

# Gut Check: Microbiome and Nutrition in Oncology



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**Assistant Professor, Hematology/Oncology**  
**University of Nebraska Medical Center**  
**5/2026**



# Conflicts of Interest

- Consulting: Abbvie, Genmab, Bristol Myers Squibb,, Curis Inc
- Research: Beigene, Abbvie, Genmab, Bristol Myers Squibb, Fate Therapeutics, Curis Inc



# Objectives

- Discuss the gap between patient interest in nutrition and oncology recommendations
- Identify simple nutrition objectives and recommendations to share during cancer therapy
- Understand the gut microbiome and its role in oncologic disease and therapy

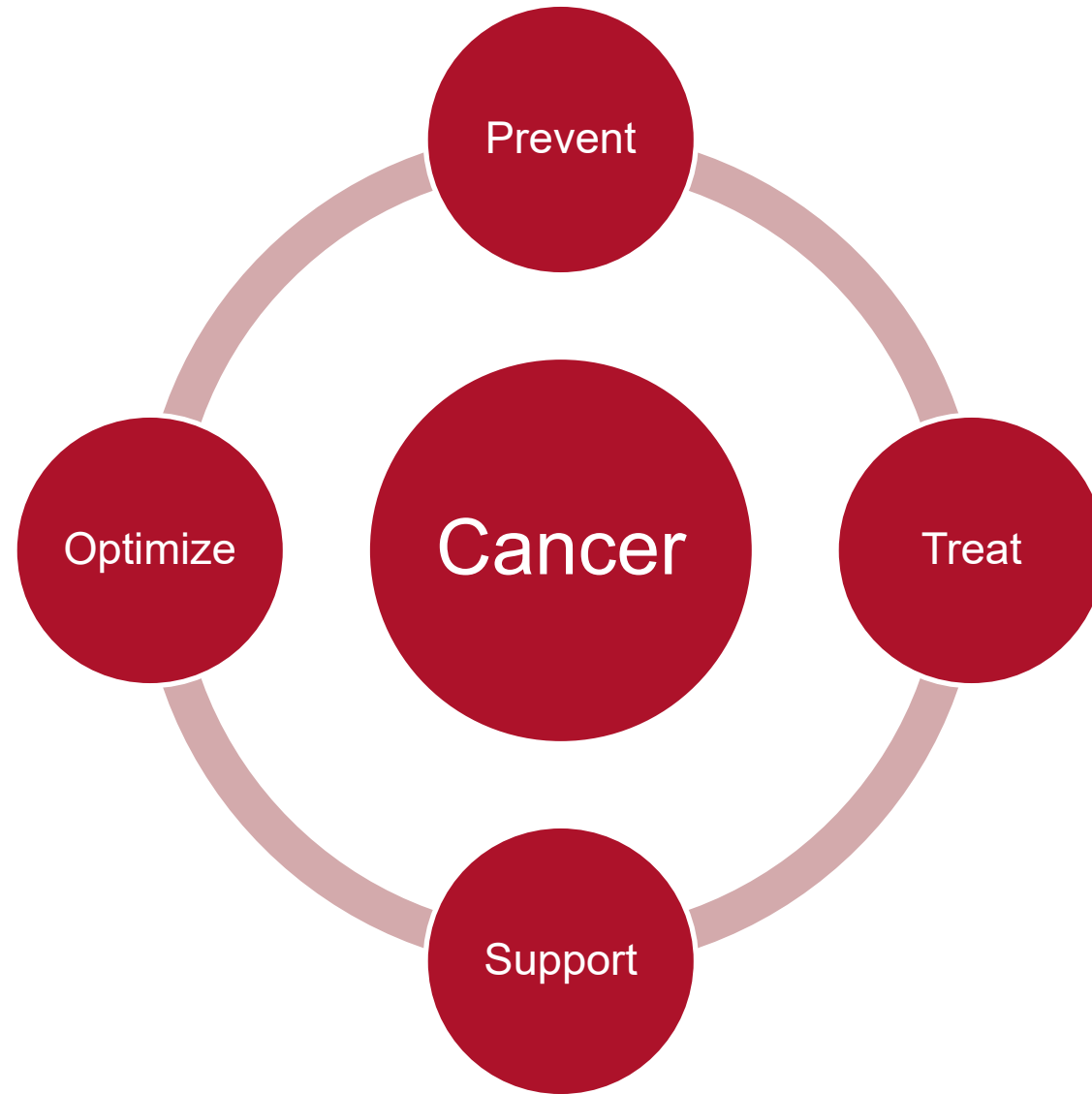


# Objectives/Disclosure

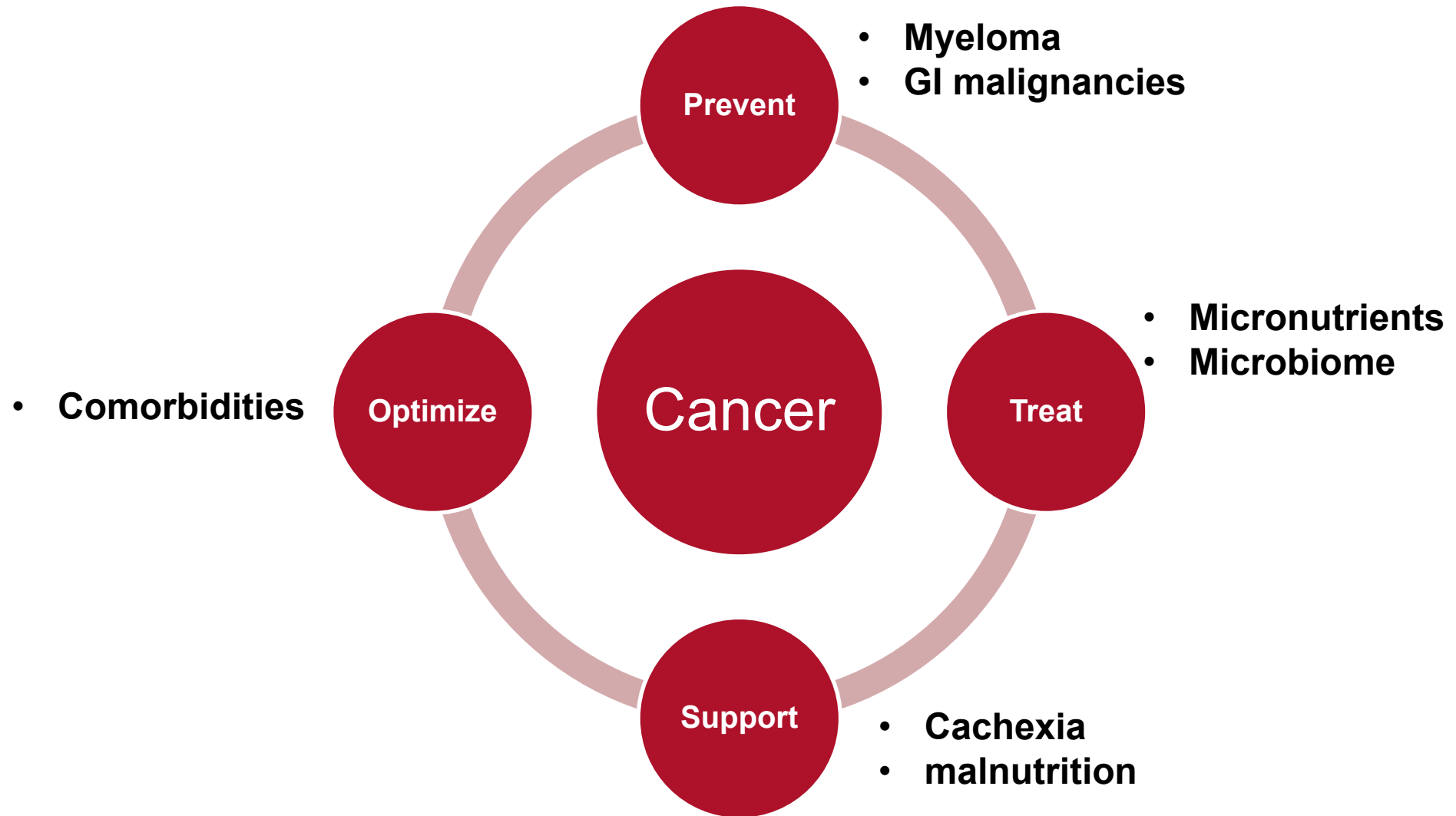
- As a hematologist, focus on these objectives thru the lens of heme malignancies:
  - Lymphoma
  - Multiple myeloma



# The hope of nutrition



# The hope of nutrition



# Patient Interest

[nature](#) > [blood cancer journal](#) > [correspondence](#) > article

Correspondence | [Open access](#) | Published: 20 April 2022

## **Nutrition perceptions, needs and practices among patients with plasma cell disorders**

- Survey of patients with plasma cell disorders
- N=400

Malik et al, *Blood Cancer Journal*, 2022  
Supported by Healthtree Foundation!



# Patient Interest: nutrition and diet

Past Experience Discussing Diet and Nutrition with Hematologists and Oncologists	
1. Since your plasma cell diagnosis, have you had questions or concerns about diet and nutrition?	<i>n</i> = 417 (%)
Yes	341 (82)
2. Which statement best describes your experience discussing diet and nutrition with your oncologist/hematologist?	<i>n</i> = 417 (%)
Hematologist/Oncologist addressed it appropriately	96 (23)
Hematologist/Oncologist did not address it	238 (57)
Hematologist/Oncologist did not address it despite the patient asking	97 (23)
Hematologist/Oncologist referred patient to a dietician/nutritionist	83 (20)

- 82% of patients have nutrition questions
- 57% not addressed by oncologists



# Patient Interest: advice received

What advice did you receive from your hematologist/oncologist?	n = 379 (%)*
Eat more plant-based foods, fiber-rich foods, plant proteins, and/or less junk/fatty foods	55 (15)
Eat a balanced diet (without details given) or lose weight by eating less	110 (29)
Referred to nutritionist/dietician	94 (25)
None – received no advice about diet and nutrition	168 (44)

- 44% no advice at all
- 29% balanced diet
- Only 25% referred for nutritionist



# **Patient Interest: advice received**

**Take home message: Our patients are interested in dietary advice during their cancer treatment**

**They look to oncology providers for leadership**

**They are likely to follow advice**



# Nutrition and Cancer

## Faddism and Quackery in Cancer Nutrition\*

Victor Herbert

In the United States alone, over 50,000 cancer patients annually have their health harmed, often have their lives shortened, and always have their pockets picked by promoters of nutrition quackery[1-4]. Why does this go on? Patients are most susceptible to quack remedies when they feel helpless, not in control of their therapy, or without hope[16,17]. Nutrition quackery thrives on specious slogans and beliefs that appeal to the need for control of one's destiny and the environment[17-19], such as the sophistic concept that natural is good and synthetic is bad[2,20]. Those most vulnerable to nutrition quackery are the many who are unable to distinguish genuine experts from charismatic snake-oil salesmen, and unable to distinguish one "doctor" from another.



# Nutrition and Cancer

**Patient interest – Oncology input =**

**A power void filled by opportunists and exposing patients to harm**



# Nutrition: Cancer Prevention

## CA: A Cancer Journal for Clinicians

The flagship journal of the American Cancer Society

Article |  Free Access

### American Cancer Society guideline for diet and physical activity for cancer prevention

Cheryl L. Rock PhD, RD, Cynthia Thomson PhD, RD, Ted Gansler MD, MPH, MBA,  
Susan M. Gapstur MPH, PhD, Marjorie L. McCullough ScD, RD , Alpa V. Patel PhD ... [See all authors](#) ✓

First published: 09 June 2020 | <https://doi.org/10.3322/caac.21591> | Citations: 392



# Nutrition: Prevention

- Whole grain: 30g/day ~5% risk reduction for colorectal
  - Rich in phytochemicals
  - Rich in fiber
  - Reduce gut transit time:: less exposure to carcinogens
  - Beneficial for microbes
- Evidence base: **probable**
  - Mostly limited to epidemiologic studies



# Nutrition: Prevention Multiple Myeloma

[PLoS One](#). 2018; 13(11): e0206047.

