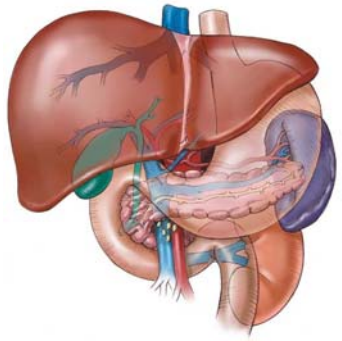
INE INSTITUTE OF NUTRITIONAL ENDOCRINOLOGY

Digestion: Liver and Gallbladder

Dr. Ritamarie Loscalzo

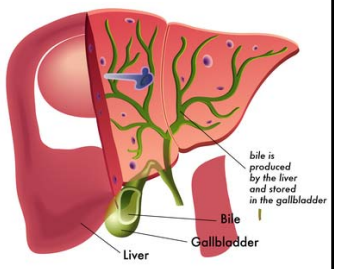
Medical Disclaimer: The information in this presentation is not intended to replace a one-on-one relationship with a qualified health care professional and is not intended as medical advice. It is intended as a sharing of knowledge and information from the research and experience of Dr. Ritamarie Loscalzo, drritamarie.com, and the experts who have contributed. We encourage you to make your own health care decisions based upon your research and in partnership with a qualified health care professional. This presentation is provided for informational purposes only and no guarantees, promises, representations or warranties of any kind regarding specific or general benefits, have been or will be made by Dr. Ritamarie Loscalzo, her affiliates or their officers, principals, representatives, agents or employees. Dr. Ritamarie Loscalzo is not responsible for, and shall have no liability for any success or failure, acts and/or omissions, the appropriateness of the participant's decisions, or the use of or reliance on this information.

The Liver and Gallbladder



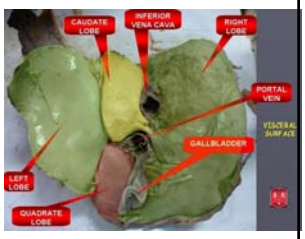
Liver Anatomy

- ✓ Reddish brown triangular organ
- ✓ 4 lobes of unequal size and shape
- ✓ Weighs 1.44 - 1.66 kg (3.2 - 3.7 lb)
- ✓ Largest internal organ
- ✓ Largest gland



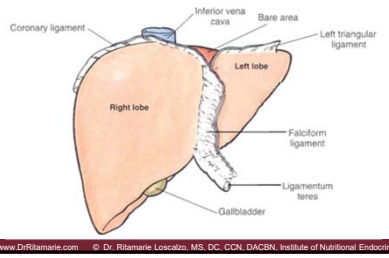
4 Distinct Liver Lobes

- ✓ **Right lobe:** 5 to 6 times larger than the left lobe
- ✓ **Left lobe:** tapered, separated from the right by the falciform ligament
- ✓ **Caudate lobe:** small lobe that extends from the posterior side of the right lobe and wraps around the inferior vena cava
- ✓ **Quadrate lobe:** small lobe inferior to the caudate lobe; extends from the posterior side of the right lobe and wraps around the gallbladder



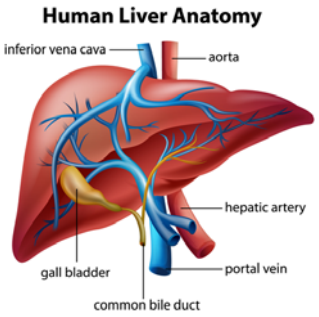
Ligaments of the Liver

- **Coronary ligament:** connects central superior edge to diaphragm
- **Left and right triangular ligaments:** connects superior ends to the diaphragm
- **Falciform ligament:** runs from the diaphragm to inferior border
- **Round ligament:** (ligamentum teres) connects to umbilicus



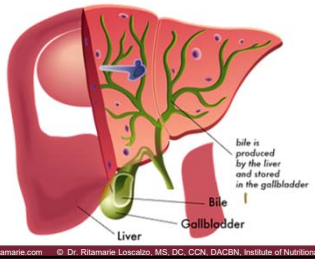
Liver Blood Supply

- ✓ Blood from spleen, stomach, pancreas, gallbladder, and intestines goes to the liver through the **hepatic portal vein**
- ✓ Blood leaving the liver collects into the **hepatic veins** that lead to the **vena cava** and return to the heart



