type of liver cancer, Hepatoma, is uncommon and usually occurs in patients with cirrhosis.
- **Metastatic Cancer**
- **Liver Failure**: Liver failure has many causes including infection, genetic diseases, and excessive alcohol.
- **Ascites**: Increase pressure in the Portal System
The Gall Bladder

- Stores bile that digests fats and colors the stool brown
- Gall stone; 6% of men and 9% of women
- Most asymptomatic; but recurrence of biliary colic common if you have had one attack
- Cholecystitis, Pancreatitis and Common Duct stones more serious
- Laparoscopic removal of gall bladder (minimally invasive)
- Diagnostic tool now used Endoscopic Ultrasound (EUS)
Factors Influencing Weight

- **Leptin** is a hormone, made by fat cells, that decreases your appetite.
- **Ghrelin** is a hormone released primarily in the stomach that increases appetite, and also plays a role in body weight.
- **Microbiome** (intestinal flora in the gut, mainly large intestine)
- **Hypothalamus** in the Central Nervous System
- Of course: Diet, Mood, Good Food, and Exercise play a significant role
Bariatric Surgery for Morbid Obesity

• When all else fails:
Disorders of the GI tract

- Celiac disease (gluten)
- GERD (gastro-esophageal reflux disease)
- Colon and Pancreatic Cancer
  Why is pancreatic cancer so hard to cure?
- Irritable Bowel syndrome (IBS)
- Diverticulosis
- Morbid Obesity (Bariatric surgery)
- Ulcerative Colitis/regional ileitis
- C difficile bacteria and other ‘super bugs’
- Hemorrhoids
GI Diagnostic Studies

- EGD (Esophago-gastro-duodenoscopy)
- Colonoscopy
- Cologard
- CT and MRI
- PET scan
- Stool guaiac
- Serum Direct and Indirect Bilirubin, ALP (alkaline phosphatase) ALT, AST, GGT
Colonoscopy Screening

• The American College of Surgeons recommends that people at average risk of colorectal cancer **start regular screening at age 45** usually with colonoscopy

• Stool Guaiac

• Cologard, a stool test that shows altered DNA and/or blood in stool.
Immune System
Lymphatic and Hematopoietic Systems related to the Immune Response
Lymphatic System/lymphoid tissue

- Tonsils
- Lymph nodes
- Thymus
- Bone marrow
- Spleen
Peripheral Blood Smear
<table>
<thead>
<tr>
<th>Differential Blood Count</th>
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<tbody>
<tr>
<td><strong>Neutrophils Relative</strong></td>
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<tr>
<td><strong>Lymphocytes Relative</strong></td>
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<td><strong>Monocytes Relative</strong></td>
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<td><strong>Eosinophils Relative</strong></td>
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<td><strong>Basophils Relative</strong></td>
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<tr>
<td><strong>Neutrophils Absolute</strong></td>
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<td><strong>Basophils Absolute</strong></td>
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The Immune System; Lymphoid System

**B cells**

*Humoral immunity*
- Antigen on bacterium
- Lymphocyte receptor
- B Cell
- Helper T cell
- Cytokines
- Antibodies
- Memory B cells
- Plasma cells

**T cells**

*Cell-mediated immunity*
- Antigen-presenting immune cell
- CD4+ Helper T cell
- Activated Helper T cell
- Cytokines
- Infected cell
- Cytotoxic T cell
Immunizations

These recommendations must be read with the footnotes that follow. For those who fall behind or start late, provide catch-up vaccination at the earliest opportunity as indicated by the green bars in Figure 1. To determine minimum intervals between doses, see the catch-up schedule (Figure 2). School entry and adolescent vaccine age groups are in bold.

