Fred Hutch Cancer Center

Nutrition for Gut Health & More

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Describe the gut microbiome and factors in development.

Discuss the role of the gut microbiome and impact on oncologic therapies.

Review evidence-based nutrition recommendations for maintaining a healthy gut microbiome.

Recipes for Success

Q + A

Gut Microbiome + Diet

“At a minimum, the diversity of the gut microbiome may be a future biomarker of long-term consumption of a “healthy” versus “unhealthy” diet, which may be linked to potential for disease development.” *Cresci*

Gut microbiome: What is it?

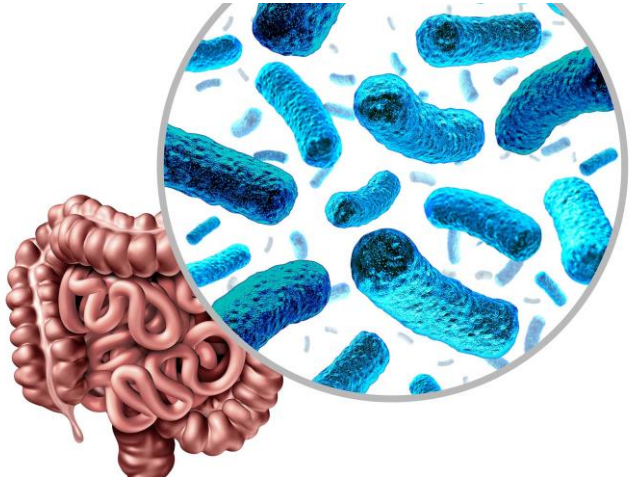
Gut microbiome is comprised of microorganisms such as bacteria, archaea, fungi, and viruses that are distributed throughout the entire GI tract.

Humans are made up of more bacterial cells (40 trillion) than human cells (30 trillion).

The GI tract contains over 3 million genes, which is 150 times more genes than in the genome of a human body.

Gut microbiome contains up to 1,000 species + more than 7000 different strains of bacteria.

Can weigh as much as 1-2 kg (similar to the weight of your brain!).



Cresci 2015, Sender 2016, Qin 2010, Integrative HMP (iHMP) Research Network Consortium, Rebersek 2021

Gut Microbiome Function

Three main functions:

- Structural
- Protective
- Metabolic

Plays an essential role in:

- Nutrient + mineral absorption
- Synthesis of enzymes, vitamins and amino acids
- Production of short-chain fatty acids (SCFAs)