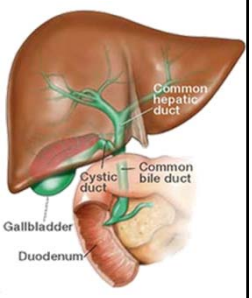
Bile Ducts

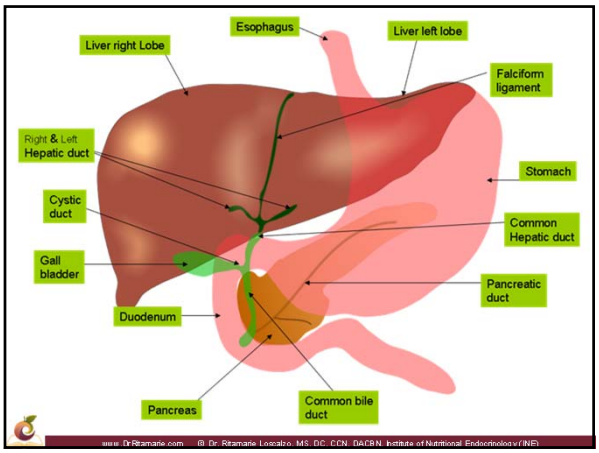
- ✓ Bile produced by liver cells drains into microscopic canals known as **bile canaliculi**
- ✓ Bile canaliculi join together to form **bile ducts, which** carry bile through the liver and gallbladder



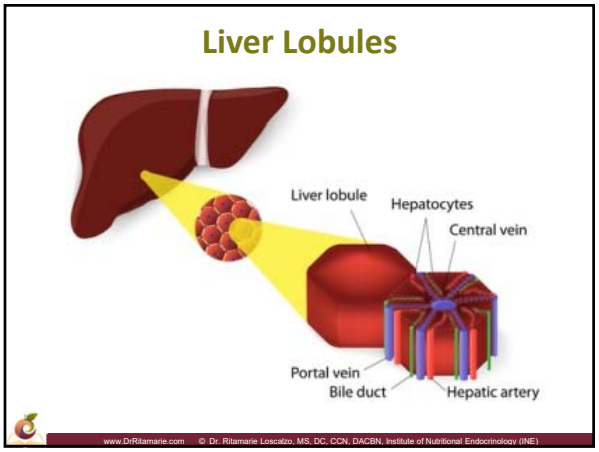
Biliary Tree

- ✓ Branched structure of bile ducts
- ✓ Bile ducts join to form the **left and right hepatic ducts**
- ✓ Hepatic ducts join to form the **common hepatic duct** - drains bile away from the liver
- ✓ The common hepatic duct joins with the **cystic duct** to carry bile to the gallbladder for storage
- ✓ Cystic duct carries bile from gallbladder to **common bile duct** to duodenum for fat digestion