<table>
<thead>
<tr>
<th>Vaccines</th>
<th>Birth</th>
<th>1 mo</th>
<th>2 mos</th>
<th>4 mos</th>
<th>6 mos</th>
<th>9 mos</th>
<th>12 mos</th>
<th>15 mos</th>
<th>18 mos</th>
<th>19-23 mos</th>
<th>2-3 yrs</th>
<th>4-6 yrs</th>
<th>7-10 yrs</th>
<th>11-12 yrs</th>
<th>13-15 yrs</th>
<th>16-18 yrs</th>
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<tbody>
<tr>
<td>Hepatitis B (HepB)</td>
<td>1st dose</td>
<td>2nd dose</td>
<td>3rd dose</td>
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<td>Rotavirus (RV)</td>
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<td>See footnote 2</td>
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<td>Pertussis (DTaP)</td>
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<td>Tetanus, diphtheria, &amp; pertussis (Tdap)</td>
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<td>4th dose</td>
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<tr>
<td>Haemophilus influenzae type b (HiB)</td>
<td>1st dose</td>
<td>2nd dose</td>
<td></td>
<td>See footnote 5</td>
<td></td>
<td>3rd or 4th dose</td>
<td>See footnote 5</td>
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<tr>
<td>Pneumococcal conjugate (PCV13)</td>
<td>1st dose</td>
<td>2nd dose</td>
<td>3rd dose</td>
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<tr>
<td>Pneumococcal polysaccharide (PPSV23)</td>
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<tr>
<td>Inactivated Poliovirus (IPV) (≥18 yrs)</td>
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<tr>
<td>Influenza (IV, LAIV)</td>
<td>2 doses for some; See footnote 8</td>
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<tr>
<td>Measles, mumps, rubella (MMR)</td>
<td>1st dose</td>
<td>2nd dose</td>
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<tr>
<td>Varicella (VAR)</td>
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<tr>
<td>Hepatitis A (HepA)</td>
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<tr>
<td>Human papillomavirus (HPV2: females only; HPV4: males and females)</td>
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<tr>
<td>Meningococcal (Hib-MenCY ≥ 6 weeks; MenACWY-D ≥ 9 mos; MenACWY-CRM ≥ 2 mos)</td>
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</tbody>
</table>

This schedule includes recommendations in effect as of January 1, 2014. Any dose not administered at the recommended age should be administered at a subsequent visit, when indicated and feasible. The use of a combination vaccine generally is preferred over separate injections of its equivalent component vaccines. Vaccination providers should consult the relevant Advisory Committee on Immunization Practices (ACIP) statement for detailed recommendations, available online at http://www.cdc.gov/vaccines/hcp/acip-recs/index.html. Clinically significant adverse events that follow vaccination should be reported to the Vaccine Adverse Event Reporting System (VAERS) online (http://www.vaers.hhs.gov) or by telephone (800-822-7967). Suspected cases of vaccine-preventable diseases should be reported to the state or local health department. Additional information, including precautions and contraindications for vaccination, is available from CDC online (http://www.cdc.gov/vaccines) or by telephone (800-CDC-INFO (800-232-4636)).

This schedule is approved by the Advisory Committee on Immunization Practices (http://www.cdc.gov/vaccines/acip), the American Academy of Pediatrics (http://www.aap.org), the American Academy of Family Physicians (http://www.aafp.org), and the American College of Obstetricians and Gynecologists (http://www.acog.org).

NOTE: The above recommendations must be read along with the footnotes of this schedule.
Adult Immunizations

Almost 1 out of every 3 people in the US will develop shingles in their lifetime

• Shingles vaccine, which protects against shingles and the complications from the disease (recommended for healthy adults 50 years and older) Two Shots/Expensive!