PMCID: PMC6211667

Published online 2018 Nov 1. doi: [10.1371/journal.pone.0206047](https://doi.org/10.1371/journal.pone.0206047)

PMID: [30383820](https://pubmed.ncbi.nlm.nih.gov/30383820/)

## Dietary intake is associated with risk of multiple myeloma and its precursor disease

[Marianna Thordardottir](#), Formal analysis, Methodology, Writing – original draft,<sup>1,\*</sup> [Ebba K. Lindqvist](#), Methodology, Writing



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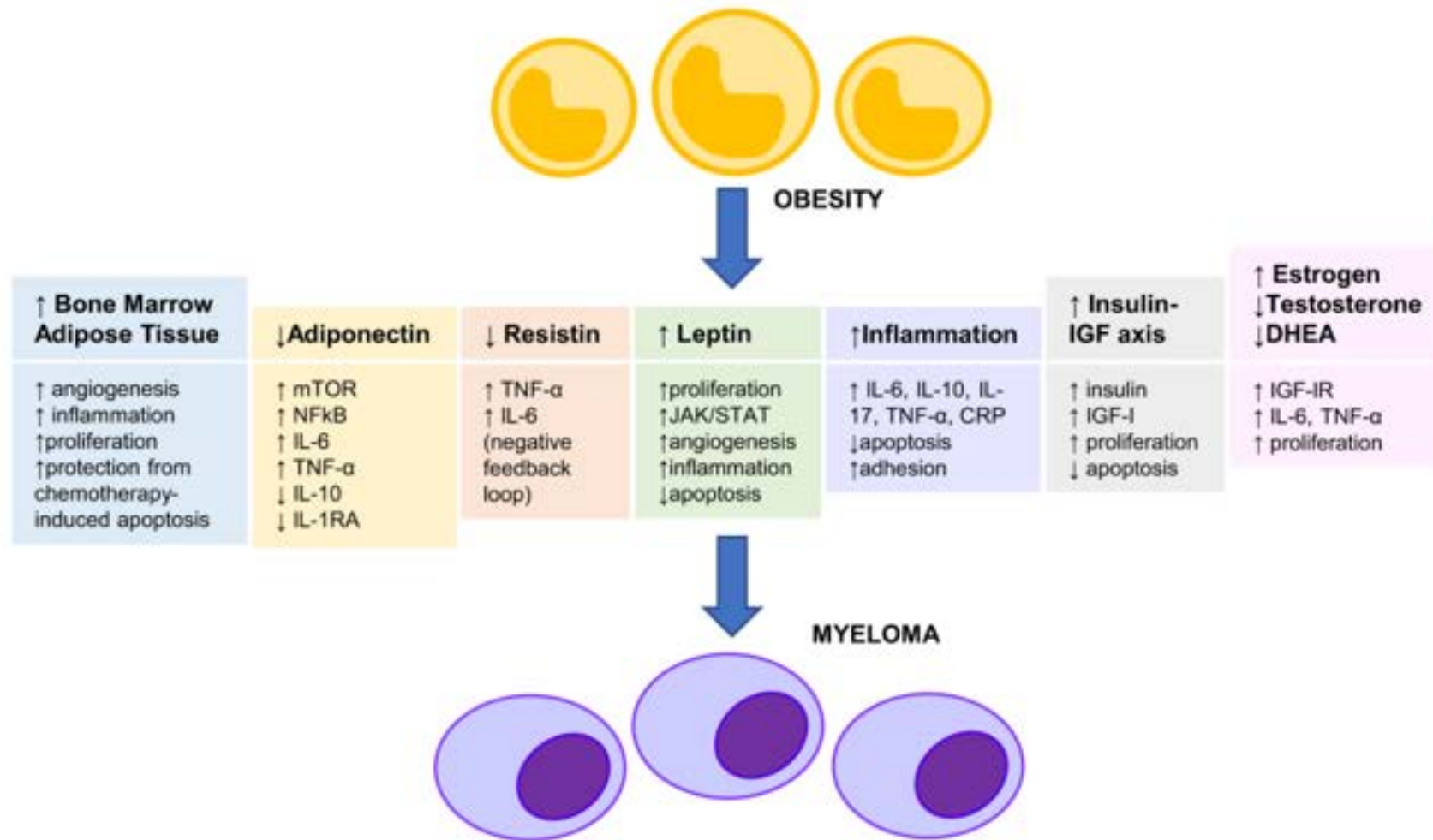
[Marianna Thordardottir](#), Formal analysis, Methodology, Writing – original draft,<sup>1,\*</sup> [Ebba K. Lindqvist](#), Methodology, Writing

- Epi survey study of population of healthy, MGUS, and multiple myeloma patients
  - N= 5000 in the survey, 300 cases of MGUS and myeloma
- Adolescent intake of fruit -> reduced incidence of MGUS: OR 0.62  $p < 0.05$
- Adults with MGUS intake of fruit -> reduced risk of **myeloma** OR 0.34  $p < 0.05$



# Nutrition: Obesity/Diets and Myeloma

Obesity = 2x increased risk of developing multiple myeloma



# Nutrition and Cancer: Support

## THE LANCET

Individualised nutritional support in medical inpatients at nutritional risk: a randomised clinical trial

[Prof Philipp Schuetz, MD](#)  <sup>a,j</sup>  · [Rebecca Fehr](#) <sup>a</sup> · [Valerie Baechli](#) <sup>a</sup> · [Martina Geiser](#) <sup>a</sup> · [Manuela Deiss](#) <sup>a</sup> · [Filomena Gomes, PhD](#) <sup>a,m</sup> et al. [Show more](#)

- EFFORT trial: RCT in Switzerland
  - Oncology inpatients screened for nutrition risk
  - Randomized to dietician-directed nutrition or no support



# EFFORT Trial: individualized nutrition

## Individual nutrition targets

**Caloric requirements**  
Harris-Benedict equation  
with adjusted bodyweight  
or indirect calorimetry

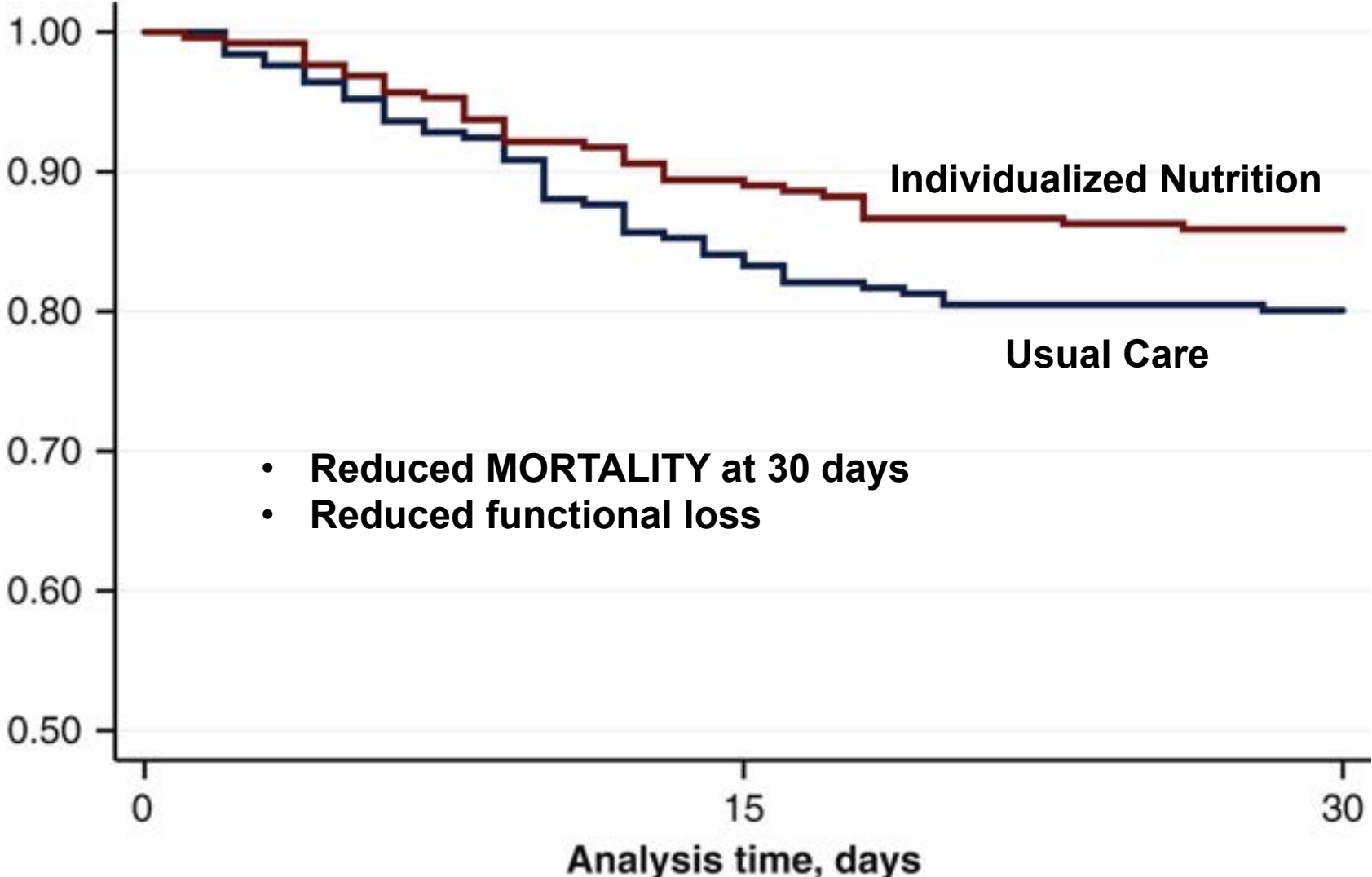
**Protein requirements**  
1.2–1.5 g/kg bodyweight  
per day (0.8 g/kg of  
bodyweight per day in  
patients with renal failure  
with no dialysis)

**Micronutrient  
requirements**  
Multivitamin use; other  
micronutrients  
according to specific  
laboratory results

**Specific targets**  
Disease-specific  
adaptations  
(eg, medium-chain  
triglycerides, low  
potassium in patients  
with renal failure)