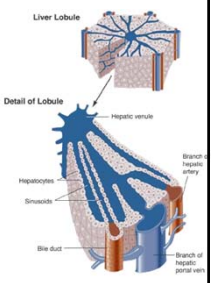


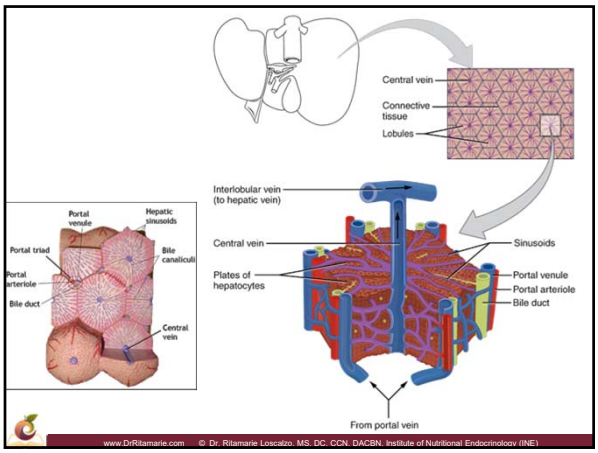
Liver Lobules



Liver Lobules

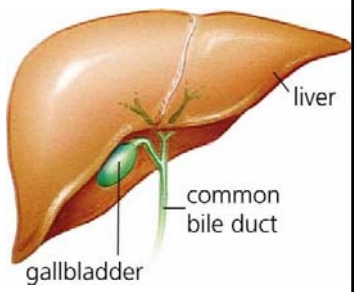
- ✓ Approximately 100,000 small hexagonal functional units known as lobules
- ✓ Each hexagonal lobule consists of:
  - ➢ Central vein in middle
  - ➢ 6 hepatic portal triads, 1 at each apex
    - Portal venule (vein)
    - Portal arteriole (artery)
    - Bile duct
- ✓ Sinusoids: capillary-like tubes which extend from the portal veins and arteries to meet the central vein
- ✓ 2 main cell types:
  - ➢ **Kupffer cells:** a type of macrophage
  - ➢ **Hepatocytes:** cuboidal epithelial cells that line the sinusoids - majority of cells in the liver and perform most of the liver's functions





Gallbladder

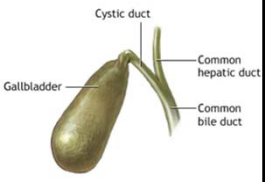
- ✓Accessory glands
- ✓Stores bile
- ✓Concentrates bile
- ✓Alkalizes chyme



Gallbladder

Gallbladder's Job Description

- ✓ Stores and concentrates bile
- ✓ **Secretes bile** when needed
- ✓ **Secretes bicarbonate** into the small intestine to alkalize the food bolus that has become acid from the stomach's actions



  - ➢ An alkaline environment is needed in the beginning of the small intestine so that starchy foods can be digested
  - ➢ An alkaline environment helps maintain a healthy intestinal lining

3 Main Functions Of Liver

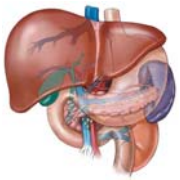
- **Blood Filtering** — Clean and clear metabolic wastes and toxins
- **Fat Digestion** — Produce bile to emulsify fats for easy absorption
- **Metabolic** — Regulation of nutrients and production of important proteins and immune factors

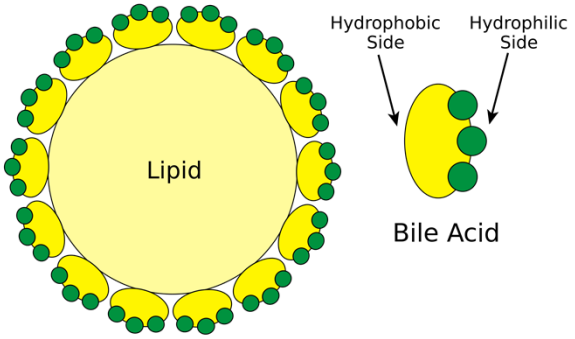
Liver Functions

- ✓ Produces **bile** to emulsify fat
- ✓ Sends bile to gallbladder for storage
- ✓ Breaks down/recycles red blood cells
- ✓ Detoxifies blood: removes alcohol, drugs, heavy metals, and toxins
- ✓ Produces cholesterol
- ✓ Produces **urea** (nitrogenous waste) from protein metabolism
- ✓ Produces clotting proteins
- ✓ Convert glucose to glycogen
- ✓ Stores nutrients: fat soluble vitamins, plus vitamin B12, iron, and copper
- ✓ Metabolize hormones

Liver and Digestion: The Role of Bile

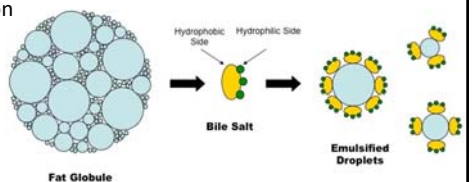
- ✓ Bitter-tasting, dark green to yellowish brown fluid
- ✓ **Emulsifies fat:** breaks into tiny globules
- ✓ 97% water, 0.7% bile salts, 0.2% bilirubin, 0.51% fats (cholesterol, fatty acids, and lecithin), small amount of inorganic salts
- ✓ **95% reabsorbed in ileum**
- ✓ Eliminates cholesterol
- ✓ Mixed with sodium bicarbonate pH 11 to **neutralize "chyme"**





