Cancer

There are more than 200 different types of cancer!
Common Cancer Types in US

- Bladder
- Breast
- Colon and Rectal
- Endometrial
- Kidney
- Leukemia
- Lung
- Melanoma
- Non-Hodgkin Lymphoma
- Pancreatic
- Prostate
- Thyroid
Cancer cells often show defects in the normal process of differentiation.

Cancer cells are usually immortal (unlimited life span).

Normal cells just divide, whereas “transformed cells” (cancer cells) continue to crowd and pile on each other.

New research has shown that a cancer stem cell or tumor initiating cell is the most important cell in cancer.
**Microscopic Appearance of Cancer Cells**

<table>
<thead>
<tr>
<th>Normal</th>
<th>Cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Normal cells" /></td>
<td><img src="image" alt="Cancer cells" /></td>
</tr>
<tr>
<td>Large number of irregularly shaped dividing cells</td>
<td></td>
</tr>
<tr>
<td>Large, variably shaped nuclei</td>
<td></td>
</tr>
<tr>
<td>Small cytoplasmic volume relative to nuclei</td>
<td></td>
</tr>
<tr>
<td>Variation in cell size and shape</td>
<td></td>
</tr>
<tr>
<td>Loss of normal specialized cell features</td>
<td></td>
</tr>
<tr>
<td>Disorganized arrangement of cells</td>
<td></td>
</tr>
<tr>
<td>Poorly defined tumor boundary</td>
<td></td>
</tr>
</tbody>
</table>
Cancer Stem Cell

1. Stem cell
   - Normal stem cell
   - Mutated stem cell, or self-renewal genes turned on

2. Progenitor cell
   - Normal progenitor cell
   - Mutated progenitor, or self-renewal genes turned on

3. Differentiated cell
   - De-differentiated cell
   - Loss of regulated cell division
   - Self-renewal genes turned on

Cancer stem cell
Etiology: Genetics

- Changes in the gene of cancer cells cause the cell to become cancerous.
- These changes include DNA mutations, changes in DNA and histone chemical modification, and changes in miRNA expression.
Cancer is predominantly a disease of aging.
- The incidence of cancer increases dramatically with age.
- The best explanation for this data is that everyone acquires genetic “hits” or mutations over time.
Chronic inflammation has been seen to be a large factor in the development of cancer.

- This is because the immune response that comes along with chronic inflammation predisposes us to cancer.
- Example: individuals who have had ulcerative colitis for 10 years or more have a 30-fold increased risk for developing colon cancer.
Etiology: Viruses & Bacteria

- **Virus:** Hepatitis B, C, Epstien-Barr virus, Kposi sarcoma herpesvirus, and human papillomavirus are associated with 15% of cancers worldwide.
- **Bacteria:** Chronic infection with H. Pylori is strongly associated with gastric carcinoma, which is a leading cause of cancer deaths worldwide.
Course of the Disease

- Invasion, or local spread, must happen before the cancer truly progresses.
  - Mechanisms of invasion: cancer proliferation, digestion of connective tissue capsules, changes in cell-to-cell adhesion, increased motility of tumor cells.

- Metastasis refers to the spreading of cancer cells from their original site to far-away tissues and organs. This is the defining characteristic of cancer and is one of the main causes of the significant pain & suffering from cancer. It is also the main cause of death from cancer.
In order for cells to metastasize, they have to be able to detach from the extracellular matrix. To enable the spread, tumors secrete proteases, which digest the ECM and basement membranes. This creates the pathways which these cancer cells then move through.