# EFFORT: nutrition outcomes



Schuetz et al, *Lancet*, 2019; Bargetzi et al, *Annals of Oncology*, 2022

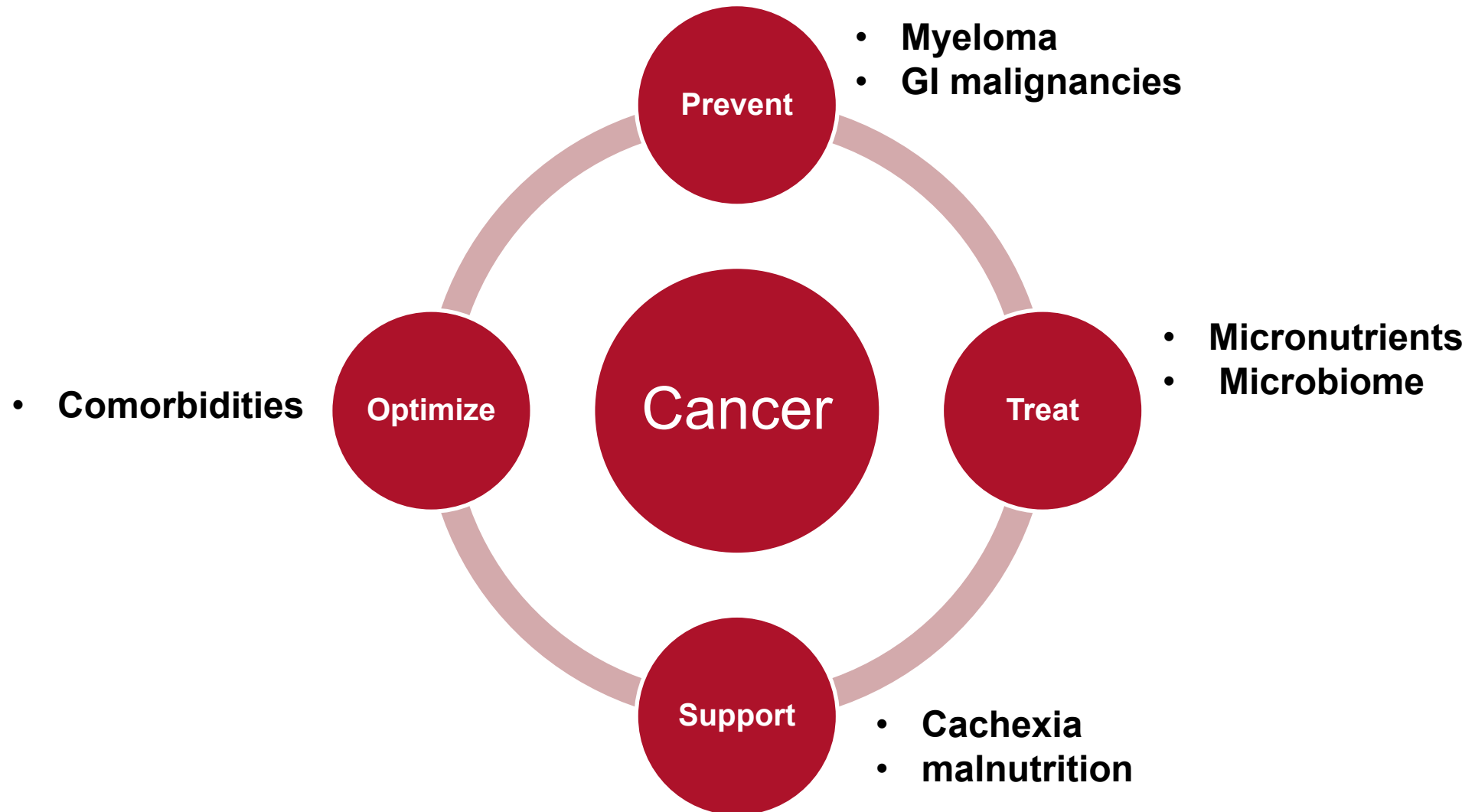


# EFFORT: conclusions

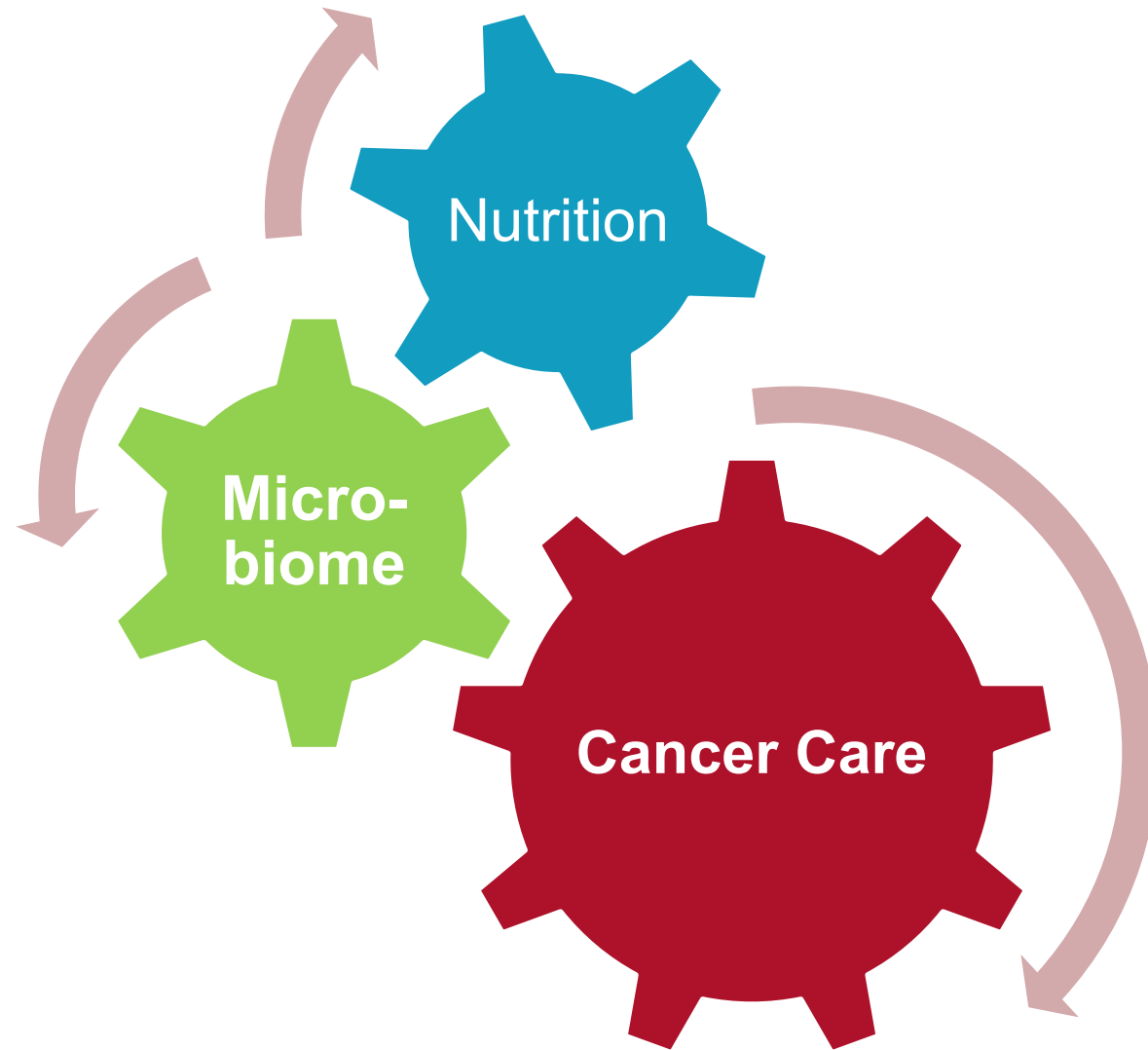
- Nutritional intervention can be potent
- A roadmap: ~73% met goals in intervention vs 22%
- Support your dieticians!



# The hope of nutrition



# Nutrition, Microbiome, and Cancer Care



# The gut microbiome



- **A community of bacteria, viruses, fungi, and parasites**
- **Many different microbiomes surround us, but the gut microbiome in particular may interact with the host immune system**
- **Function**
  - **Non-digestible carbohydrate breakdown (ie short-chain fatty acids like butyrate)**
  - **Metabolite: Amino-acid, vitamin, and hormone synthesis**
  - **Host immune modulation: regulate Th17/Treg balance**
- **A new Immune “Organ”**

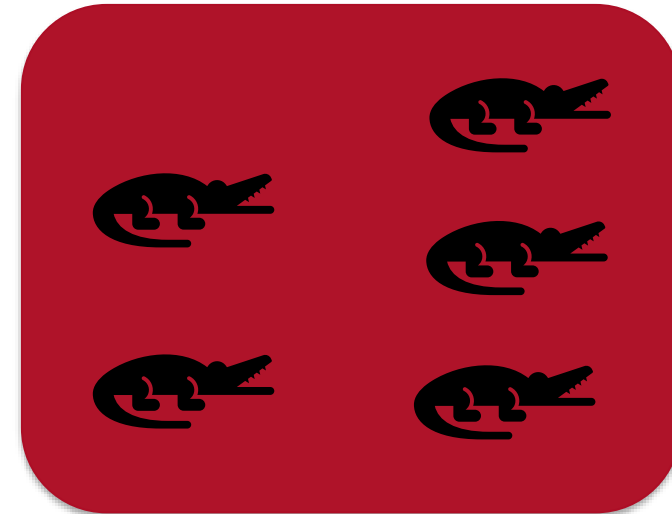
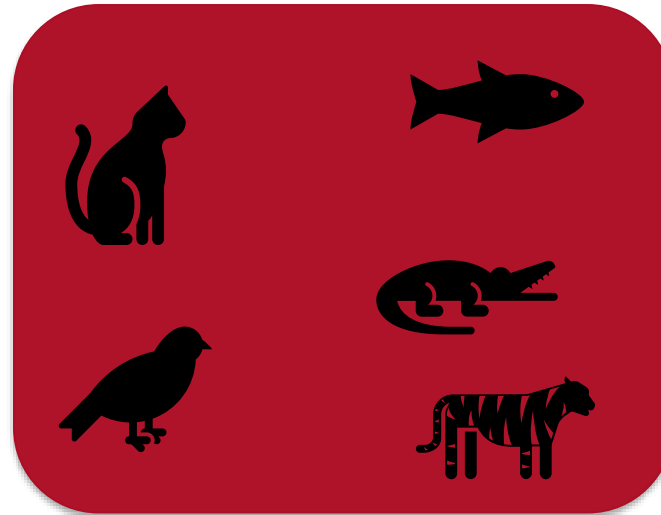


# The gut microbiome: The Force?



# Gut Microbiota Diversity

- Alpha diversity: measures the observed diversity for a given community
  - Comprised of:
    - Species richness (number)
    - Uniqueness (how many diff)
    - Evenness



# How Does the Gut Microbiome Influence Disease States?



# Key Microbiome Point

**Context** is key when reviewing microbiome associations- what is associated with cancer pathogenesis may not be the same mechanism as what's associated with cancer therapy



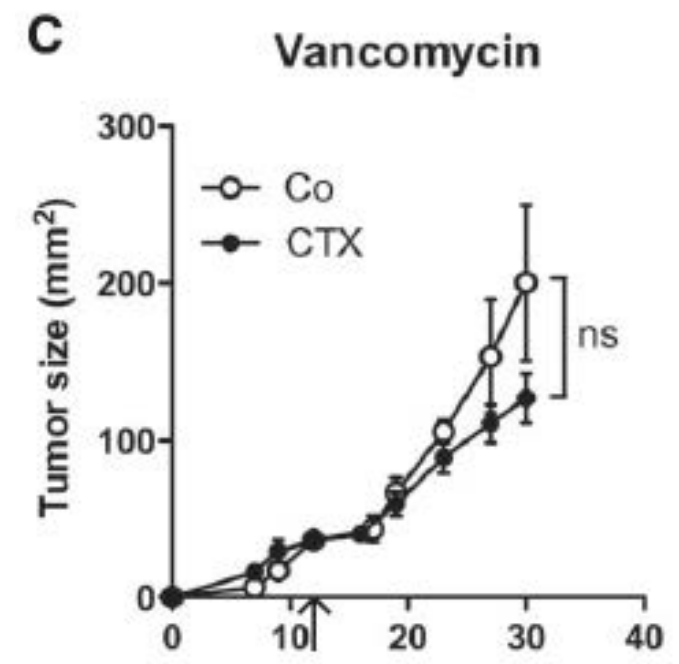
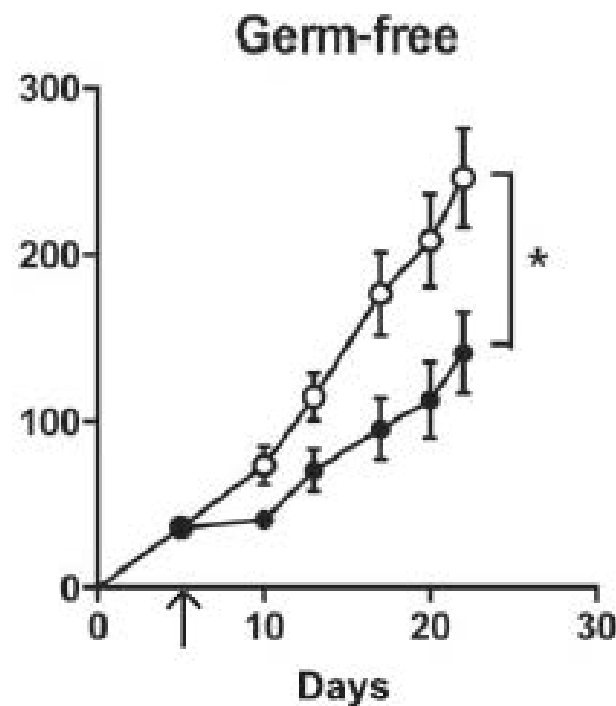
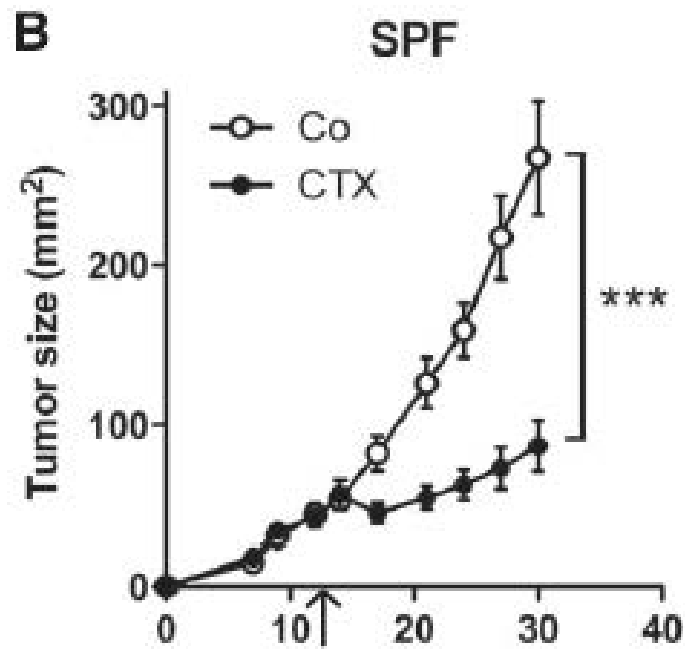
# **Microbiome – Immune – Cancer Axis Mechanisms**



# Gut Microbiome: Immune Activation

Cyclophosphamide: Viaud et al revealed that the gut microbiota is involved in the anti-neoplastic activity of cyclophosphamide