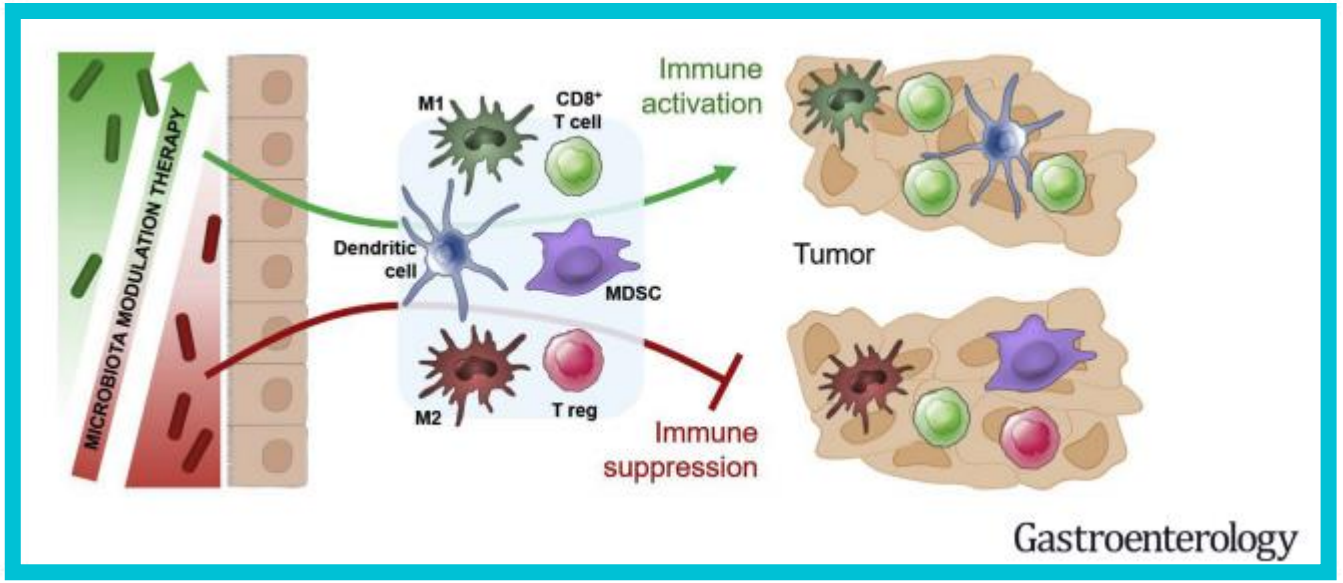
Rebersek 2021

Gut Microbiome + Human Health

Studies show the maintenance of a healthy gut microbiome is inseparable from host health.

Bidirectional relationship between the GI microbiome and innate immune system.

Ongoing investigations are revealing the importance of the gut microorganisms in exerting beneficial effects on human health.



Zheng 2020, Geuking 2014, Cresci 2015, Matson 2021

Gut Microbiome Function + Host Health

Fermentation byproducts of gut microbiota (acetate, propionate + butyrate) are important for gut health:

- Provide energy for epithelial cells
- Enhance epithelial barrier integrity
- Provide immunomodulation
- Protect against pathogens

Coordinate action/communication between the gut microbiome and host immune system

- Robust gut microbiota enables the immune system to recognize and attack opportunistic bacteria

Gut Microbiome

Primary Influential Factors

Cresci 2015

Eubiosis vs Dysbiosis

EUBIOSIS = STATE OF HEALTH:

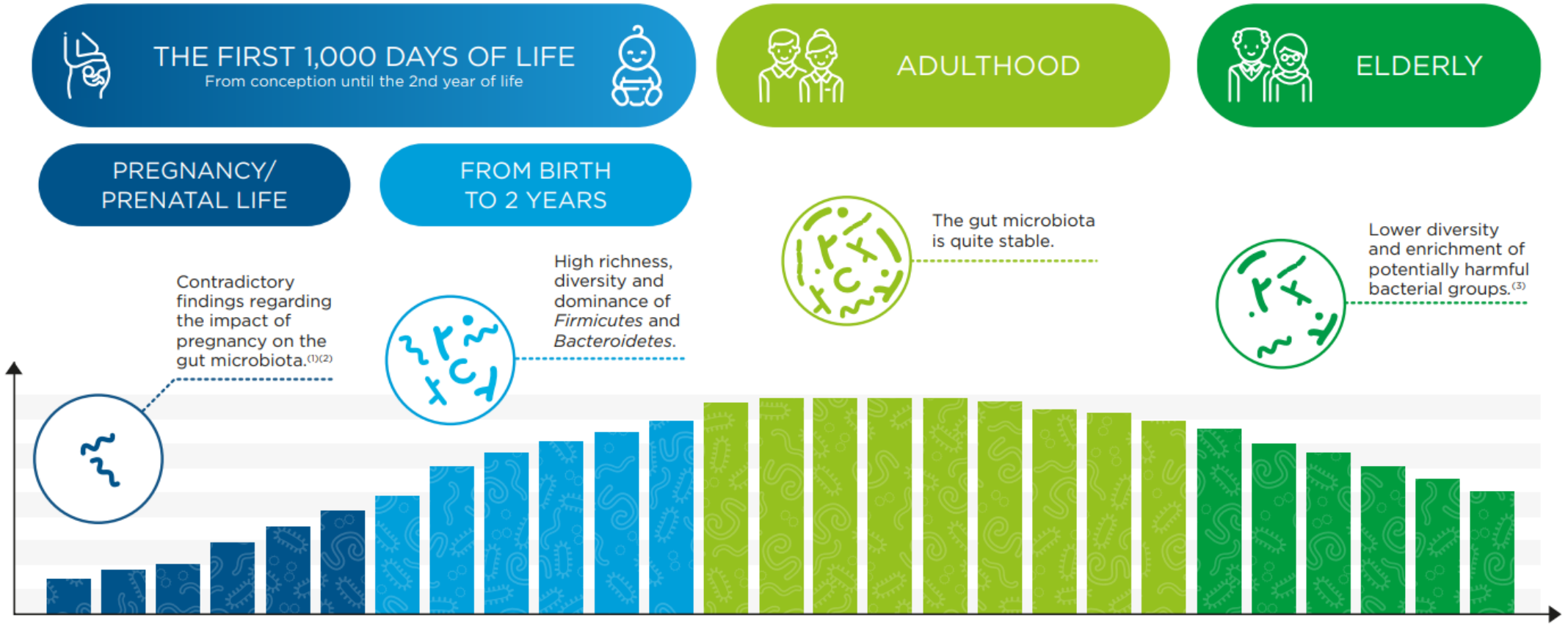
- √ Diversity of bacteria in the gut microbiota
- √ Balance between pro-inflammatory + anti-inflammatory cytokines
- √ An intact/healthy mucosal barrier and mucus layer.