• Pneumococcal polysaccharide vaccine (PPSV23), which protects against serious pneumococcal disease, including meningitis and bloodstream infections (recommended for all adults 65 years or older, and for adults younger than 65 years who have certain health conditions)
Leukemias and Lymphomas

- Acute Lymphocytic Leukemia (ALL)
- Acute Myeloid Leukemia (AML)
- Chronic Lymphocytic Leukemia (CLL)
- Chronic Myeloid Leukemia (CML)
- Chronic Myelomonocytic Leukemia (CMML)
- Myeloproliferative Neoplasms (MPNs)
- Polycythemia Vera
- Essential thrombocythemia
- Myelofibrosis
- Multiple Myeloma
Autoimmune Diseases

- Rheumatoid Arthritis
- Psoriasis
- Multiple Sclerosis
- Crohn’s Disease
- Ulcerative Colitis
- Type I diabetes/juvenile
- Addison’s Disease
- Graves Disease
- Scleroderma
- Lupus Erythematosus
- Pernicious Anemia
- Polyarthritis Nodosa
- Myasthenia Gravis
Aids; HIV

• A retro virus that infects CD4-T cells causing a decline in their numbers. Less than 200 is critical level.
• 1.1 million infected in US and no longer considered fatal but a chronic disease with no complete cure and need for lifelong medication.
• Screening of high risk individuals (after 45 days from inoculation this detects 99% of cases).
• When treatment leads to no detectable virus, there is no chance of transmission.
• Three classes of new drugs for treatment; mainstay Truvada and Descovy (15,000/yr ). Problems with compliance.
• These drugs may be taken to prevent infection in high risk individuals.
Tests

- Antinuclear antibody (ANA)
- Rheumatoid factor
- CBC
- C-reactive protein (CRP)
- Erythrocyte sedimentation rate (ESR)
- Urinalysis
- Complement
Genetics and Cellular Anatomy

Amino Acids

- Adenine (A)
- Thymine (T)
- Cytosine (C)
- Guanine (G)
When Should Someone have a Genetic test?

- **At birth?**
- **When they come down with a disease/cancer for precision medical care?**
- **Wait for genetics to advance more?**

Arguments to get it in the newborn period

- 1. Uncover repairable genetic defects (CRISPR-cas9 or gene replacement therapy).
- 2. Predict predisposition for various illnesses
In *humans*, each cell normally contains 23 pairs of *chromosomes*, for a total of 46. Twenty-two of these pairs, called autosomes, look the same in both males and females. The 23rd pair, the sex *chromosomes*, differ between males and females.
Difference between Meiosis and Mitosis

- Sperm and ova

**Sperm CELL**
- Sperm structure
- Acrosome
- Centriole
- Mitochondria
- Nucleus
- Axial filament

*The head of each sperm has a nucleus containing chromosomes, and an acrosomal membrane which holds enzymes needed for fertilization. The tail of the sperm helps it move in a corkscrew action on its journey from the testes to the female reproductive organs.*

**MITOSIS**
- Prometaphase
- Metaphase
- Prophase
- Cytokinesis
- Telophase
- Anaphase
Genes and Chromosomes

Definitions

Genotype
The combination of alleles of a gene carried by an organism

Phenotype
The expression of alleles of a gene carried by an organism

Centromere
Joins chromatids in cell division

Alleles
Different versions of a gene
Dominant alleles = capital letter
Recessive alleles = lower-case letter

Carrier
Heterozygous carrier of a recessive disease-causing allele

Gene loci
Specific positions of genes on a chromosome

Homozygous dominant
Having two copies of the same dominant allele

Homozygous recessive
Having two copies of the same recessive allele. Recessive alleles are only expressed when homozygous.

Codominant
Pairs of alleles which are both expressed when present.

Heterozygous
Having two different alleles. The dominant allele is expressed.
Essential Cellular Elements
<table>
<thead>
<tr>
<th>Common Genetic Disorders that relate to an identifiable gene</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cystic Fibrosis</td>
</tr>
<tr>
<td>• Hemophilia</td>
</tr>
<tr>
<td>• Huntington’s Chorea</td>
</tr>
<tr>
<td>• Neurofibromatosis</td>
</tr>
<tr>
<td>• Thalassemia</td>
</tr>
<tr>
<td>• Tourette syndrome</td>
</tr>
<tr>
<td>• Von Willenbrands</td>
</tr>
<tr>
<td>• Sickle Cell</td>
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<tr>
<td>• Down’s</td>
</tr>
</tbody>
</table>
Designer Babies and Curative Technique for genetic disorders?