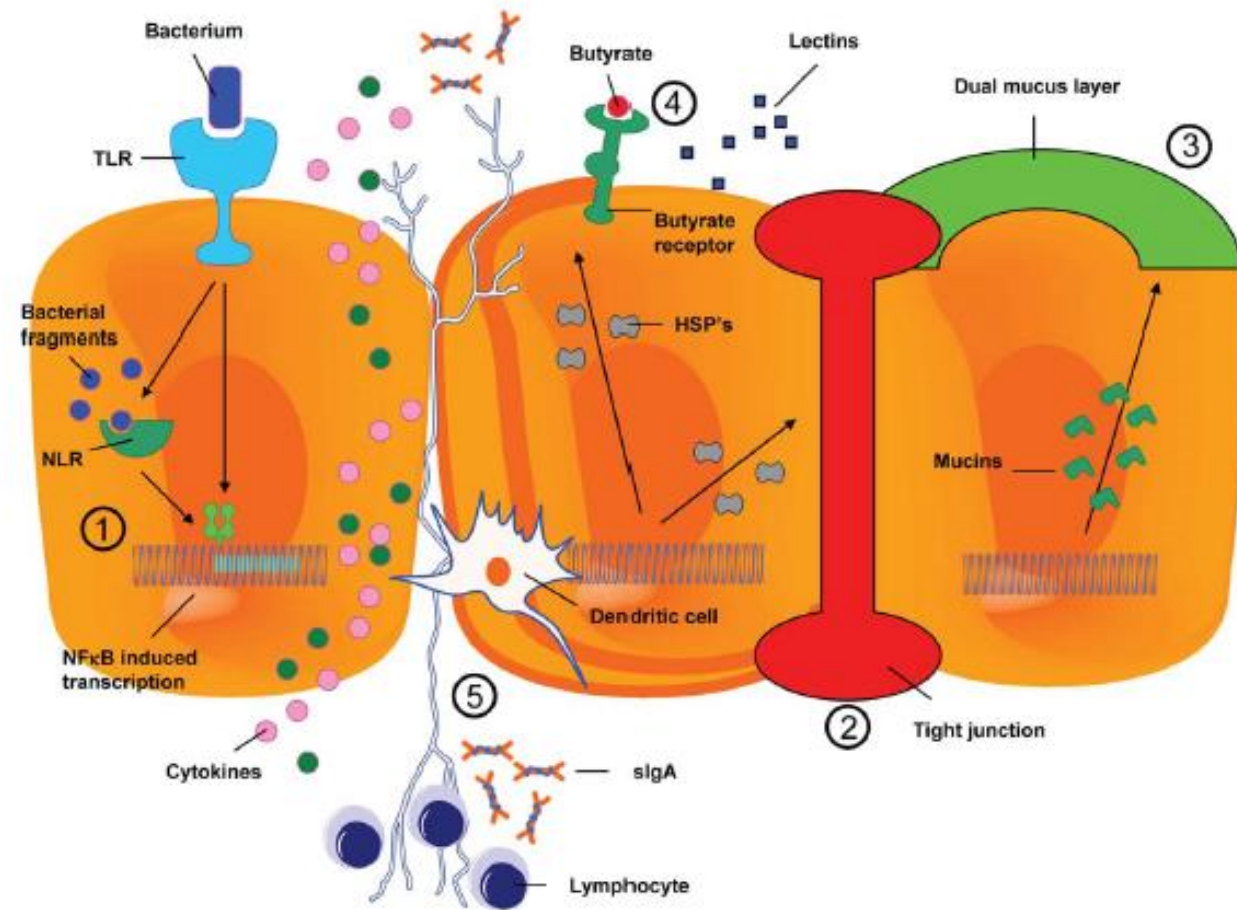
- traced to gut translocation of gram-positive species into nearby lymphoid organs, stimulating T-cell responses
- Similar observation for platinum agents



# **Role of Metabolites: Short Chain Fatty Acids**



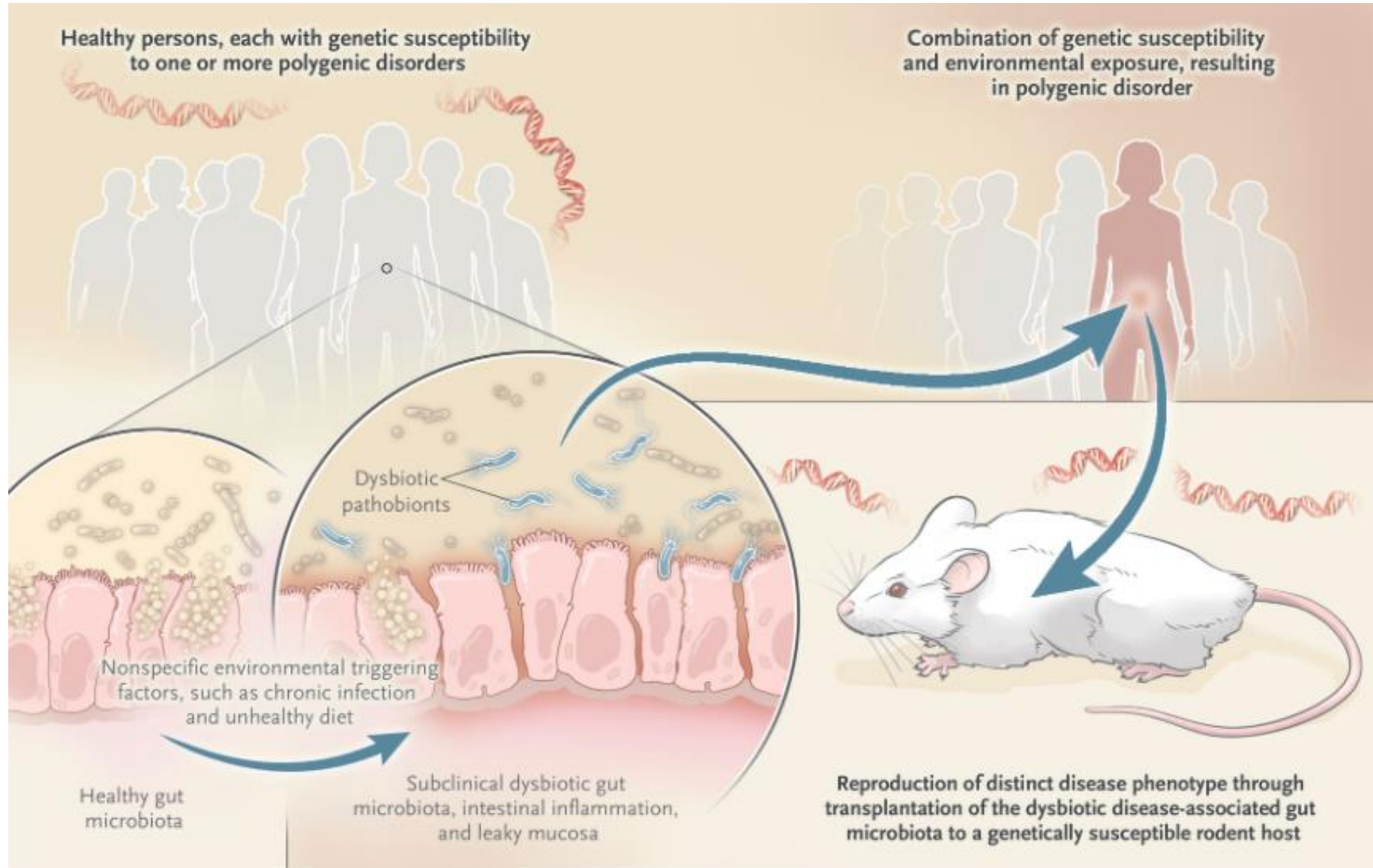
# Short Chain Fatty Acids and Intestinal Barrier