DYSBIOSIS = ALTERATION OF THE MICROBIAL COMMUNITY:

- Causes altered metabolism in the intestine → disturbs functions of the microbiota
- Can result in ↓ diversity + helpful bacteria
- Connected to a wide array of chronic diseases = cardiovascular, metabolic, neurological, autoimmune, GI diseases, obesity and cancer

Rebersek 2021

Gut Microbiome over the Human Lifecycle

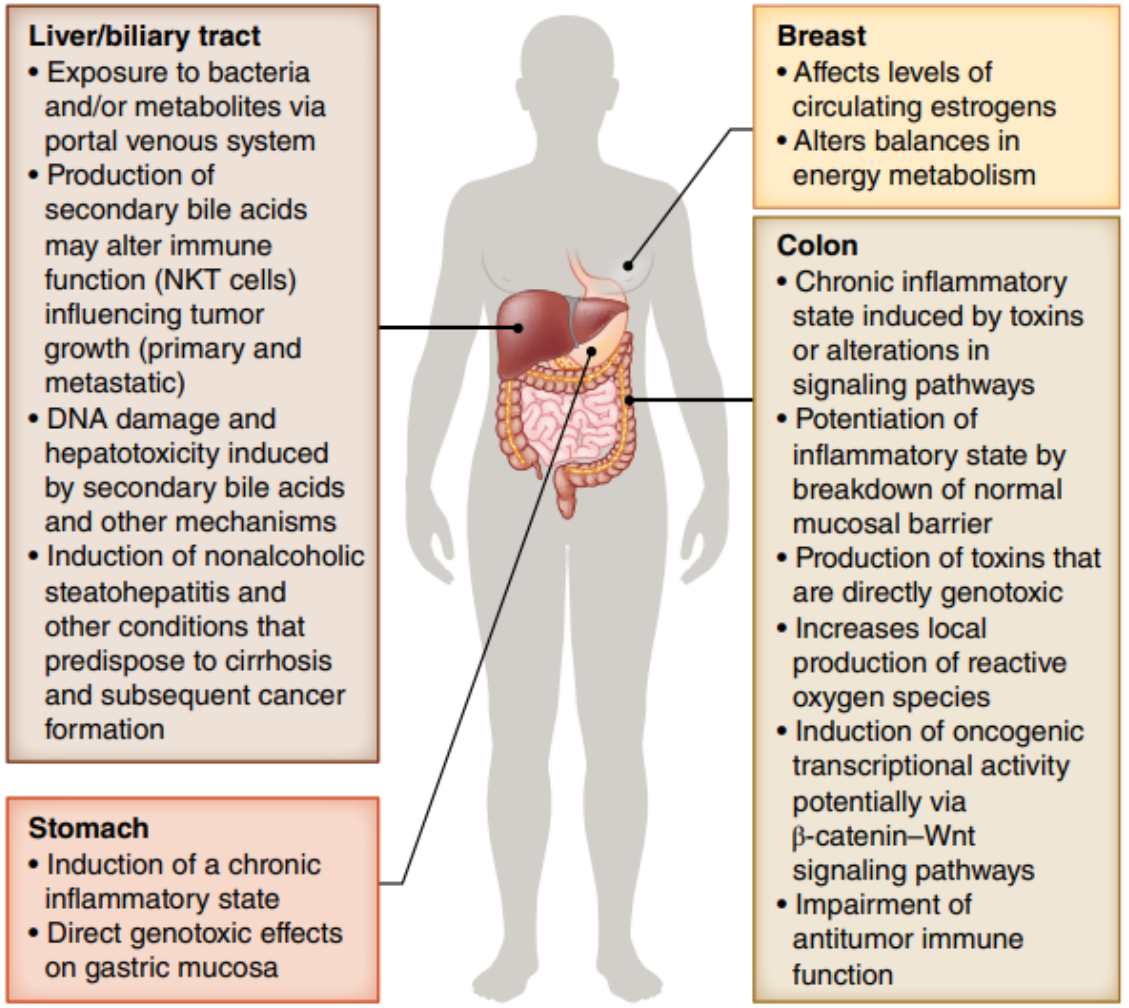


ESNM (European society of Neurogastroenterology + Motility)

Role of the gut microbiome and impact on oncologic therapies

Gut Dysbiosis and Cancer Development

- Gut dysbiosis and cancer development is increasingly being recognized.
- Certain bacteria and viruses have been implicated in cellular dysplasia and carcinogenesis.
- Known oncogenic gut bacteria include Salmonella and Helicobacter in biliary cancer and Helicobacter pylori in gastric cancer.