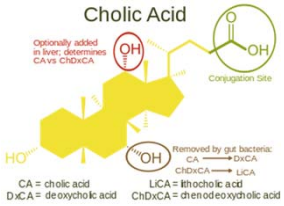
Bile Acids and Bile Salts

- ✓ **Bile acids** are steroid acids
- ✓ Conjugated with taurine or glycine in the liver, forming **bile salts**
- ✓ **Primary bile acids** are those synthesized by the liver
- ✓ **Secondary bile acids** result from bacterial actions in the colon



Major Bile Salts

- ✓ Derivatives of cholic acid
  - ➢ Taurocholic acid
  - ➢ Glycocholic acid
- ✓ Derivatives of chenodeoxycholic acid
  - ➢ Taurochenodeoxycholic acid
  - ➢ Glycochenodeoxycholic
- ✓ 7-alpha-dehydroxylated derivatives
  - ➢ Deoxycholic acid
  - ➢ Lithocholic acid



Fat Digestion: What's Involved

- ✓ Fats don't dissolve in water, so they need to be **emulsified**
- ✓ Requires **lipase** from the pancreas and **bile,** made in the liver, and stored and concentrated in the gallbladder
- ✓ Bile inserts itself between fat and water so the fat cells get suspended in water (emulsification)
- ✓ Lipase efficiently breaks down emulsified fats; not large globules

Impact of Poor Performance By the Gallbladder and Liver?

- ✓ Fatigue
- ✓ Headaches
- ✓ Low motivation
- ✓ Depression
- ✓ Digestive woes
- ✓ Bloating
- ✓ Feeling out of sync with life

Biggest Cause of…

Liver Disease:

- ✓ Overexposure to toxins like alcohol or environmental pollutants
- ✓ Poor diet
- ✓ High fructose corn syrup and fatty liver syndrome
- ✓ Sedentary/junk food lifestyle
- ✓ Viruses like Hepatitis A, B, C
- ✓ Parasites

Gallbladder Issues:

- ✓ Food allergies: especially eggs, wheat, coffee, pork, and onions
- ✓ Inadequate stomach acid
- ✓ Lack of exercise
- ✓ Weight gain
- ✓ Risk increases with more childbirth
- ✓ Rapid weight loss
- ✓ Excess refined sugars
- ✓ Birth control pills, synthetic hormones
- ✓ Constipation
- ✓ Parasites

Gallbladder "Attacks" and Surgery

- ✓ Sluggish bile movement can lead to stones (usually made up of cholesterol)
- ✓ These **block the passage of bile** into the bowel, resulting in vomiting and pain on the right side of the abdomen, especially after ingestion of fatty foods
- ✓ Surgical removal of the gallbladder typically relieves some of these symptoms and issues, but **gallstones can also affect adjacent organs,** such as the pancreas
- ✓ When lipase levels are high after removal of the gallbladder, it is a sign that **inflammation is present** in delicate pancreatic tissues
- ✓ This condition may take weeks or months to heal

Living Without a Gallbladder: Special Considerations

- ✓ **Avoid** fried foods, trans fats
- ✓ **Minimize or avoid** dairy
- ✓ **Avoid** fats cooked with sugar
- ✓ **Reduce grains:** inefficient digestion of starch without gallbladder's bicarbonate

- ✓ **Use bitters** before meals to stimulate bile production and movement
- ✓ **Supplement with lipase,** the fat digesting enzyme
- ✓ **Supplement with bile salts,** 2 with all fatty meals
  - 5 days on, 2 days off until feeling well; cycle on and off

Preventing Gallbladder Removal

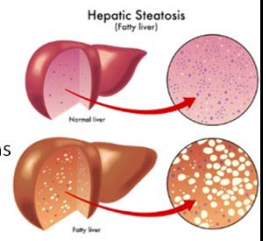
Preventing gallstones and flushing out congested bile

- ✓ Fasting and juicing
- ✓ Regular cleansing
- ✓ Bitters
- ✓ Herbs and foods that thin bile: Beets, especially fermented, turmeric, milk thistle, artichoke, dandelion
- ✓ Apple cider vinegar: malic acid softens bile
- ✓ Anti-inflammatory herbs
- ✓ Anti-spasmodic herbs
- ✓ Liver/gallbladder formulas

Ultrasound is important to diagnose the size and location of the stones, and follow-up assessment is critical.