- Gene Splicing techniques/problems (Crispr-Cas9)
- Eugenics/ethical considerations
- Role inheritance plays; nature vs. nurture
- Crack babies, smoking, need for prenatal care
Pulmonary System
Pulmonary System
The Pleural Space

PNEUMOTHORAX

- Trachea
- Collapsed lung
- Normal lung
- Air or fluid in the pleural space
- Diaphragm
- Pleural space
Functions of the Lungs

- Exchange of CO2 and O2 (hypoxia and hypercapnia)
- Acid and Base Balance (Respiratory Alkalosis)
- Blood return to the heart
- Filtering and removal of bacteria (tracheal elevator)
Pulmonary Studies

- Chest x-ray (not a screening test)
- Pulse Oximetry
- Serum CO2 and arterial blood gases
- Spiral CT with Calcium index
- Sputum Culture
- Intubation
- Lung Biopsy
Electrolytes
Normal Blood Ph. is 7.4: below is acidosis, above alkalosis

<table>
<thead>
<tr>
<th>Electrolyte</th>
<th>Value</th>
<th>Normal Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>138 mmol/L</td>
<td>135 - 146 mmol/L</td>
</tr>
<tr>
<td>Potassium</td>
<td>4.5 mmol/L</td>
<td>3.5 - 5.1 mmol/L</td>
</tr>
<tr>
<td>Chloride</td>
<td>102 mmol/L</td>
<td>98 - 110 mmol/L</td>
</tr>
<tr>
<td>CO2</td>
<td>25 mmol/L</td>
<td>22 - 29 mmol/L</td>
</tr>
<tr>
<td>Anion Gap</td>
<td>11 mmol/L</td>
<td>5 - 13 mmol/L</td>
</tr>
</tbody>
</table>
Pulmonary Function Tests; spirometry

Lung Volumes

- Inspiratory Reserve Volume
- Tidal Volume
- Expiratory Reserve Volume
- Residual Volume
- Inspiratory Capacity
- Vital Capacity
- Functional Reserve Capacity
- Total Lung Capacity

Time
Volume
Normal Pulmonary Function

• The **normal** one second value for the (Forced Expiratory Volume) FEV1/FVC (Forced Volume Capacity) ratio is 70% (and 65% in persons older than age 65).
Covid-10

Unique Virus that causes micro-emboli and lung damage can occur before symptoms develop. Diagnosis D-dimer, CRP, Ferritin, LDH levels (some prognostic value)

**Therapy:**
- Ventilation with PO2 of greater than 60% not SOB, Intubation as late a possible, use of prone position
- Antiviral treatment early Remdesivir
- Steroids (hydroxydexamethasone) 10% reduction in mortality
- Convalescent Serum-if given early in lesser sick patients.
- Anticoagulation with LMWH (Low Molecular Weight Heparin) to prevent DVT and strokes.
Pneumonia

- Bacterial (community acquired and hospital acquired)
- Viral
- Aspiration
- Pneumocystis Pneumonia and unusual bacterial in Immune compromised patients of any sort. HIV especially
- Procalcitonin responds to tissue injury: New lab test to differentiate between bacterial and viral pneumonia and meningitis.
Idiopathic Pulmonary Fibrosis.