- Normal cells would undergo apoptosis once they entered these pathways, but tumor cells have adapted to a hypoxic environment so they can resist this.
- The choice of where the tumor cells spread to is still poorly understood, but tissue selectivity is likely caused by interactions between cancer cells and specific receptors. (For example, breast cancer often spreads to bones, but rarely to the kidney or spleen).
Staging of Cancer

- Stage 0: Carcinoma in situ
- Stage 1, 2, and 3: Larger tumor, has spread to nearby lymph nodes or tissues or organs adjacent to location of primary tumor
- Stage 4: Cancer has spread to distant tissues or organs.
Staging of Cancer
Diagnosis of Cancer

- There are a variety of ways to discover cancer.
  - Screening tests, routine exams, investigation of symptoms
- Cancer produces a wide variety of symptoms.
- Once a tumor is identified, they must then go in and remove some of the tissue to make a definitive diagnosis.
- A pathologist then looks at the tissue and uses an available test to classify the cancer further.
  - Immunohistochemical stains, flow cytometry, electron microscopy, chromosome analysis, nucleic acid-based molecular studies.
If the tumor is found to be cancerous, staging is very important to see if the cancer has spread.
The size of the tumor, degree to which it has locally invaded, and the extent to which it has spread is looked at.
Cancer Risk Factors

“Behaviors such as avoiding exposure to tobacco products, maintaining a healthy weight, staying physically active throughout life, and consuming a healthy diet can substantially reduce one’s lifetime risk of developing or dying from cancer.”
- Overweight/obesity contribute to 14-20% cancer-related mortality
  - Most closely related cancers include: breast, colon and rectum, endometrium, kidney, esophagus, and pancreas
Risk Factors: Tobacco Smoke

- Smoking is the most preventable cause of death in our society
- Contains more than 50 known carcinogens
- Is **strongly** linked with lung and breast cancer
- Also linked with larynx, oral cavity, nose and sinus, pharynx, esophagus, stomach, pancreas, cervix, ovary, bladder, kidney, colorectum, and acute myeloid leukemia cancers.
Risk Factors: Environmental Factors

- Elevated cancer rates are more common in cities, farming locations, near hazardous waste sites, downwind of industrial and radiation activities, near contaminated water wells, and in areas with high pesticide use.
We are constantly exposed to xenobiotics, these chemicals can be found in our diet. They are transported in the blood by lipoproteins and penetrate lipid membranes.

- Foreign chemical substance found in an individual that is not normally naturally produced in that individual.
- They then react with DNA or directly with cell structures to cause damage.
- Detox enzymes and the antioxidant system are systems to counteract these effects.

Dietary sources of carcinogenic substances include compounds produced in the cooking of fat, meat, or protein, and naturally occurring carcinogens associated with plant foods, like alkaloids or mold byproducts.
Some nutritional factors have been found to influence susceptibility to cancer.

Nutritional deficiencies, such as vitamin D and compounds founds in fruits and vegetables, can increase cancer incidence.

In conclusion, evidence suggests that diet is a significant factor in the cause, progression, and prevention of cancer.

- Diet affects cell cycle control, differentiation, DNA repair, etc. These processes are influenced by DNA methylation. Imbalance of nutrients can lead to hypomethylation. But much more research is needed to identify how specific nutrients alter DNA methylation. (patho book page 406)
In a large study of 900,000 Americans, individuals were followed for 16 years. This study showed that obesity is linked to cancer.

The actual mechanisms of obesity-associated cancer risks are still largely unclear.
Risk Factors: Alcohol Consumption

- Continual alcohol consumption is a **strong** risk factor for cancer.
  - Oral cavity, pharynx, hypopharynx, larynx, esophagus, and liver.

- Alcohol also interacts with smoke, which in turn increases the risk for a malignant tumor. The alcohol may possibly act as a solvent for the carcinogenic chemicals in smoke products.