- In most of these cases, carcinogenesis is believed to be secondary to the creation of a local chronic inflammatory state; however, some bacteria, including H. pylori, have direct genotoxic effects.
- ***Additionally, evidence supports the notion that generalized dysbiosis of the gut microbiota may contribute to carcinogenesis.***



Helmink 2019

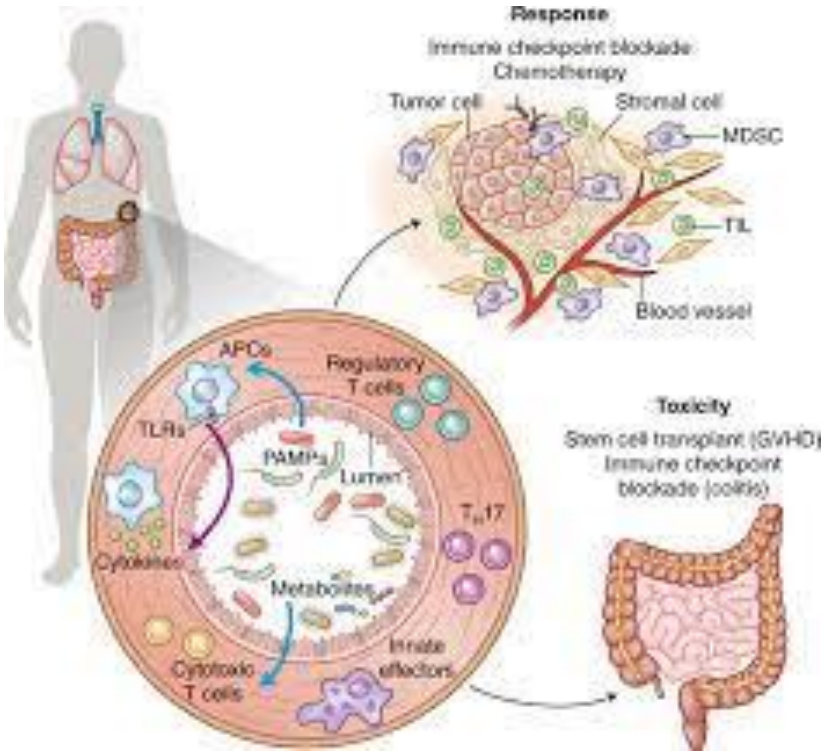
Impact of gut microbiome during cancer therapy

- Highly diverse bacterial populations inhabit the GI tract and modulate host inflammation with promotion of immune tolerance

- During oncologic therapy, the GI tract may be damaged and colonizing bacteria are impacted, leading to an impaired intestinal microbiota with reduced diversity

- Gut microbes can impact both the response to various cancer therapies and associated toxicities