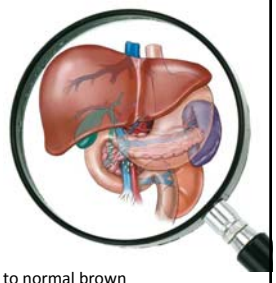
Liver Pathology

- ✓ **Fatty liver**
  - ➢ Inability to process sugar
  - ➢ Excess triglycerides
  - ➢ Immunity and autoimmunity
  - ➢ Fat in belly
  - ➢ Increased metabolic problems
  - ➢ Alcohol, high fat, high sugar
- ✓ **Cirrhosis**
  - ➢ Alcoholic
  - ➢ Non-alcoholic
- ✓ **Hepatitis**



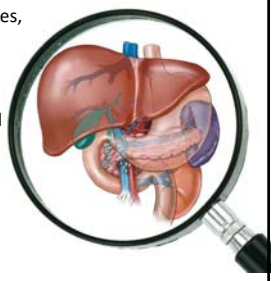
Liver/Gallbladder Assessment: 1

- ✓ Early stages of dysfunction may have NO symptoms
- ✓ Greasy or high fat foods cause distress
- ✓ Lower bowel gas and/or bloating several hours after eating
- ✓ Bitter metallic taste in mouth, especially in morning
- ✓ Belching throughout the day, chronic fatigue, irritability, tendency to headaches, anxiety
- ✓ Unexplained itchy skin
- ✓ Yellowish cast to eyes
- ✓ Stool color alternates from clay-colored to normal brown
- ✓ Reddened skin, especially palms
- ✓ Dry or flaky skin and/or hair



Liver/Gallbladder Assessment: 2

- ✓ History of gallbladder attacks or stones, hepatitis – right sided shoulder pain
- ✓ Gallbladder removed
- ✓ Female, fat, fertile, and forty – this is what they teach in med school
- ✓ Environmental sensitivities
- ✓ Pain between shoulder blades
- ✓ Greasy stools
- ✓ Easily intoxicated and hung over
- ✓ Alcohol use, alcoholism
- ✓ Sometimes a person with liver problems may have no symptoms until a blood test comes back that the liver enzymes are elevated



Liver/Gallbladder Testing

Exam:

- ✓ Tenderness between 6th and 7th ribs on the right
- ✓ Tenderness over 3rd rib, 3 inches to the right of mid-line
- ✓ Tenderness beneath the right rib cage

Testing:

- ✓ Increased SGOT, SGPT
- ✓ Increased LDH
- ✓ Increased GGT
- ✓ Increased alkaline phosphorus
- ✓ Decreased uric acid suggestive of phase 2 liver detox insufficiency
- ✓ Liver detoxification panel
- ✓ Cholesterol, HDL, and LDL decreased-bile insufficiency

Liver Profile: Part 1

- **Alanine Aminotransferase (ALT or SGPT):** An enzyme found primarily in the liver, also in heart; abnormalities may represent liver disease
- **Aspartate Aminotransferase (AST or SGOT):** An enzyme found in skeletal and heart muscle, liver, and other organs; abnormalities may represent liver disease
- **Bilirubin, Total:** A chemical involved with liver functions – breakdown product of hemoglobin; high concentrations may result in jaundice
- **Alkaline Phosphatase:** A body protein important in diagnosing proper bone and liver functions; can be elevated in leaky gut
- **Lactate Dehydrogenase (LDH):** An enzyme found mostly in the heart, muscles, liver, kidney, brain, and red blood cells; when an organ of the body is damaged, LDH is released in greater quantity into the blood stream

Liver Profile: Part 2

- **Protein, Total:** Together with albumin, it is a measure of the state of nutrition in the body
- **Globulin, Total:** A major group of proteins in the blood comprising the infection-fighting antibodies
- **Albumin, Serum:** One of the major proteins in the blood and a reflection of the general state of nutrition
- **Albumin/Globulin Ratio:** Calculated by dividing the albumin by the globulin
- **GGT:** Gamma-glutamyl transferase - detects liver and bile duct injury; alcoholism elevates this