- **Word of Wisdom 😊**
Acute Lymphoblastic Leukemia

- Leukemia characterized by excess lymphoblasts.
- Immature white blood cells multiply and are overproduced.
  - This crowds out normal cells in the bone marrow.
- The five-year event free survival rate is nearly 80% for children and 40% for adults.
# Survival Rates of ALL

## Table 1. Results of Selected Clinical Trials in Patients with ALL.*

<table>
<thead>
<tr>
<th>Patients and Study Group</th>
<th>Years of Study</th>
<th>No. of Patients</th>
<th>Age Range</th>
<th>5-Yr Event-free Survival</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Children</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALL–BFM 90</td>
<td>1990–1995</td>
<td>2178</td>
<td>0–18</td>
<td>78±1.0</td>
<td>Schrappe et al.¹</td>
</tr>
<tr>
<td>CCG-1800</td>
<td>1989–1995</td>
<td>5121</td>
<td>0–21</td>
<td>75±1.0</td>
<td>Gaynon et al.²</td>
</tr>
<tr>
<td>COALL-92</td>
<td>1992–1997</td>
<td>536</td>
<td>1–15</td>
<td>76.9±1.9</td>
<td>Harms and Janka-Schaub³</td>
</tr>
<tr>
<td>DFC protocol 91-01</td>
<td>1991–1995</td>
<td>377</td>
<td>0–10</td>
<td>83±2</td>
<td>Silverman et al.⁴</td>
</tr>
<tr>
<td>NOPHO ALL-92</td>
<td>1992–1998</td>
<td>1143</td>
<td>0–15</td>
<td>77.6±1.4</td>
<td>Gustafsson et al.⁵</td>
</tr>
<tr>
<td>SJCRH XIII</td>
<td>1991–1998</td>
<td>412</td>
<td>0–18</td>
<td>79.4±2.3</td>
<td>Pui et al.⁶</td>
</tr>
<tr>
<td><strong>Adults</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GMALL 02/84</td>
<td>1983–1987</td>
<td>562</td>
<td>15–65</td>
<td>39 (at 7 yr)†</td>
<td>Gökbuget and Hoelzer⁷</td>
</tr>
<tr>
<td>MDACC</td>
<td>1992–1998</td>
<td>204</td>
<td>16–79</td>
<td>38†</td>
<td>Kantarjian et al.⁸</td>
</tr>
</tbody>
</table>

* Plus–minus values are means ±SE. BFM denotes Berlin–Frankfurt–Münster, CCG Children’s Cancer Group, COALL Cooperative Study Group of Childhood Acute Lymphoblastic Leukemia, DFC Dana–Farber Consortium, NOPHO Nordic Society of Pediatric Haematology and Oncology, SJCRH St. Jude Children’s Research Hospital, GMALL German Acute Lymphoblastic Leukemia Study Group, MDACC M. D. Anderson Cancer Center, and UCSF University of California, San Francisco.

† The rate of continuous complete remission is shown; patients in whom induction therapy failed and those who died were excluded from the analysis.
Benign Vs. Malignant

- **Benign tumors are not cancerous.**
  - They can typically be removed.
  - They do not come back in most cases.
  - They do not spread to other parts of the body
- **Malignant tumors are cancerous.**
  - They can invade and damage nearby tissues and organs.
  - They can metastasize.
Incidence and Prevalence

- There are an estimated 287,963 people living with leukemia today in the United States.
- Leukemia represents about 2.9% of all cancer cases.
- It represents 4.1% of all cancer deaths (23,720 deaths in 2013).
Tumor Vs. Blood Cancer

- Leukemia, lymphoma, and myeloma are all cancers of the blood.
- Other cancers (lung cancer, brain cancer, breast cancer, colon cancer, etc) are cancers that involve actual solid tumors and can be staged.
Goals of Treatment

- Cure
- Control
- Palliative Care
4 Basic Cancer Treatments

- Surgery
- Radiation
- Chemotherapy
- Hematopoietic Stem Cell Transplant
Surgery

• Success Rate
• Classes of Surgery to Treat and Prevent Cancer
• Combination Therapy: Can be used with chemotherapy or radiation therapy
Nutritional Implications

Surgery done on the alimentary tract (mouth to anus,) can damage nutrient digestion and absorption.

Nutritional Assessment: VERY important to recognize what part of alimentary tract has been removed or impaired.