Van Vliet et al, PLoS Pathogens 2010

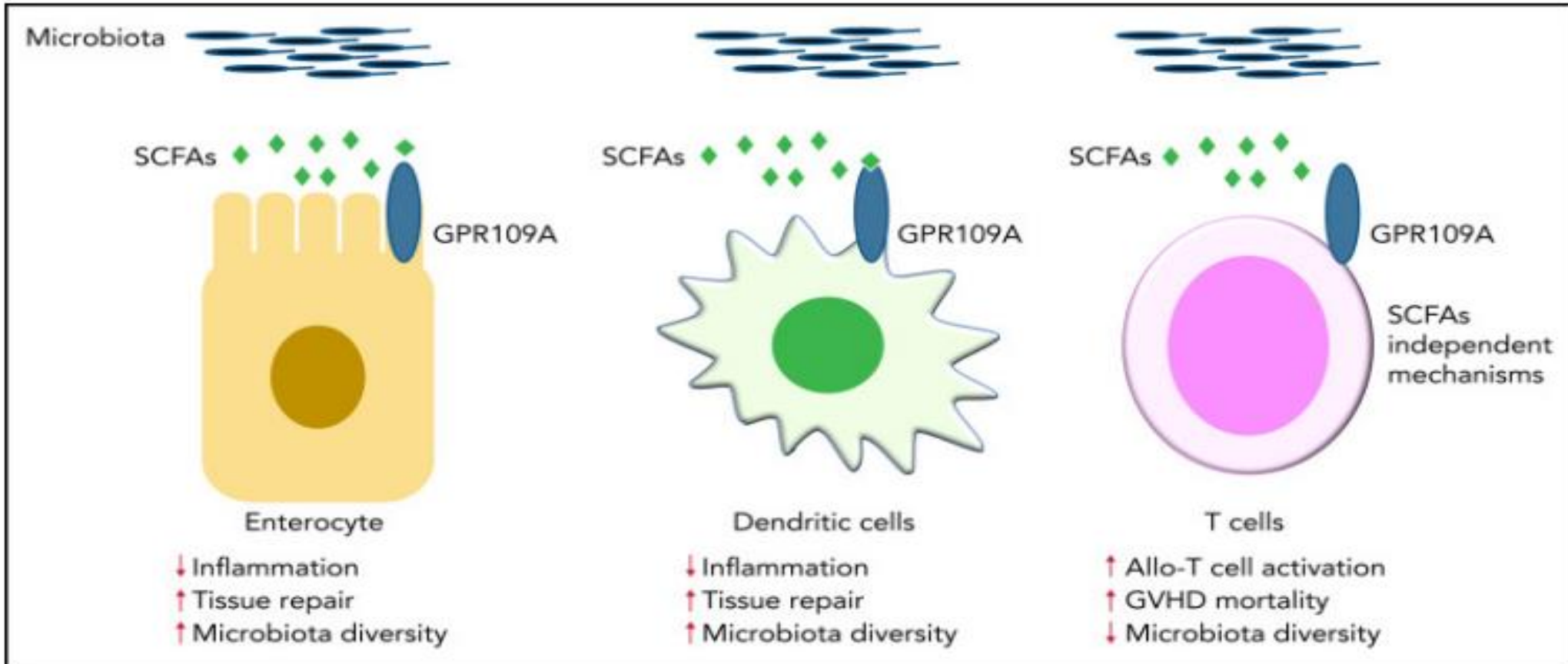


# Common Ground Hypothesis



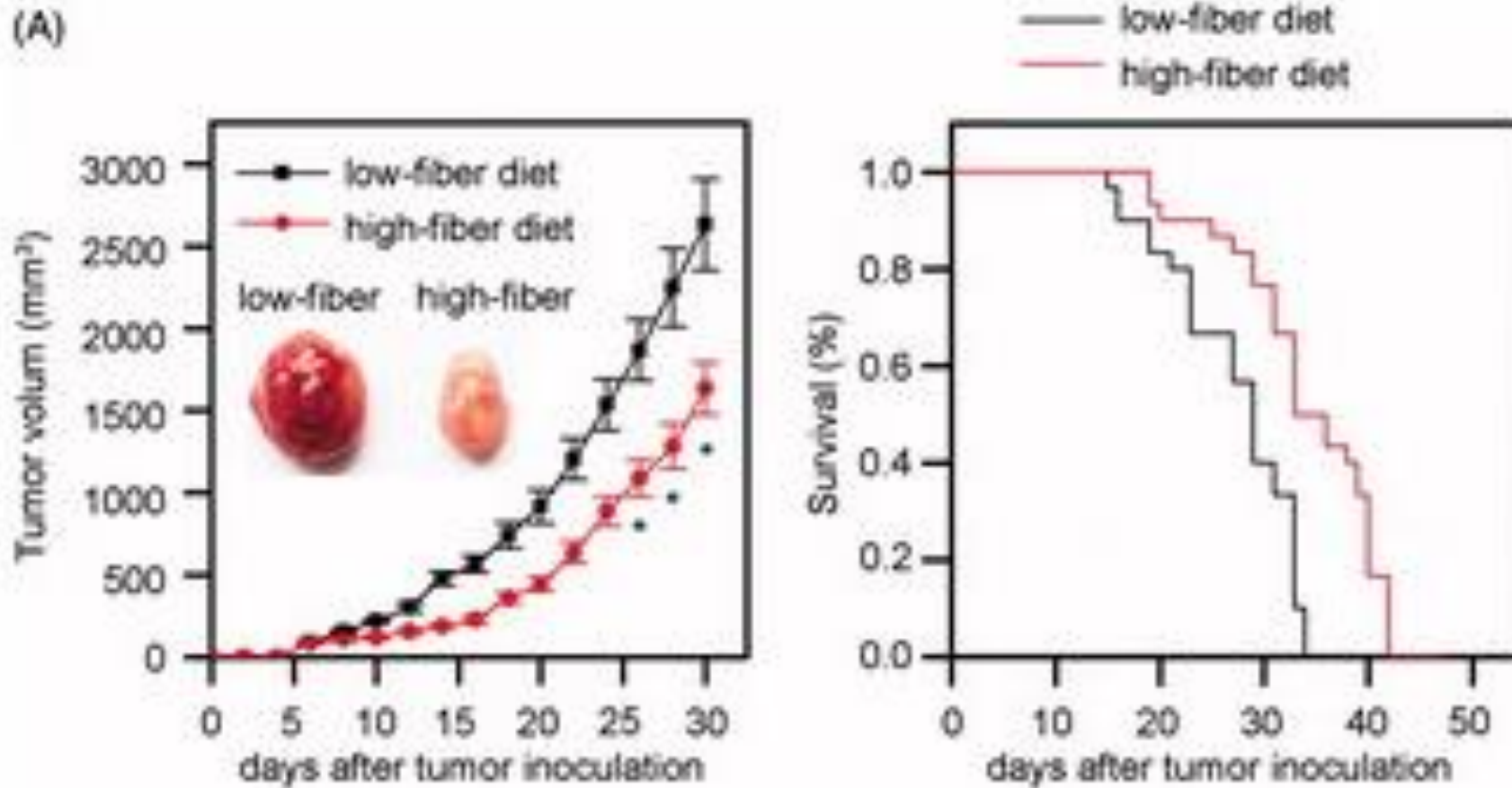
# Mechanism: Microbiome metabolites

## Short chain fatty acids (SCFA) : butyrate

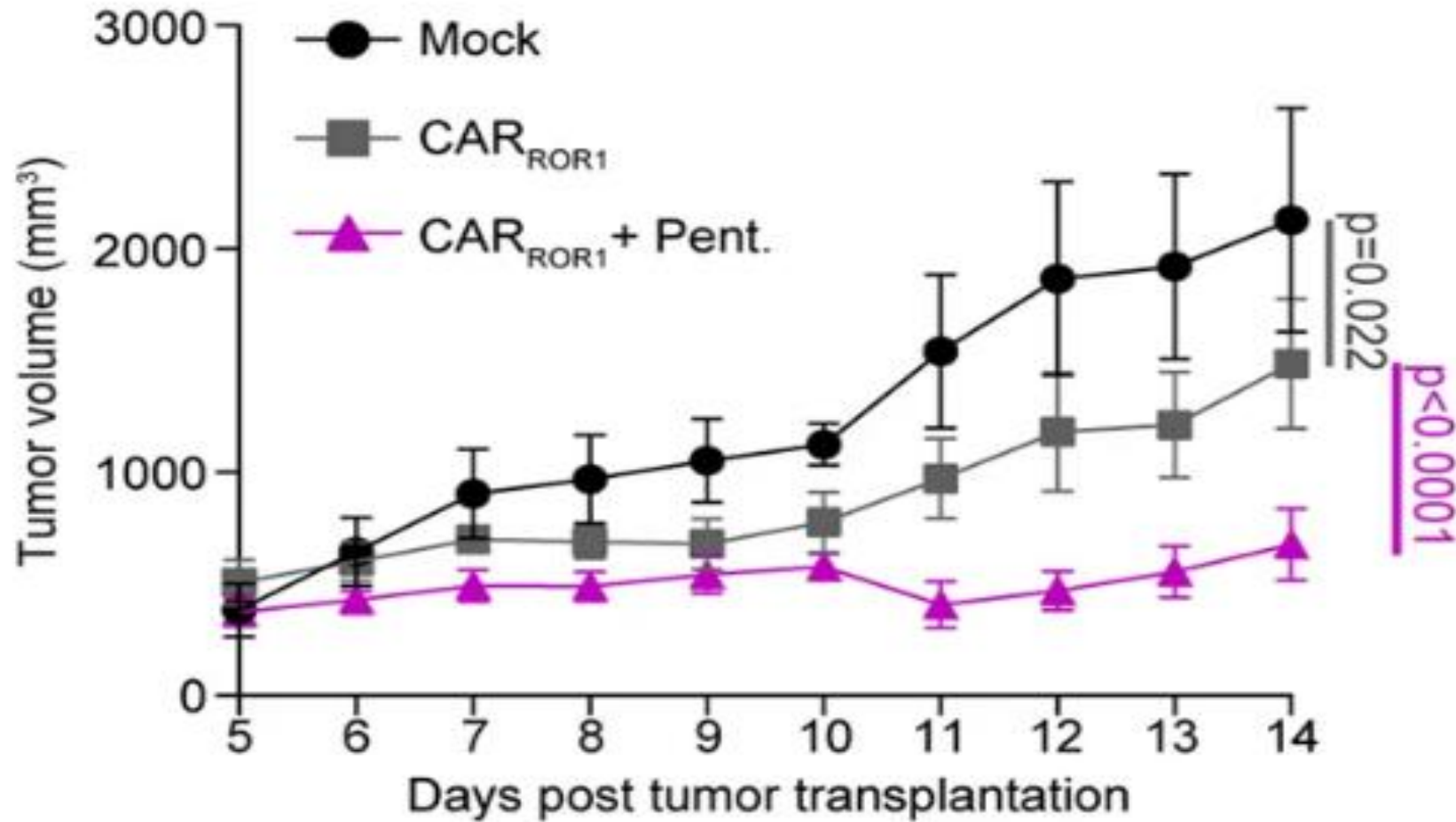


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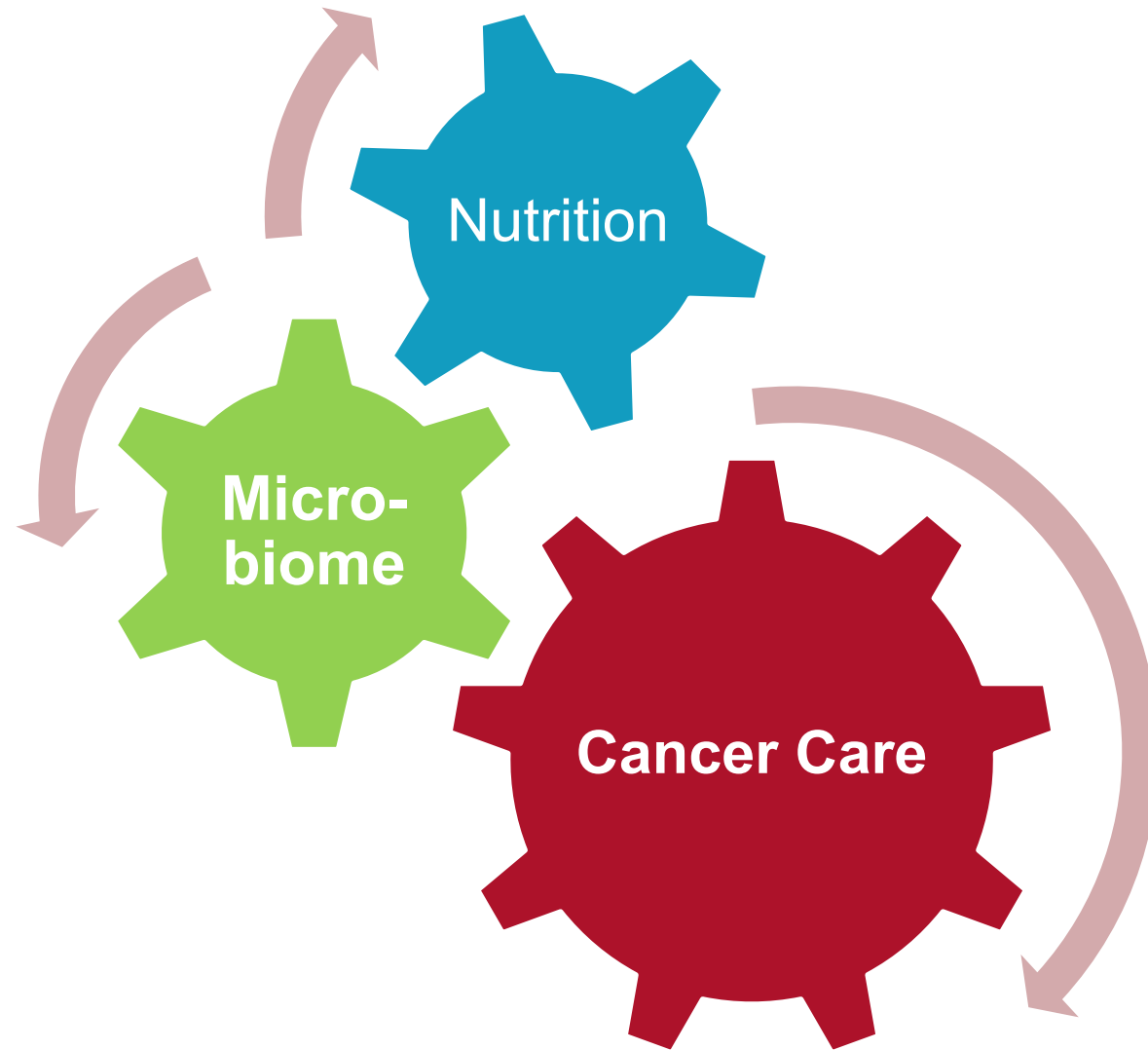
Short chain fatty acids (SCFA) : butyrate in lymphoma tumors