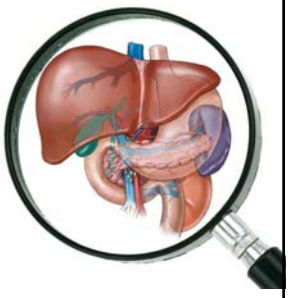
Liver and Gallbladder

Liver

- ✓ GGT +
- ✓ Alkaline Phosphatase +

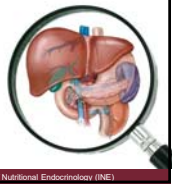
Bile Insufficiency

- ✓ Cholesterol -
- ✓ HDL -
- ✓ LDL -



Liver and Gallbladder Lab Findings

- ✓ Glucose (hi)
- ✓ BUN (lo)
- ✓ Protein (lo)
- ✓ Albumin (lo)
- ✓ Globulin (hi)
- ✓ Bilirubin (hi)
- ✓ Alkaline Phosphatase (hi)
- ✓ LDH (hi)
- ✓ AST (hi)
- ✓ ALT (hi)
- ✓ ALT(lo) early fatty liver
- ✓ GGT (hi)
- ✓ Iron (hi)
- ✓ Cholesterol or LDL (hi) - fatty liver, fat malabsorption, gallbladder stress
- ✓ Iron (hi) hemochromatosis
- ✓ Triglycerides (lo or hi) - fat malabsorption
- ✓ HDL (lo)
- ✓ Monocytes (hi)



Isoenzymes (Isozymes)

✓ **LDH**
- LDH-1 primarily in heart muscle and red blood cells
- LDH-2 concentrated in white blood cells
- LDH-3 highest in the lung
- LDH-4 highest in the kidney, placenta, and pancreas
- LDH-5 highest in the liver and skeletal muscle

✓ **Alkaline Phosphatase**
- Liver
- Bone
- Intestine
- Placenta

General Diet and Lifestyle Support for Liver

- **Avoid late night snacking**
- **Bed by midnight** (liver regenerates between 1:00 am and 3:00 am)
- **Decrease toxic load:** water, organic food, fiber to bind toxins
- **Oil Change:**
  - No fried, no oxidized oils
  - EFAs: Hemp, chia, algae, flax, and walnuts
- **Protein: Ample, high quality**
  - Individual variances
  - Protein powder if needed
  - Spirulina and other green powders

Liver and Gallbladder Support

Diet and Lifestyle:
- ✓ Breathe and relax before eating
- ✓ Chew thoroughly
- ✓ Avoid sugar, refined carbohydrates, gluten, and alcohol
- ✓ Avoid trans and bad fats
- ✓ Identify and eliminate food allergies
- ✓ Essential fatty acid-rich foods and supplements (chia, flax, hemp, and walnuts)
- ✓ Chlorophyll-rich foods
- ✓ Lots of water
- ✓ Don't overeat
- ✓ Don't skip meals

Supplements:
- ✓ Bitters to stimulate bile production
- ✓ Lipase
- ✓ Taurine
- ✓ Vitamin C
- ✓ Liver cleansing herbs: milk thistle, dandelion, yellow dock, and burdock root
- ✓ Liver stimulating herbs: fennel, anise, and cayenne
- ✓ Lecithin
- ✓ Peppermint oil
- ✓ B vitamins

Liver Supportive Foods

- ✓ Brassicas – indole-3-carbinol
  - ➢ **Especially broccoli sprouts and seeds**
- ✓ Citrus peels: limonene
- ✓ Caraway: limonene
- ✓ Turmeric
- ✓ Avocado
- ✓ Basil
- ✓ Beets
- ✓ Leafy bitter greens
- ✓ Mushrooms
- ✓ Cardamom
- ✓ Cayenne
- ✓ Chlorella
- ✓ Cilantro
- ✓ Cinnamon
- ✓ Dandelion
- ✓ Dill
- ✓ Fennel
- ✓ Garlic
- ✓ Ginger
- ✓ Grapefruit
- ✓ Green juices
- ✓ Jerusalem artichoke
- ✓ Onion
- ✓ Peppermint
- ✓ Rosemary
- ✓ Sea vegetables
- ✓ Thyme
- ✓ Radishes
- ✓ Wheat grass

Superfoods for Liver

- ➢ Spirulina
- ➢ Chlorella
- ➢ Green macha tea
- ➢ Chlorophyll
- ➢ Seaweeds
- ➢ Milk thistle
- ➢ Burdock
- ➢ Dandelion
- ➢ Hawthorn