General Symptoms include: fatigue, appetite changes, changes in bowel function, pain.
<table>
<thead>
<tr>
<th>Head and Neck Cancer</th>
<th>Esophageal Cancer</th>
<th>Oral Cavity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dysphagia</td>
<td>Gastroparesis</td>
<td>Dysphagia</td>
</tr>
<tr>
<td>EN support</td>
<td>Indigestion</td>
<td>Aspiration</td>
</tr>
<tr>
<td></td>
<td>Decreased motility</td>
<td>Xerostomia</td>
</tr>
<tr>
<td></td>
<td>Dysphagia</td>
<td>Alteration in taste/smell</td>
</tr>
</tbody>
</table>
Side Effects of Surgery

Gastric Cancer

• Dumping Syndrome
• Malabsorption
• Dehydration

Intestinal Tract Cancer

• Bile Acid Depletion
• Lactose Intolerance
• Diarrhea
# Side Effects of Surgery

<table>
<thead>
<tr>
<th>Pancreatic Cancer</th>
<th>Small Bowel Cancer</th>
<th>Colon or Rectal Cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Delayed Gastric Emptying</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Glucose Intolerance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Diarrhea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fat Malabsorption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Lactose Intolerance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Bile Acid Depletion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Diarrhea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Vitamin/Mineral Malabsorption</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Dehydration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Bloating, cramping</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Diarrhea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Fluid and Electrolyte Imbalance</td>
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</tr>
</tbody>
</table>
Chemotherapy

Cytotoxic Agents

- Alkylating Agents
- Antitumor Antibiotics
- Antimetabolites
- Plant Alkaloids
Alkylating Agents

Mechanism of Action: They react with the proteins bound that form the DNA molecules by adding an alkyl group. This prevents proper protein linking in DNA strands and then cancer cell death.
Antitumor Antibiotics

Mechanism of Action: They work through DNA intercalation and blocking the DNA/RNA synthesis
Antimetabolites

Antimetabolites inhibit nucleic acid or nucleotide synthesis
Plant Alkaloids

Mechanism of Action: Bind to tubulin dimers and interfere with microtubule structure. They also inhibit mitosis in metaphase.
Routes of Administration

- **Oral**: capsule, pill or liquid
- **Intravenous (IV)**: medication is transferred through an injection (most frequent use)
- **Intrathecal**: medication is delivered through injection into the CNS
- **Intraperitoneal**: delivery of medication through catheter into abdominal cavity
- **Intravesicular**: medication is administered through a Foley catheter into the bladder
Significant Side Effects of Chemotherapy

Neutropenia - Reduced number of white blood cells

Myelosuppression - Suppression of bone marrow production of neutrophils, platelets, and RBCs

Severity of Side Effects Depend On:
• Which Cytotoxic Agents are used
• How much dosage
• How long treatment is received
• Cycles of Chemotherapy
• Other Drugs taken
• Individual’s prior/current health status
Other Side Effects of Chemotherapy

- Diarrhea, N/V
- Oral Changes
- Mucositis
- Hair Loss
Mucositis

Xerostomia

Stomatitis

**FIGURE 39-3** Severe oral mucositis following marrow transplantation. The patient also received a course of high-dose cyclophosphamide and whole-body radiation.
Success Rate of Chemotherapy
✓ Chemotherapy Dose Limited
✓ Damage to Bone Marrow
✓ Combination Therapy; Chemotherapy with Bone Marrow Transplant
Success Rate of Chemotherapy with Acute Lymphoblastic Leukemia

• 80-90% of ALL adults will have complete remission after treatment
• 50% of ALL adults that have complete remission will have a relapse

• ALL chemotherapy treatments are administered over about 2 years in several phases

1. Remission Induction
2. Consolidation
3. Maintenance
Radiation Therapy

- Used as Cure, Control and Palliative therapy
- At least 50% of cancer patients will receive radiation therapy at some point of their cancer treatment.
- Administered externally into the body through a megavoltage machine or by placing a radioactive implant near the tumor.
- Only affects region the tumor and surrounding area
External Beam & Internal Beam Radiation

**External Radiation:** Delivered in photon beams using a machine called a linear accelerator.
- This machine uses electricity to form subatomic particles and creates radiation.
- Patients may receive treatment daily or over several weeks.