# Short-chain fatty acids can activate effector T-cell populations including CAR-T



# Nutrition, Microbiome, and Cancer Care

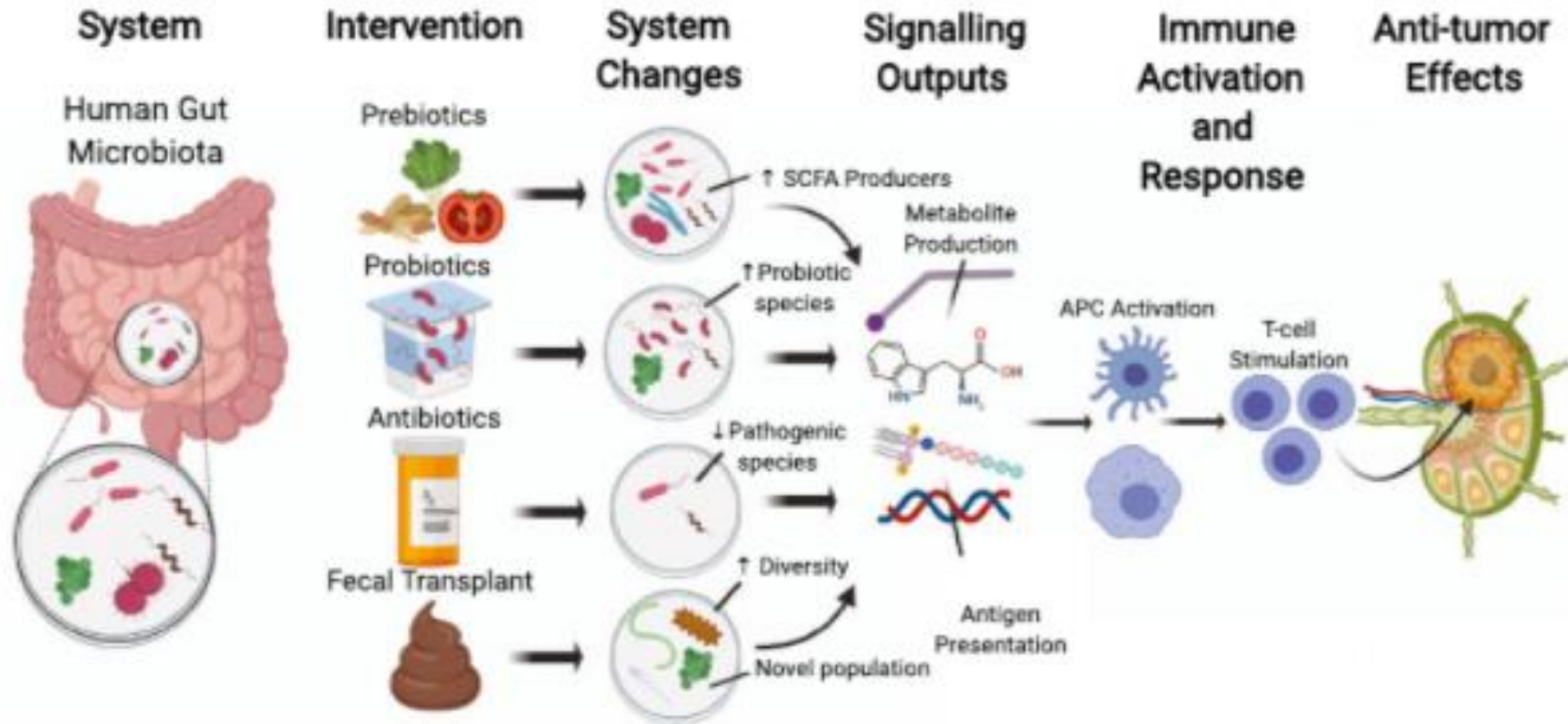


# Targeted Approaches to Modifying the Microbiome



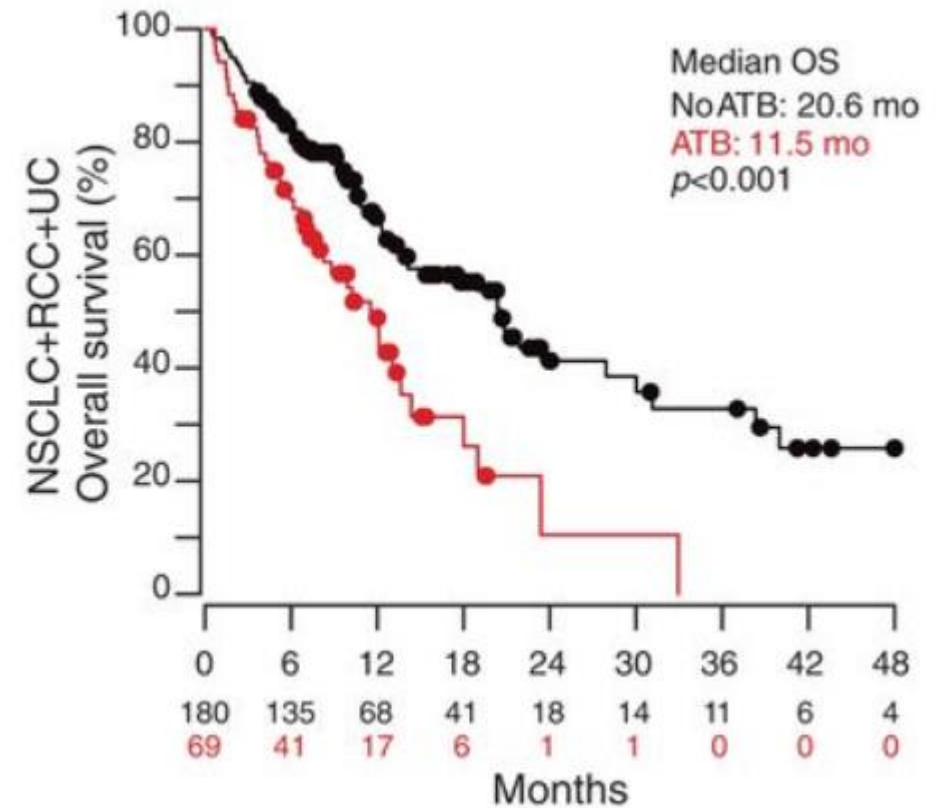
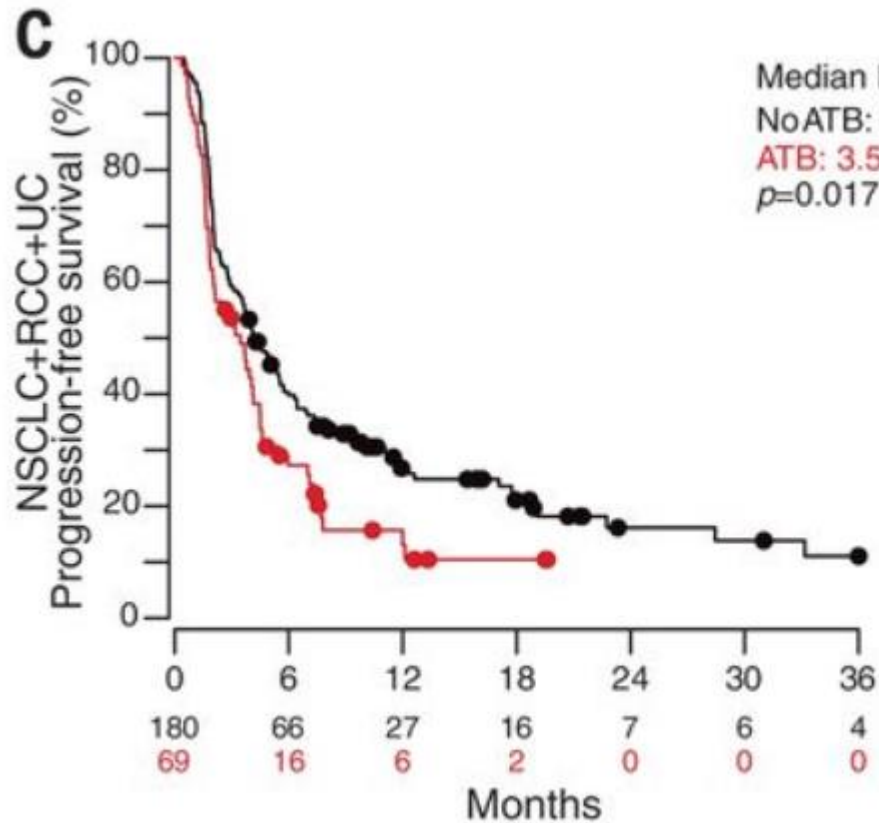
# Targeting Gut Microbiota

Microbiome Review in Heme Malignancies/D'Angelo et al



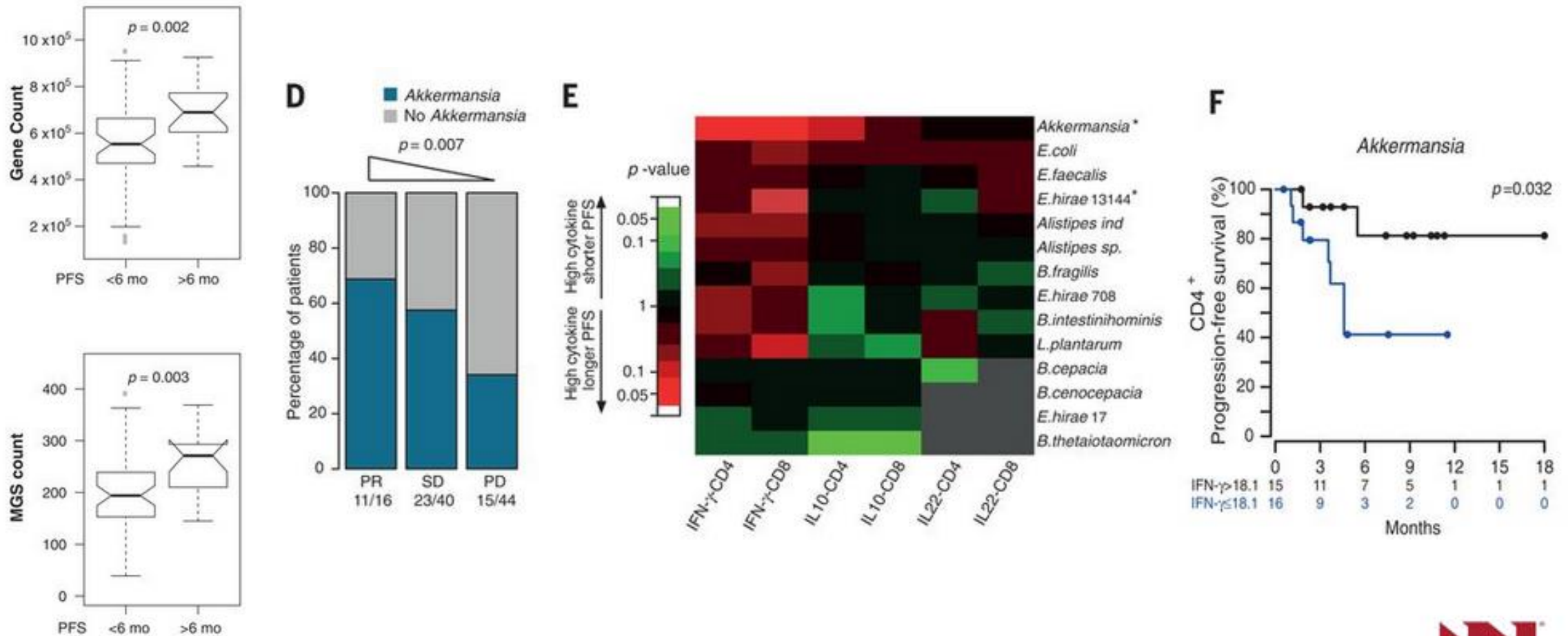
# Targeting Gut Microbiota: Antibiotics

- In context of cancer immunotherapy- antibiotics may be harmful: PD-1 Inhibitor

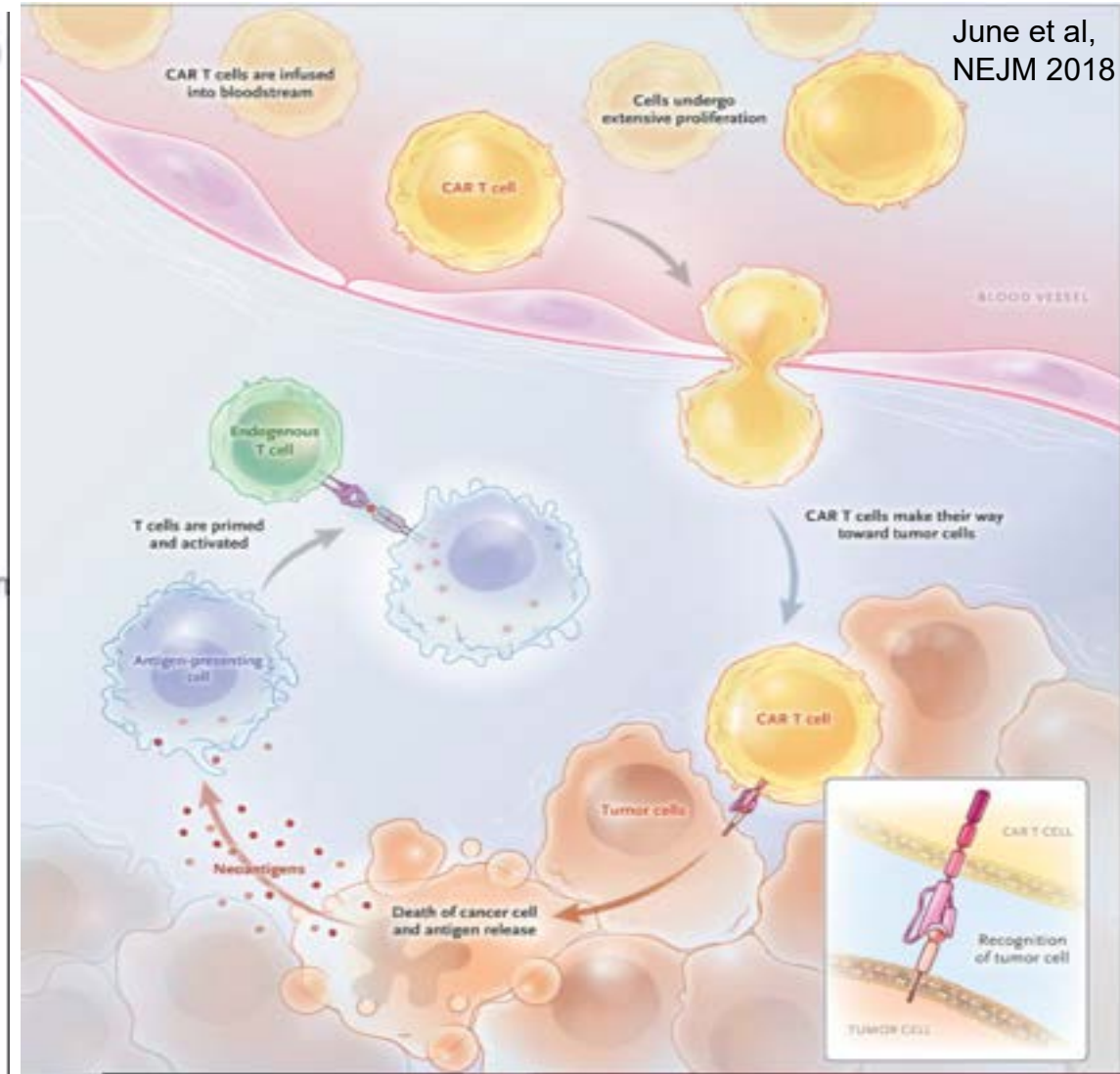
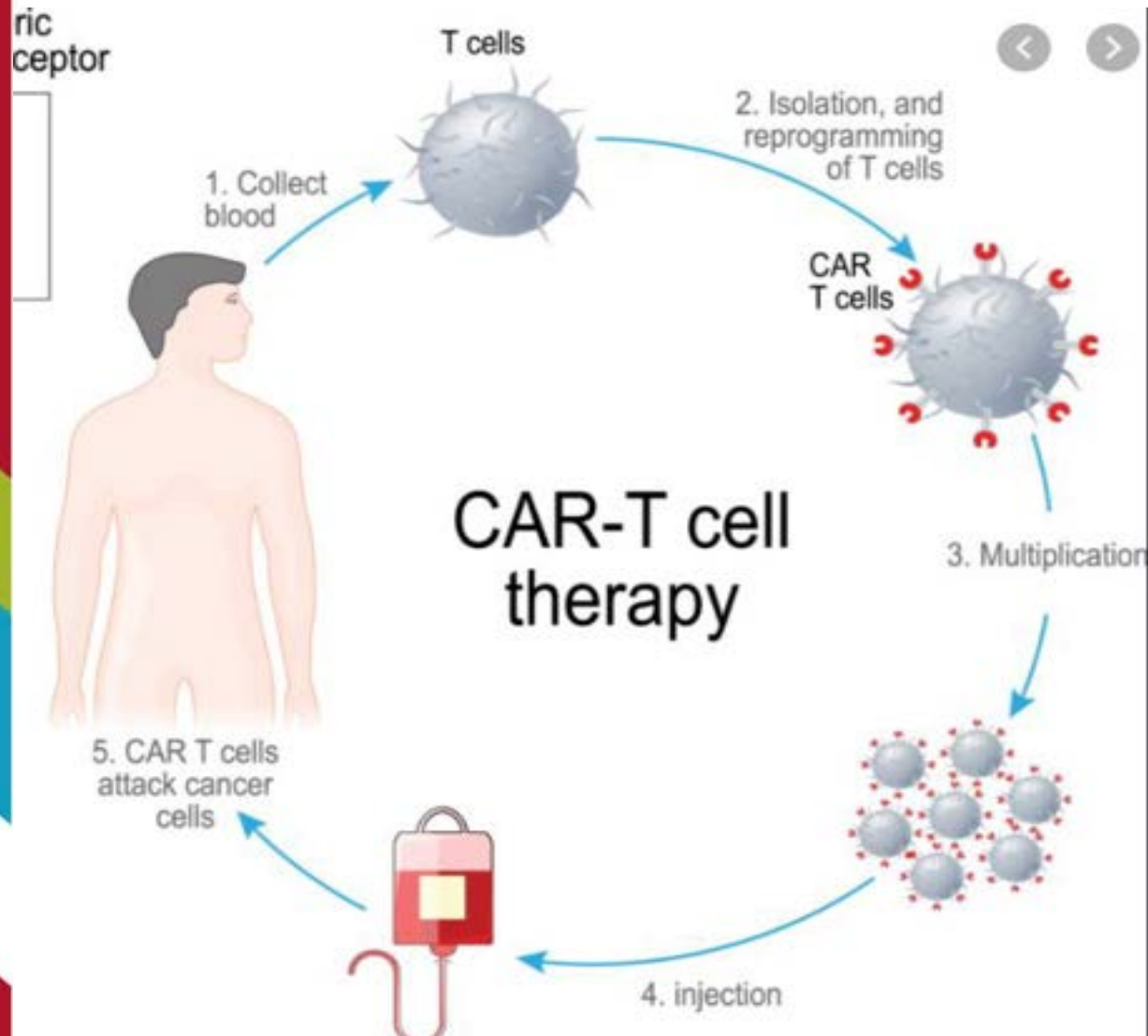