- **QUESTION: Does altering the gut microbiome improve patient outcomes?**



Helmink, 2019

Impact of gut microbiome: solid tumors

- **Breast cancer:**
  - Review paper evaluating the role of the gut microbiota dysbiosis in breast cancer patients summarized that women who consumed a vegetarian diet or Mediterranean diet had higher intestinal microbiome diversity with lower estrogen levels *(Ruo, 2021)*
- **Liver cancer:**
  - Patients with liver cancer treated with bacteriotherapy have been able to modify the microbiota composition, thereby reducing overall inflammation and fibrosis *(Moreno-Gonzalez, 2019)*
- **Melanoma:**
  - Higher dietary fiber intake associated with improved progression-free survival in 128 patients with metastatic disease maintained on immune checkpoint blockade treatment *(Spencer, 2021)*
- **NSCLC:**
  - Patients who responded to nivolumab therapy had a higher microbiome diversity with significantly prolonged progression survival when compared to those with low diversity *(Jin, 2019)*
- **Pancreatic cancer:**
  - Diverse gut microbiome associated with improved CD8 T-cell response and prolonged survival in patients with pancreatic ductal adenocarcinoma *(Riquelme, 2019)*

Diet recommendations for maintaining a healthy gut microbiome*.

***Work with a Registered Dietitian and medical provider to determine what diet modification and/or supplements may be indicated for your specific condition.**

***Do not start supplements without approval from your medical provider.**


We can all apply the motto
“BE THE BEST AT GETTING BETTER”
to our diet and lifestyle choices.

Diet and Gut Microbiome

Diet is critical.

Major role of the gut microbiome is food digestion + harvesting key nutrients that the host is not capable of metabolizing on its own.

BOTTOM LINE= Diverse microbiome associated with diets high in fruits, vegetables + fiber compared with a Western diet rich in fat, sugars + animal protein and depleted of fiber.

The American Gut Project

The number of plant types you eat plays a role in the diversity of their gut microbiome.

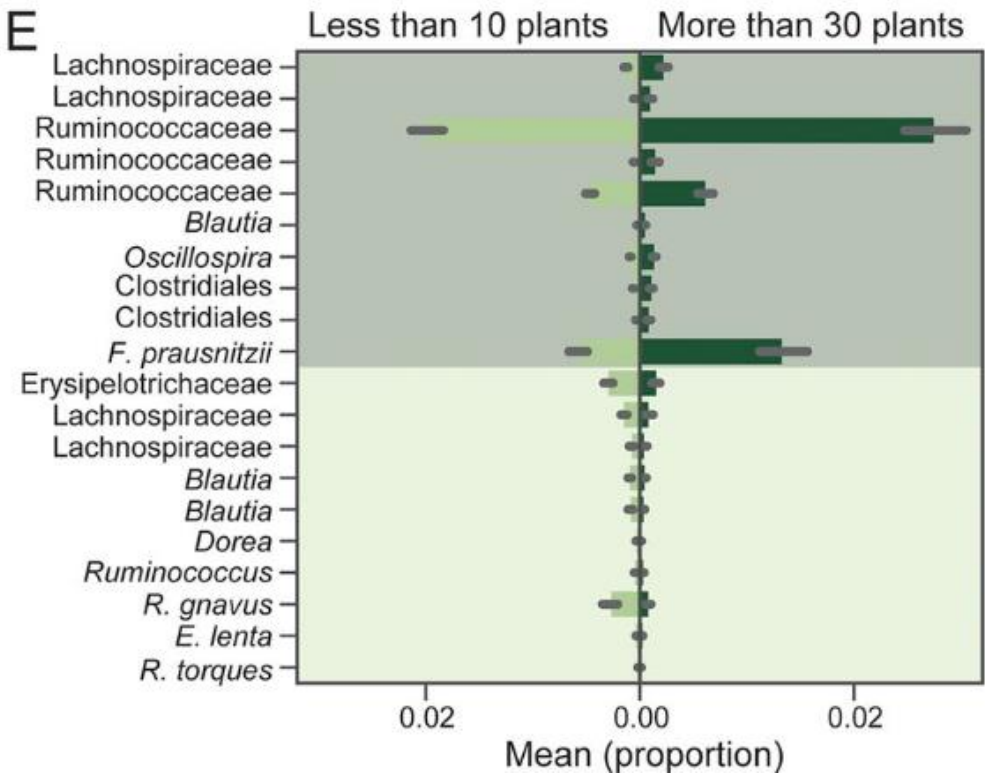
Participants who ate >30 different plant types/week had gut microbiomes that were more diverse than those who ate 10 or fewer plant types/week.