**Internal Radiation (Brachytherapy):** Radioactive materials placed inside body
- Radioactive isotopes sealed in pellets placed through catheters, needles, other carriers.
- When isotopes decay, they give off radiation to cancer cells and surrounding cells.
- After complete decay, the isotopes are no longer radioactive and are harmless.

- Radiation is generally administered 5 days a week
- Sometimes even twice a day
- Depending on cancer treatment may last up to 9 weeks
Combination Therapy with Radiation

• Chemotherapy with Radiation

• Stem Cell Transplant

Treatment of ALL with Radiation Therapy

• Radiation or Chemotherapy

• Stem Cell Transplant
Side Effects of Radiation

- Fatigue
- Loss of Appetite
- Skin Changes
- Hair Loss in Targeted Area
### Radiation Therapy Sites and Associated Nutritional Implications

<table>
<thead>
<tr>
<th>Central Nervous System</th>
<th>Head and Neck</th>
<th>Thorax</th>
<th>Abdomen</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute:</strong></td>
<td><strong>Acute:</strong></td>
<td><strong>Acute:</strong></td>
<td><strong>Acute:</strong></td>
</tr>
<tr>
<td>• N/V</td>
<td>• Xerostomia</td>
<td>• Esophagitis</td>
<td>• N/V</td>
</tr>
<tr>
<td>• Fatigue</td>
<td>• Mucositis</td>
<td>• Dysphagia</td>
<td>• Bowel function changes</td>
</tr>
<tr>
<td>• Loss of Appetite</td>
<td>• Sore mouth/throat</td>
<td>• Heartburn</td>
<td>• Colitis/enteritis</td>
</tr>
<tr>
<td>• Hyperglycemia</td>
<td>• Dysphagia</td>
<td>• Fatigue</td>
<td></td>
</tr>
<tr>
<td><strong>Late:</strong></td>
<td><strong>Late:</strong></td>
<td><strong>Late:</strong></td>
<td><strong>Late:</strong></td>
</tr>
<tr>
<td>• Headache</td>
<td>• Changes in taste/smell</td>
<td>• Loss of appetite</td>
<td>• Diarrhea</td>
</tr>
<tr>
<td>• Lethargy</td>
<td>• Fatigue</td>
<td></td>
<td>• Malabsorption</td>
</tr>
<tr>
<td></td>
<td><strong>Late:</strong></td>
<td></td>
<td>• cystitis</td>
</tr>
<tr>
<td></td>
<td>• Trismus</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Mucosal atrophy</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Total Body Irradiation
or Systemic Radiation Therapy

- Radiation Therapy used in Hematopoietic Cell Transplantation (HCT)
- Depresses immune system to decrease rejection risk
Hematopoietic Cell Transplantation (HCT)

- Used especially with Leukemia and Lymphoma cancer types
- Stem cells used for HCT are from bone marrow, peripheral blood or umbilical cord
- TBI or chemotherapy preparation
- IV infusion of hematopoietic cells (autologous or histocompatible related, allogeneic, syngeneic)
Acute Toxicities of HCT

- May last 2-4 weeks after transplant
- N/V
- Anorexia
- Dysguesia
- Stomatitis
- Fatigue
- Diarrhea
- Esophageal and Oral Mucositis

➤ PN has become a standard for patient care
Autologous HCT and Its Replacement

**Autologous HCT** - Use of the individual’s own stem cells
- Often leads to pancytopenia (reduced cellular components in blood)

**Mobilized Stem Cell Progenitors** are Replacing Autologous HCT
- Shortens the period of pancytopenia
- Important for those at risk for bleeding, sepsis, other infections
Graft-versus-Host-Disease (GVHD)

A. Donor Stem Cells react against the tissues of the transplant recipient
B. Acute GVHD can appear within 100 days after the transplant or as early as 7-10 days
C. It may develop into chronic GVHD which requires long-term treatment and dietary changes