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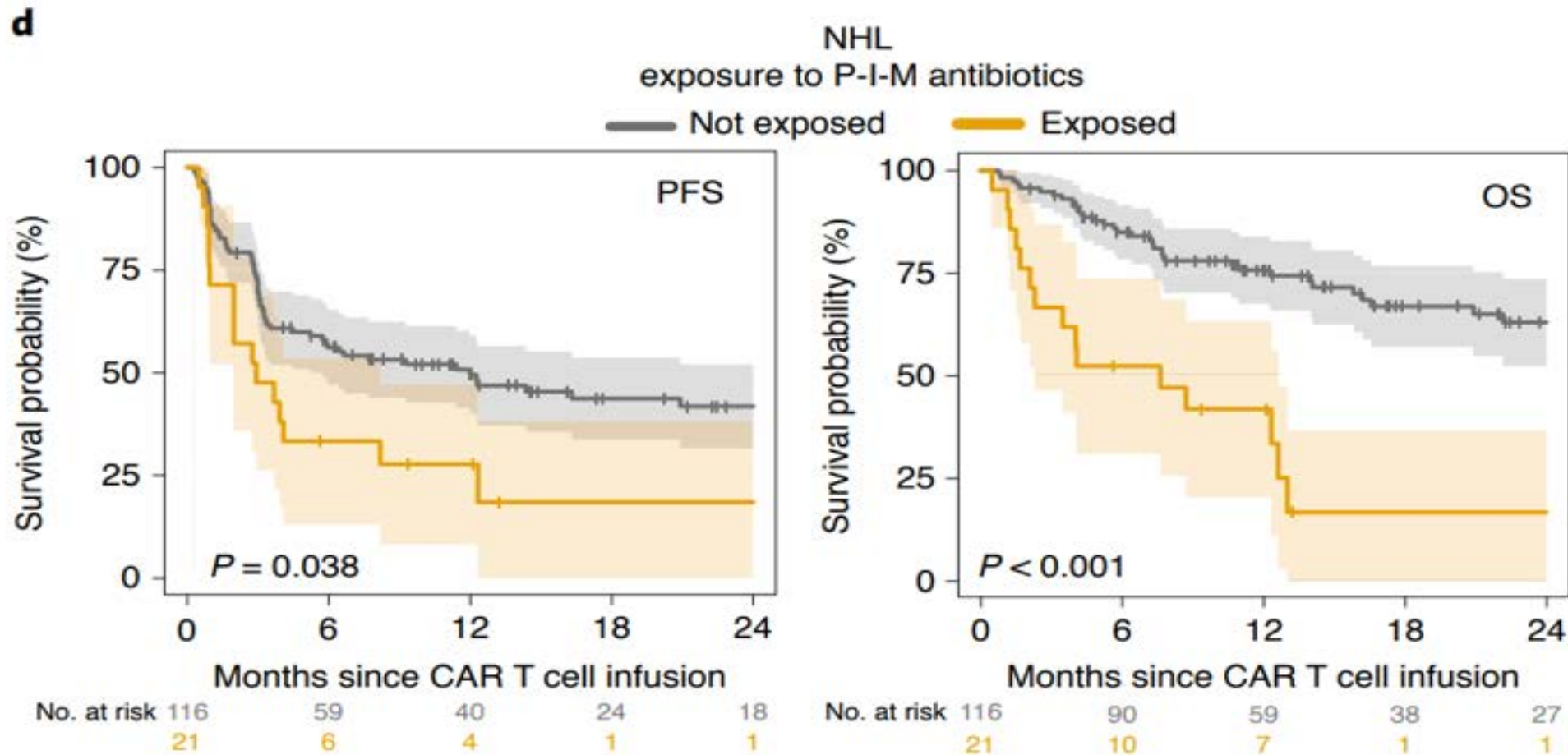


# CAR T: chimeric antigen receptor: immunotherapy



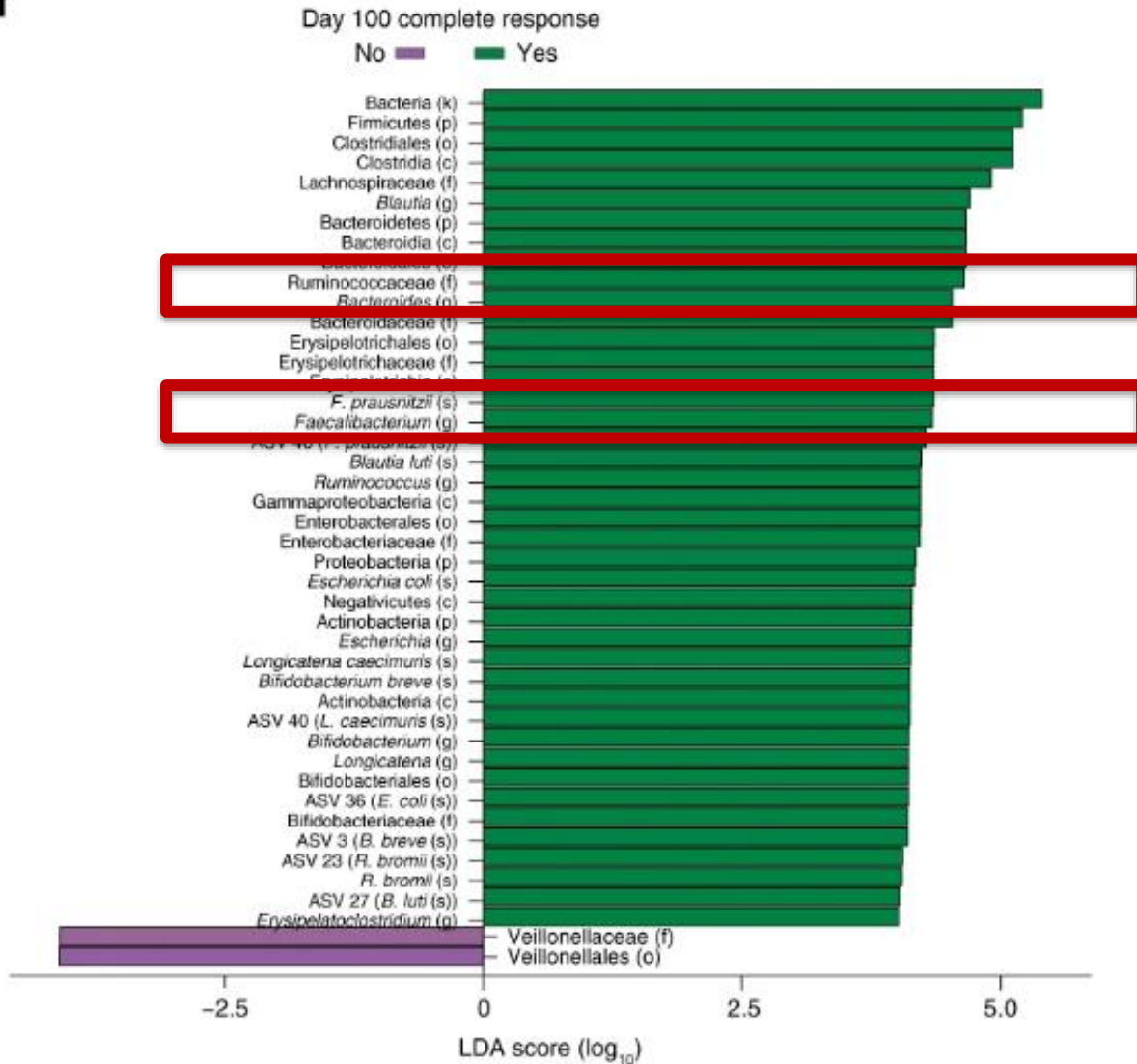
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- In context of cancer immunotherapy- antibiotics may be harmful: **CAR T**

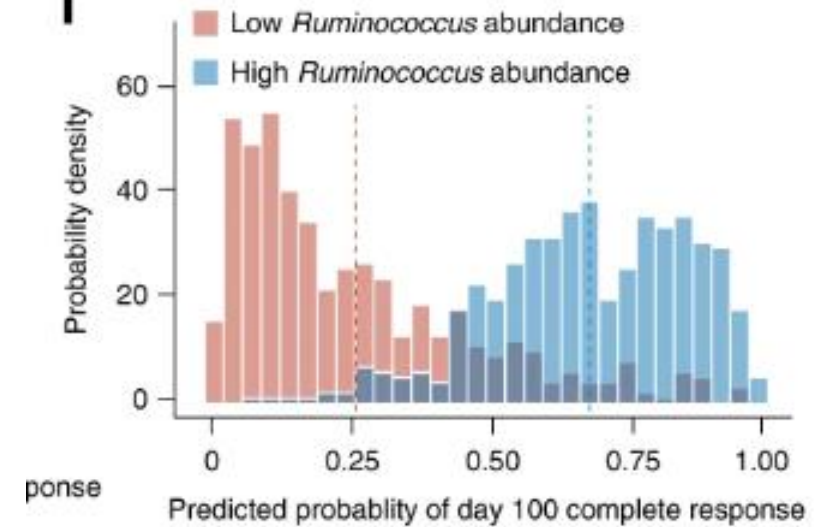


# CAR-T and Microbiome

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# Antibiotics, Microbiome, Cancer Growth

- In context of cancer growth, antibiotics may be helpful?