This is likely why fiber supplements do not have the same metabolic/microbiome effect.

To learn more or participate, visit AmericanGut.org.

Unique Fiber Types Matters for Diversity

N = 11,336



- # of unique plant species consumed is associated with microbial diversity, rather than self-reported categories (i.e. Vegetarian)
- Bacteria differ in CHO binding molecules and enzymes that hydrolyze diverse substrates in the gut, therefore a more diverse diet likely supports a more diverse microbiome
- Plant consumption also associated with a reduction in certain antibiotic resistance genes

McDonald 2018

Fiber and Phytochemicals

Goal	Sources	Serving
• 30 grams/day • ~10% Americans meet this goal	• Fruit • Vegetables • Whole grains • Nuts/seeds • Beans	• ½ cup cooked whole grain • 1 cup whole grain cereal • 1 cup raw fruit/vegetable • ½ cup cooked fruit/vegetable • ~1.5 oz whole nuts • 2 Tb nut butter

Nutrition Matters

American Institute for Cancer Research®

Nutrition:

Part of Your Cancer Treatment Plan

From day one, nutrition should be considered alongside treatment for improved outcomes.

After a cancer diagnosis, eating well can help you throughout chemotherapy, radiation therapy and surgery. Aim to follow AICR's Cancer Prevention Recommendations during treatment.*

NUTRITION CAN HELP YOU:

- Heal and recover faster from treatments
- Reduce your risk of infection
- Support your immune system
- Build your strength and energy
- Tolerate side effects from treatments
- Maintain a healthy weight
- Replace or retain nutrients that are stored in your body
- Reduce your risk of cancer recurrence

***Work with a dietitian and your cancer care team to set up your personal nutrition plan.**

https://www.aicr.org/

Modes of gut microbiome modulation: Diet

American Institute for Cancer Research

Eat a diet rich in plant foods such as whole grains, vegetables, fruits, and legumes	• Endorsed by the American Institute of Cancer Research (AICR) for cancer prevention
Base diet around plant foods which contain fiber (to help diversify the gut microbiome) and other nutrients to reduce cancer risk	• Consumption of plant foods (lower in calories) also help maintain a healthy weight • 2/3 of plate/bowl should include plant-based foods
Enjoy at least 4 cups (raw and cooked) daily	• Eat a “Rainbow of Colors” • Don’t forget about beans, lentils, peas, nuts

AICR's Foods that Fight Cancer™

No single food can protect you against cancer by itself.

But research shows that a diet filled with a variety of vegetables, fruits, whole grains, beans and other plant foods helps lower risk for many cancers. In laboratory studies, many individual minerals, vitamins and phytochemicals demonstrate anti-cancer effects. By including more foods that fight cancer into your diet, you will help reduce your risk of developing cancer.

APPLES

ASPARAGUS

BLUEBERRIES

BROCCOLI AND CRUCIFEROUS VEGETABLES

BRUSSELS SPROUTS

CARROTS

CAULIFLOWER

CHERRIES

COFFEE

CRANBERRIES

FLAXSEED

GARLIC

GRAPEFRUIT

GRAPES

KALE

ORANGES

PULSES: DRY BEANS, PEAS, AND LENTILS (LEGUMES)

RASPBERRIES

SOY

SPINACH

SQUASH (WINTER)