Side Effects
• Gastroenteritis
• Abdominal pain
• N/V
• Large amounts of diarrhea
GVHD Medical Treatment

Acute GVHD Treatment:
- Depletion of T lymphocytes from the donor graft
- Drugs to prevent or lessen GVHD
  - Glucocorticoids (prednisone) combined with cyclosporine
  - Immunosuppressive drugs
- Doesn’t always respond to drugs
- Sometimes fatal outcomes
- Death often occurs due to infections developed in patients with suppressed immune systems

Chronic GVHD Treatment:
- Corticosteroids are primary therapy
- Cyclosporine with prednisone also may be used
5 Phases of Graft-versus-Host Disease (GVHD) Dietary Regimen

1. Total Bowel Rest
2. Reintroduction Oral Feedings and Beverages
3. Reintroduction of Solids
4. Normal Foods Gradually Introduced As Tolerance is Established
5. Resume the Individual’s Normal Diet
Sinusoidal Obstructive Syndrome (SOS)

Chemotherapy or Radiation Therapy-Induced Damage to Liver

Symptoms:
• Right Upper Quadrant Discomfort
• Hepatomegaly
• Fluid Retention
• Jaundice

Severe Cases:
• Encephalopathy
• Multiple-Organ System Failure
HCT Success Rate

- HCT has cured thousands of deadly cancers
- Relapses have occurred in cases within a few months/years
- Relapse is very unlikely to occur after 5 years of transplant
- After Relapse, treatment options are very limited
Medications

- Appetite Stimulants/ orexigenics
- Anti-nausea
- Antidiarrhea
- Laxatives
Appetite Stimulants

- Dronabinol: orexigenic part of marijuana
- Dronabinol + megastrol acetate: stimulates appetite and weight gain
- Corticosteroids: not as effective for long term weight gain
- Anabolic agents- Oxandrolone: oral anabolic agent used for weight gain and to offset protein catabolism
- Metoclopramide: prokinetic agent, helps with early satiety and anorexia
- Growth Hormone: increases appetite
Anti-nausea medications

- Antiemetics - offer symptom relief
- Phenothiazines - block dopamine receptors
- Butyrophenones - dopamine receptor antagonists
- Serotonin Receptor Antagonists - block serotonin receptors in upper GI
- Corticosteroids - drug of choice for nausea and vomiting
Anti-Diarrheals

- **Bulk forming agents**: absorb water from intestine
  - Psyllium (metamucil)
  - FiberCon
  - Attapulgite

- **Antimotility agents**: Inhibit peristalsis and prolongs transit time
  - Loperamide
  - Diphenoxylate/atropine
Laxatives

- **Stool Softener:** reduces surface tension of stool
  - Docusate
- **Stimulant:** stimulates myenteric plexus
  - Senna
  - Biscodyl
- **Bulk forming agent:** holds water in stool
  - Psyllium
- **lubricant:** causes local irritation
  - Mineral oil
- **Saline laxative:** retains water in intestinal lumen
  - Milk of Magnesia
• Nutrient risks for cancer:
  ○ Alcohol
  ○ Body weight
  ○ Fat
  ○ Too high or too low protein levels
  ○ Nitrates and polycyclic aromatic hydrocarbons
  ○ Toxic environments
  ○ Bisphenol A
MNT Screening and Assessment

- Health care members should especially look for weight loss, disease, metabolic stress and physical examination
- Activities of Daily Living (ADL)
- Common Toxicity Criteria (CTC)
- Karnofsky Performance Scale (KPS)
For early cancer and weight gain: 30-40 kcal/kg/day
Normometabolic cancer: 25-30 kcal/kg/day
Hypermetabolic (stressed) cancer: 35 kcal/kg/day
Hematopoietic cell transplant: 30-35 kcal/kg/day
Protein needs are evaluated based on stress, malnutrition, disease extent, and ability to metabolize protein