Cholagogue Herbs

What They Do:

- ✓ Stimulate flow of bile from liver
- ✓ Stimulate bile secretion from gallbladder
- ✓ Strengthen liver
- ✓ Enhance detoxification

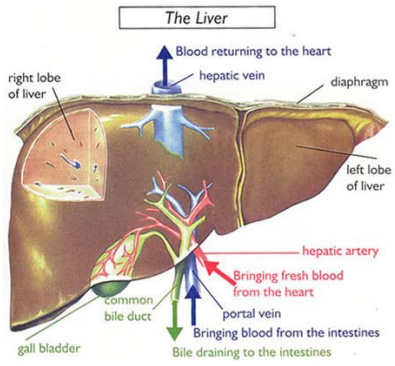
Herbs:

- ✓ Artichoke
- ✓ Barberry
- ✓ Blue flag
- ✓ Boneset
- ✓ Dandelion root
- ✓ Fringe tree bark
- ✓ Gentian
- ✓ Goldenseal
- ✓ Greater celandine
- ✓ Rosemary
- ✓ Sage
- ✓ Wild indigo
- ✓ Wild yam
- ✓ Yellow dock

Gentle 5-Day Liver/Gallbladder Cleanse

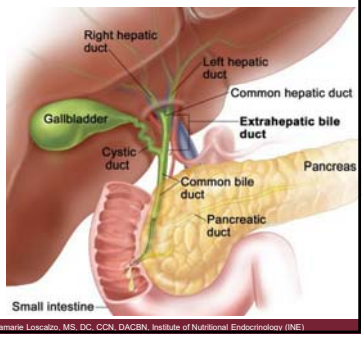
- ✓ **Take Herbs for Liver and Gallbladder**
  - ***HealthForce Nutritionals Liver Rescue***: 1 capsule 3 times daily
  - Any favorite formula
- ✓ **Daily Diet**
  - *Gut Rejuvenator Drink* in the morning
  - Green drinks – 1 quart or more each day
  - Eat simple-to-digest foods
  - Bitters with each meal
  - Incorporate as many liver support foods as possible
- ▪ **Daily Drink: 3x/Day – Natural Gentle Cholagogue**
  - 1 tablespoon lemon juice
  - 1 tablespoon organic olive oil
  - 1 tablespoon apple cider vinegar
- ✓ **Maintenance**
  - Take liver formula 2 times a day for 1 month
  - Consume probiotics daily
  - Follow Daily Diet list above

Liver Detoxification



Bile Salt Supplements

- ✓ Indicated after gallbladder removal
- ✓ Go slow
- ✓ Possibly needed when gallbladder is sluggish



General Liver Support Through Diet: 1

- **Avoid late night snacking**
  (Regenerates 1:00 am - 3:00 am)
- **Cleanup:** Water, organic, fiber to bind
- **Oil Change:**
  - No fried, no oxidized oils
  - EFAs
- **Protein: "Goldilocks principle"**
  - Ample, high quality
  - Individual variances
  - Hemp, chia

General Liver Support Through Diet: 2

- Whole foods, nutrient-dense
  - Greens, esp. bitter, like mustard and dandelion
  - Fruits and veggies, esp. citrus peels
  - Fats
  - Choline – soy lecithin
  - Mushrooms
  - Radishes, beets, artichokes
  - Cruciferous veggies
  - Vitamin C rich
  - Vitamin E rich
  - B vitamins
  - Turmeric and curry

General Liver Support Through Diet: 3

- Superfoods
  - Spirulina
  - Chlorella
  - Green macha tea
  - Chlorophyll
  - Seaweeds
- Herbs
  - Milk thistle

Extra Reading and Video Clips

- ✓ **Liver Anatomy**
  http://www.drritamarie.com/go/YTLiverAnatomy
- ✓ **Liver Physiology**
  http://www.drritamarie.com/go/YTLiverPhysiology
- ✓ **Liver Structure and Flow**
  http://www.drritamarie.com/go/YTLiverStructureAndFlow
- ✓ **Liver Cirrhosis**
  http://www.drritamarie.com/go/YTLiverCirrhosis
- ✓ **Liver Pathology**
  http://www.drritamarie.com/go/LiverPathology