- Most have no known cause; 3-5 year course. Newer treatments with nintedanib and pirfenidone, ground glass appearance on x-ray, pulmonary hypertension.
- Anything that damages the lung like irradiation, certain drugs, pneumonia, pneumoconiosis,
- Rare diseases like connective tissue disease, Systemic lupus erythematosus, Rheumatoid arthritis, Sarcoidosis, Scleroderma
# Medical Conditions

- COPD/ Emphysema
- Tuberculosis and Histoplasmosis
- Pulmonary embolus
- CHF
- Atelectasis
- Histoplasmosis in Ohio Valley-usually mild symptoms
The Pleural Spaces

- Asbestosis and Mesothelioma (of the pleura)
- Pleural Effusions; Transudate or Exudate
- Congestive Heart Failure most common cause but many others such as Cirrhosis, Cancer, Pneumonia, Nephrotic syndrome, Drugs
- Empyema
- Hemothorax mainly due to trauma
- Chest Tubes
Occupational Exposures

- Silicosis
- Black lung disease
- Asbestosis
- Talcosis
- Hyperimmune pulmonitis
- All of these conditions you can multiply by 10 in heavy smokers.
Lung Cancer (number 1 killer that killed about 154,000 Americans in 2018)

- The number that die from lung cancer about equals all the rest that die of other cancers.
- CT Lung Cancer Screening (55 yo with 30 pack years of smoking within past 15 years.)
Pulmonary Emboli and DVT

- Hypercoagulable states and genetic predisposition
- Vascular damage or trauma
- Circulatory stasis and dependency
Global Health Disorders

**A grim reaper**

Global top ten causes of death, m, 2017

1. Ischaemic heart disease
2. Strokes
3. Chronic obstructive pulmonary disease
4. Lower respiratory infections
5. Alzheimer's and other dementias
6. Trachea, bronchus, lung cancers
7. Tuberculosis
8. Diabetes
9. Road injury
10. Diarrhoeal diseases

Source: WHO

Tuberculosis deaths among people with HIV
Cardiovascular System
CARDIOVASCULAR SYSTEM

THE HUMAN HEART
Human Heart with four chambers

(a) Frontal section through the heart
Overview of Circulation
The Arch of the Aorta
Cardiac Electrical System

Electrocardio physiologist
Abdominal Aorta and Vena Cava
Anti-coagulants: Some Indications
DVT, atrial fib, heart valves, prevent stroke, emboli

- Warfarin or Coumadin (INR to regulate with 2-3 range effective in patients taking warfarin)
- Factor Xa inhibitors or DOAC (direct oral anticoagulants such as (Eliquis)
- Aspirin
- Plavix
- NSAIDS
- Heparin
- Low Molecular Weight Heparin (lovenox)
Giant Cell Arteritis/Temporal Arteritis

- Headache and fever of unknown origin in older folks
- Jaw claudication, tenderness over temporal region and visual loss
- Can involve all large arteries and .5 to 1 percent of population.
- Effective treatment with steroids and new monoclonal antibodies.
Heart Conditions

- Arrhythmias (atrial fib, atrial flutter, ventricular tachycardia, and fibrillation)
- Heart Attack or Myocardial Infarction
- CHF (two types)
- HPT
- Congenital defects
Heart Failure

- **An Epidemic due to an aging population:**
  - Two types of Left Ventricular Heart Failure: Normal and Low Ejection Fraction Failure: One is a large heart with ventricular hypertrophy and low EF, the other is normal EF with normal heart size and wall rigidity.
  - Symptoms of SOB, Dyspnea on exertion, orthopnea, peripheral edema. Possibly coronary syndrome pain.

- Pulmonary Hypertension: (>25 mm Hg/cor pulmonale) due to hereditary, COPD and other pulmonary diseases, Left sided heart failure, multiple pulmonary emboli, Obstructive Sleep Apnea.
The Metabolic Syndrome

The Epidemic Complex of

- a. Obesity
- b. Hypertension
- c. Hypercholesterolemia
- d. Hyperlipidemia
- e. Adult Onset of Diabetes Mellitus (Hgb A1C >6 or 6.5.)
Tests and Interventions for Acute Myocardial Infarction, Angina and CHF