- Adequate hydration and electrolyte required
- Patients struggling with meeting nutrient needs may need multivitamin, but is not useful in cancer prevention
- Supplements not recommended during treatment
Nutrition Intervention

- Goals should be directed towards a specific measure
- Avoid Nutrition impact symptoms
  - Oral nutrition
  - Anorexia and taste/smell interactions
  - Energy metabolism alterations
  - Cachexia
- Tumor type, size and location
MNT intervention

- Eat protein and calories when able
- Focus meals towards biggest appetite
- Stick with foods easy to keep down
- Drink plenty of liquids
Common symptoms

- Weight loss
- Anorexia
- Nausea/ vomiting
- Diarrhea
- Constipation
- Sore throat
- Fatigue
- Neutropenia
- Altered taste/ smell
- Thickened saliva
- xerostomia
MNT: Neutropenic Diet  
(Case Study: Acute Lymphoblastic Leukemia)

- Wash hands frequently and keep surfaces clean
- Never eat raw or undercooked animal products
- Wash all fruits and vegetables, stick to canned if quality is questionable
- No old or moldy foods
- Maintain good oral hygiene
MNT: Appetite Loss/ Anorexia

- occurs as a result of cancer, fatigue, pain, stress, medications
- Eat small, frequent, energy dense meals
- Focus on increasing protein and calories when able
- Keep snacks nearby
- Drink cool/room temperature liquids throughout the day, drink only small amounts during meals
MNT: Nausea/ Vomiting

- Side effect of surgery and therapy or cancer itself
- Eat foods that are easy on the stomach and sound appealing
- Eat small, frequent meals
- Do not skip meals or snacks
- Limit liquids during meals but consume throughout the day
- Eat food at room temperature
- Plan when it is best to eat and drink
Results from chemotherapy, location of cancer, and medication

Drink plenty of liquids, especially hot ones.

Eat high fiber foods such as whole grains, fruits and vegetables, legumes, beans and nuts.
MNT: Diarrhea

- Caused by cancer treatments, infections and medications
- Drink fluids to replace losses
- Eat small, frequent meals
- Consume high sodium and potassium foods to replace losses - bananas, potatoes, etc.
- Eat low-fiber foods
- Avoid sugar-free products, greasy and fatty foods, spicy foods, and caffeine
MNT: Dry Mouth

- Occurs after chemo and radiation therapy, as well as some medications
- Drink water throughout the day
- Consume tart and sweet foods as well as hard candy and gum
- Eat foods easy to swallow
- Moisten foods
- Avoid alcohol, beer, wine
MNT: sore throat/ sore mouth

- Sore throat
  - Eat small, frequent meals
  - Easily swallowed foods
  - High protein/calorie foods
  - Prepare soft food and cut into small pieces
  - Sip through straw

- Sore mouth
  - Soft, ender, easily chewed foods
  - Use small spoon
  - Ice chips to help numb mouth
  - Avoid citrus, spicy, acidic foods
Nutrition Recommendations for Survivors

- Important to have a sound diet, good nutrition and incorporate physical activity
- Guide for Informed Choices for Nutrition and Physical Activity for cancer survivors
Dietary Supplements

- $23$ billion a year is spent on natural products to enhance health
- Most used is nonvitamin, nonmineral products
- Symptom management, sometimes in hope for tumor suppression
- Many take supplement as replacement for prescriptions
Achieve and maintain a healthy weight throughout life.

- Be as lean as possible throughout life without being underweight.
- Avoid excess weight gain at all ages. For those who are currently overweight or obese, losing even a small amount of weight has health benefits and is a good place to start.
- Engage in regular physical activity and limit consumption of high-calorie foods and beverages as key strategies for maintaining a healthy weight.
American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention

**Adopt a physically active lifestyle.**

- Adults should engage in at least 150 minutes of moderate intensity or 75 minutes of vigorous intensity activity each week, or an equivalent combination, preferably spread throughout the week.
- Children and adolescents should engage in at least 1 hour of moderate or vigorous intensity activity each day, with vigorous intensity activity occurring at least 3 days each week.
- Limit sedentary behavior such as sitting, lying down, watching television, or other forms of screen-based entertainment.
- Doing some physical activity above usual activities, no matter what one’s level of activity, can have many health benefits.
American Cancer Society Guidelines on Nutrition and Physical Activity for Cancer Prevention

Consume a healthy diet, with an emphasis on plant foods.