STRAWBERRIES

TEA

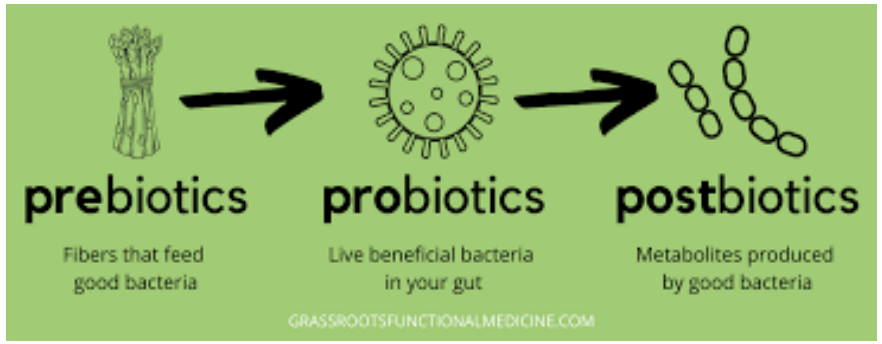
TOMATOES

WALNUTS

WHOLE GRAINS

Modes of gut microbiome modulation: probiotics, prebiotics, postbiotics

- **Probiotics**
  - Contain a defined amount of viable microorganism that upon administration, confer a benefit to the host
  - Examples: pasteurized food sources (yogurt, kefir, acidophilus milk)



- **Prebiotics**
  - Consist of nondigestible food ingredients (undigested fibers) that support the growth of beneficial bacteria
  - Examples: whole grains, bananas, onions, garlic, artichokes

- **Postbiotics**
  - "End game" of probiotics and prebiotics – released from gut bacteria that are fed nondigestible food ingredients (undigested fibers) that support the growth of beneficial bacteria
  - Examples: Short-chain fatty acids, vitamins, amino acids, lipopolysaccharides (large molecules found on the outer layer of certain bacteria)

Staffas, 2016

Putting Science on Your Plate

Tips to add Fiber and Phytonutrients

Add fruit to breakfast

Make a veggie omelet

Mix up the grains: quinoa, bulgar, etc

Mix seeds in salad, smoothies or oatmeal

Eat nuts as snacks and/or add to baked goods + salads

Include roasted vegetables w/lunch and dinner

Kitchen Strategy

Stay one step ahead:

When prepping a meal, consider future uses for those ingredients:

If cutting 4 carrots to roast with dinner, cut up a 5th one for a snack tomorrow

Roasting cauliflower for dinner? Roast 25% more and save for “leftover salad”

Mix any leftover cooked vegetables with eggs and serve with whole wheat toast for a plant-based breakfast

Cook whole grains (barley, quinoa, brown rice, etc) in large batches to use in a variety ways

Strategies for Success

Pre-prep your breakfast, lunch and snacks! (This can be done by someone else…)

Purchase premade salads and/or fruit bowls if too rushed to make your own.

Build a desk/locker “pantry” with self stable items such as individually wrapped popcorn, nuts, and bars.

Consider a new lunch box or thermos with compartments.

Prep in advance a few days of salads layered in mason jars.

Plan your meals around high fiber, high protein foods for a long-lasting fuel.

Increasing Vegetable Intake: Greens

- Keep a container of greens in your fridge. They go with just about everything:
  - Add to eggs & sandwiches
  - Start each plate with greens
  - Leftover salad
  - Add to smoothies, soups and beans

- Kale fennel salad

Dressings

Increasing Vegetable Intake: Carrots

Keep carrots in your fridge:

- They last a long time – great “backup” veggie
- Very versatile with many raw and cooked uses
- Inexpensive (<$1/pound)

Baked root vegetables fries with Mexican crema

Increasing Bean Intake

The most economical protein source:

- Enjoy as a main dish, like chili, stuffed bell peppers, tacos/burritos, vegetarian curries, etc.
- Use bean spreads like humus on veggie sandwiches or as a snack/side with cut vegetables
- Roasted chickpeas are a great crunchy snack alternative to chips and/or a great salad topping

- Kale Caesar salad with chickpea croutons

Summary

- Diet is key for supporting a healthy gut microbiome.
- Encourage a whole-foods, plant-based diet with a focus on diversity.
- Modulation of the gut microbiome may play a role in improving outcomes for oncology patients as well as other chronic diseases.
- We can all embrace “Being the Best at Getting Better”!

Great Resources

- Cook for Your Life: https://www.cookforyourlife.org/

- American Institute for Cancer Research: https://www.aicr.org/cancer-survival/

- American Cancer Society: https://www.cancer.org/

- Fred Hutch public facing website: https://www.fredhutch.org/en/education-training/pa

- Find a Registered Dietitian: https://www.eatright.org/find-a-nutrition-expert

Fred Hutch
Cancer Center

Thank you

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