- PCI (Percutaneous Cardiac Interventions) and Atrial Ablations
- Chest X-ray
- Echocardiogram (TEE)
- Stress Test
- Blood Tests for Myocardial Damage
  - Troponin
  - CPK
  - Natriuretic peptide ANP.
### Major Classifications of Antihypertensive Medications

- **ACE (angiotensin converting enzyme inhibitors)**
- **ARBs (Angiotensin II receptor blockers)**
- **Calcium Channel Blockers**
- **Beta-blockers**
- **Diuretics (Thiazides, Loop Diuretics, K+ sparing)**
Genitourinary System
The Genitourinary System
Renal Collecting System
Renal Blood Supply and Anatomy

20 Percent of Cardiac output goes to the Kidney
Diagram of Renal Tubule/Nephron

Creatinine and Bun Values
Functions of the Kidney

❖ Water and electrolyte balance (Na & K)
❖ Acid-base balance (Hydronium ion)
❖ Elimination of metabolic waste like urea, creatinine, drugs and toxins
❖ Blood pressure regulation with angiotensin
❖ Erythropoietin hormone that stimulates RBC production
### Affliction of Genitourinary System

- Pyelonephritis and Cystitis
- Kidney Stones
- Urinary Incontinence
- Renal Cell Carcinoma and bladder cancer
- Uremia due to ESRD
- Glomerulonephritis
- Congenital disorders
The Nephrotic Syndrome; a disorder effecting the glomeruli of the Kidney

- Massive proteinuria; greater than 3.5 gms
- Hypoalbuminemia less than 2.5 grams per dl
- Hyperlipidemia
- Edema-osmotic pressure

- Many Causes but some idiopathic due to an unknown factor circulating in the blood.
Male Reproductive System

- Vas deferens
- Bladder
- Colon
- Penis
- Urethra
- Epididymis
- Prostate
- Seminal vesicle
- Testicle
Male Problems

- BPH
- Cancer of the prostate
- Prostatitis (acute and chronic)
- Epididymitis
- STD (sexually transmitted disease)
- ED (erectile dysfunction)
- Peronei's Disease
Female Reproductive System

Diagram of Female Reproductive System

- Ampulla
- Peritubal region
- Isthmus
- Fundus of uterus
- Body of uterus
- Uterine tube
- Ovarian ligament
- Corpus luteum
- Ovarian follicle
- Primary follicle
- Secondary follicle
- Mature follicle
- Corpus albicans
- Corpus luteum
- Uterine cavity
- Endometrium
- Internal orifice
- Isthmus of uterus
- Cervical canal
- Cervix
- Cervical os (external orifice)
- Vaginal rugae
- Vagina
- Sperm cell
<table>
<thead>
<tr>
<th>Overactive Bladder Disorder (OBD) and Urinary Stress Incontinence (Pelvic Relaxation)</th>
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<tbody>
<tr>
<td><strong>OBD treatments:</strong></td>
</tr>
<tr>
<td>▪ Timed Voiding</td>
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<tr>
<td>▪ Anticholinergics</td>
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<tr>
<td>▪ Sacral and tibial nerve stimulation</td>
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<tr>
<td>▪ Botox injections</td>
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<tr>
<td><strong>Urinary Stress Incontinence:</strong></td>
</tr>
<tr>
<td>▪ Pessary and perineal exercises</td>
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<tr>
<td>▪ Estrogen vaginal cream</td>
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<tr>
<td>▪ Sling procedures</td>
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</tbody>
</table>
More Female Conditions

- Cancer of the Cervix (HPV)
- STD
- Uterine fibroids
- Infertility
- Need for C section
Cervical Cancer—13,000 cases a year

- HPV (types 16 & 18) responsible for 70 percent of cases.
- HPV vaccination (females and males?) with Gardasil 9 at age 11 or 12.
- Pap smears and HPV Testing on cervical smears
- Colposcopy
- Why don’t PCPs do pelvic examinations?