- Choose foods and beverages in amounts that help achieve and maintain a healthy weight.
- Limit consumption of processed meat and red meat.
- Eat at least 2.5 cups of vegetables and fruits each day.
- Choose whole grains instead of refined grain products.

If you drink alcoholic beverages, limit consumption.

- Drink no more than 1 drink per day for women or 2 per day for men.
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Nutrition Assessment

- **Anthropometrics**
  
  Ht: 5’9”  Wt: 198 lbs  BMI: 29.2
Nutrition Assessment

Biochemical

**Before transplant**
Too Low: WBC, RBC, hemoglobin, hematocrit, neutrophils, osteoblasts

Too High: monocytes

**After transplant**
Too Low: WBC, RBC, hemoglobin, hematocrit, neutrophils, osteoblasts, magnesium, Albumin, pre-albumin, lymphocytes

Too High: Monocytes, BUN
Nutrition Assessment

- **Clinical and Physical Findings after transplant**
  - Well-nourished, skin clammy with a rash, mild edema in lower extremities, mucositis

- **Diet**
  - 48-hr recall shows >100% calorie and protein needs
  - No food allergies
• Genetics
  -Mother: diabetes    -Father: hypertension
• History
  ○ Diagnosed in 2008 with ALL
  ○ Initial wt 230, lost 50 after chemo in 2008, regained 20
Inadequate oral intake *related to* total body irradiation *as evidenced* by mouth pain, 12-16 bowel movements a day, and occasional nausea.
Sample diet:

- High Protein, calorically dense meals
- Breakfast
  - ½ cooked cereal, ½ milk, 1-2 scrambled eggs, ½ fruit juice
- Snack
  - ½ yogurt, ¼ cup granola
- Lunch
  - Turkey sandwich on whole wheat bread, 1 pear, ½ c carrots
- Snack
  - 2 tbsp peanut butter on toast or an apple
- Dinner
  - 4 oz chicken, 1 cup steamed vegetables, ½ c rice, 1 c milk
- Snack
  - Whole wheat crackers and peanut butter or hummus, with ½ c juice or tea
Why weight change occurs

- **Metabolic alterations**
  - Elevated CHO, protein, lipid metabolism
  - Affected by tumor growth

- **Anorexia**
  - From disease or the treatments

- **Cytokines produced**
  - Elevates REE

- **Treatment**
  - Causes fluid and electrolyte imbalance
### TPN

**Protein Needs:** 1.2-1.5 g/kg

**Calorie Needs:**
- stressed: 35 kcal/kg

90 kg

**CHO:** 620g/.4 = 1550ml

**Fat:** 1 gm/kg = 90g

**Fluid:** 33 ml/kg/day = 2970ml

**Total calories:** 3150 kcal

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<tr>
<td><strong>Final dextrose concentration</strong></td>
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<tr>
<td><strong>Total final volume</strong></td>
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Relapse

- Depends on:
  - Stage of cancer diagnosis
  - Effectiveness and type of treatment

- Types:
  - Local
  - Regional
  - Distant

- Prevention:
  - Eating healthy
  - Exercising
    - (ACS recommendations)
Complimentary/Alternative Medicine

- Dietary supplements
  - symptom management
  - tumor suppression
Complimentary/Alternative Medicine

- **Macrobiotic diet:**
  - promotes natural healing
  - high in whole grains, vegetables and beans;
  - low in seafood, poultry, red meat, eggs, and dairy

- **Metabolic diet:**
  - detoxifies
  - strengthens the immune system
  - high organic/natural foods
  - low in animal products, refined flour/sugar, and processed foods