# Multiple Myeloma

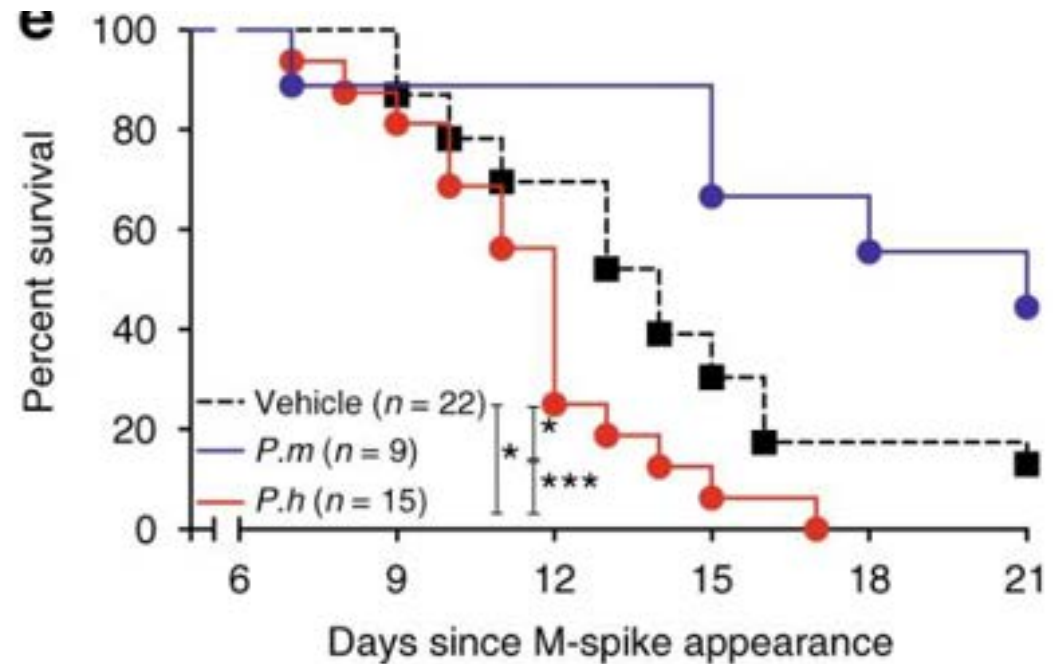
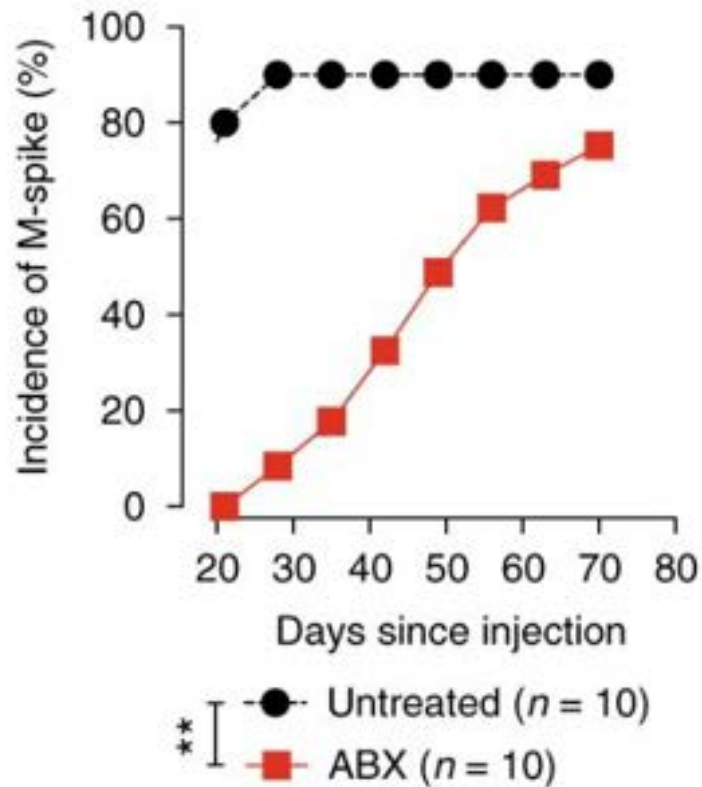
- An incurable cancer of plasma cells (differentiated B-cells) with a median prognosis approaching 10+ years
- Preceded by MGUS (the colon polyp of myeloma)
- Lytic bone disease, renal failure, anemia, calcium+
- Standard of care: **induction (3-4 drugs) -> auto-stem cell transplant**



# Progression of Myeloma

- In context of cancer pathogenesis antibiotics may be helpful?:

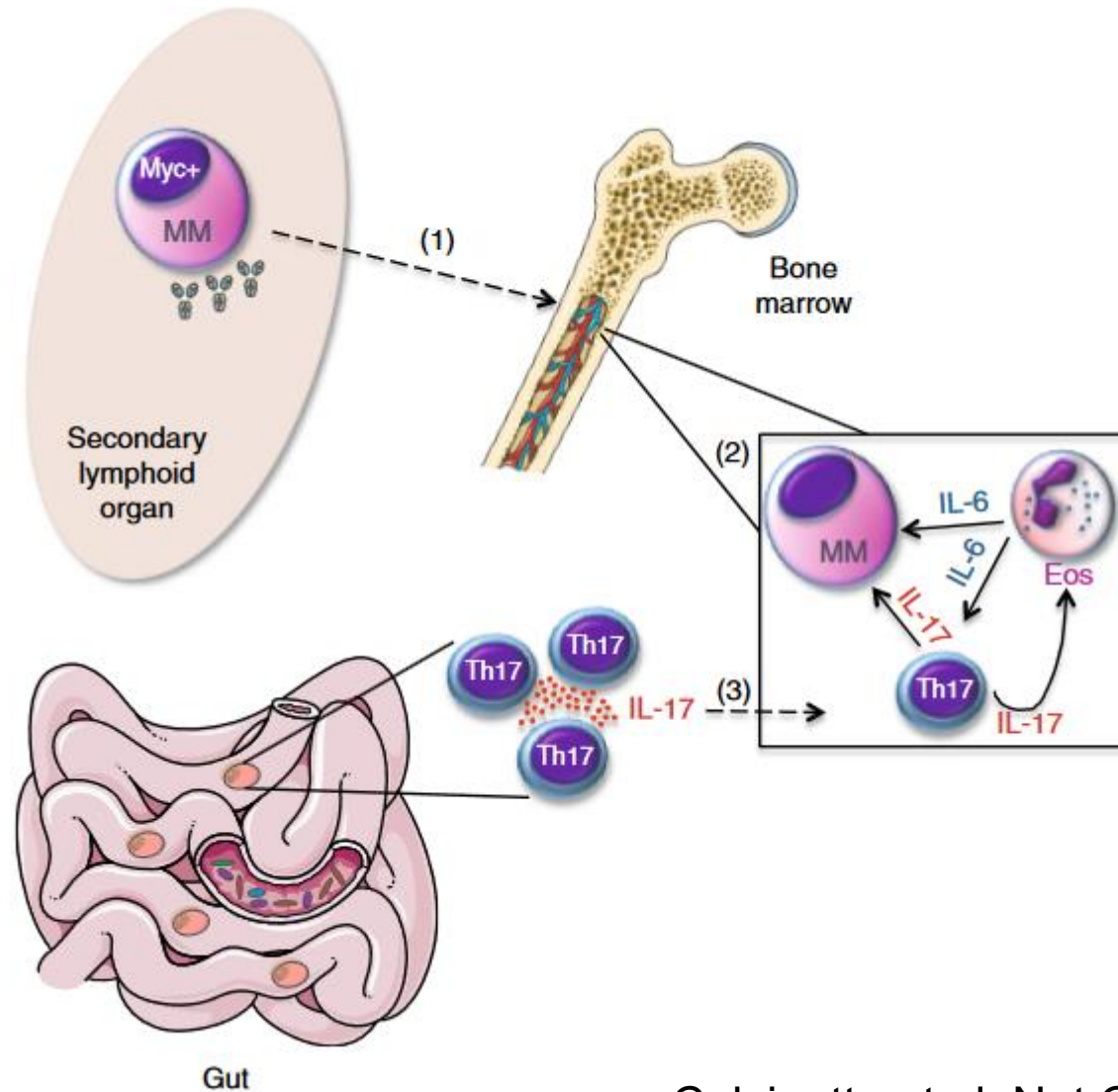
- mouse model
- Antibiotics delayed progression
- Traced to gut microbiome presence of *Prevotella heparinolytica*



Calcinotto et al, Nature Communications, 2018

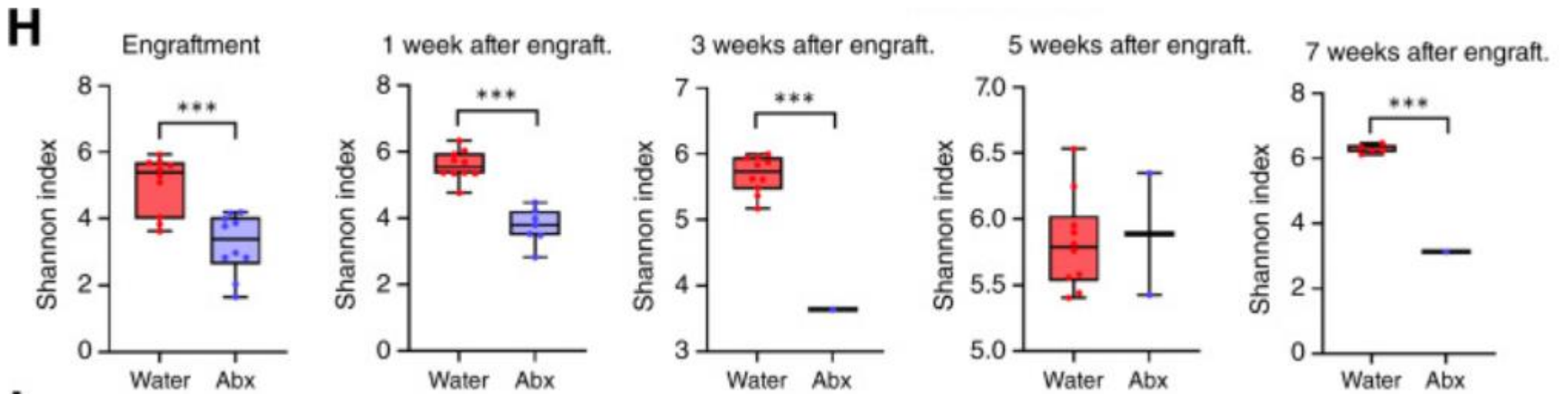
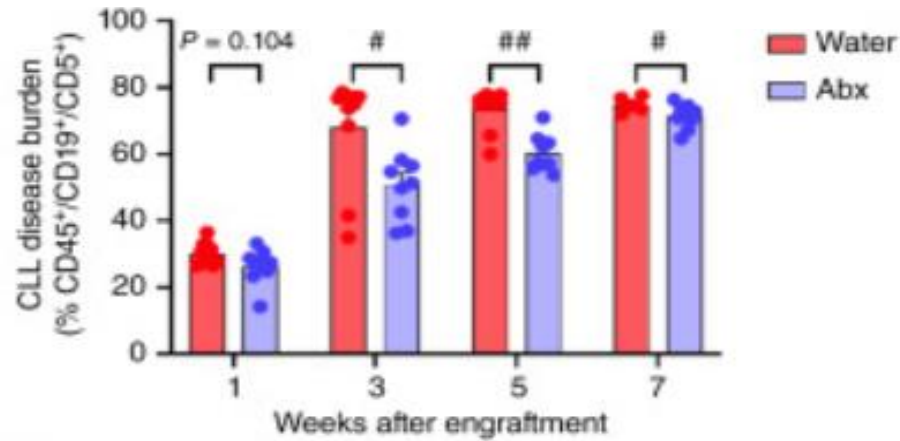


# Multiple Myeloma and The Microbiome

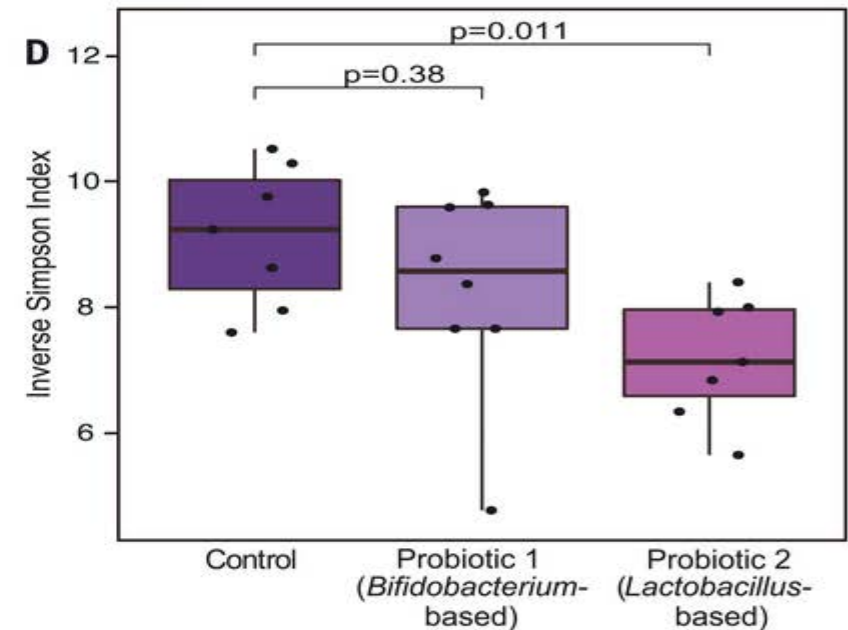
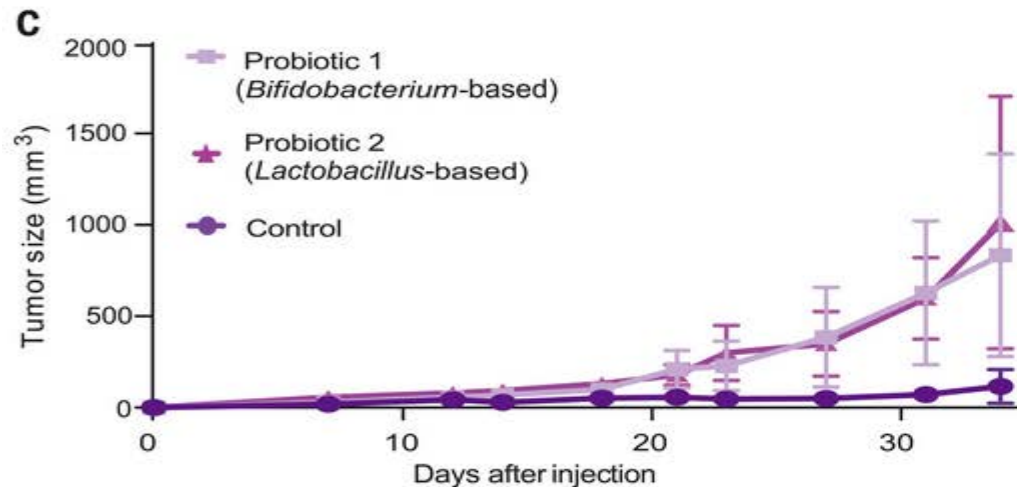
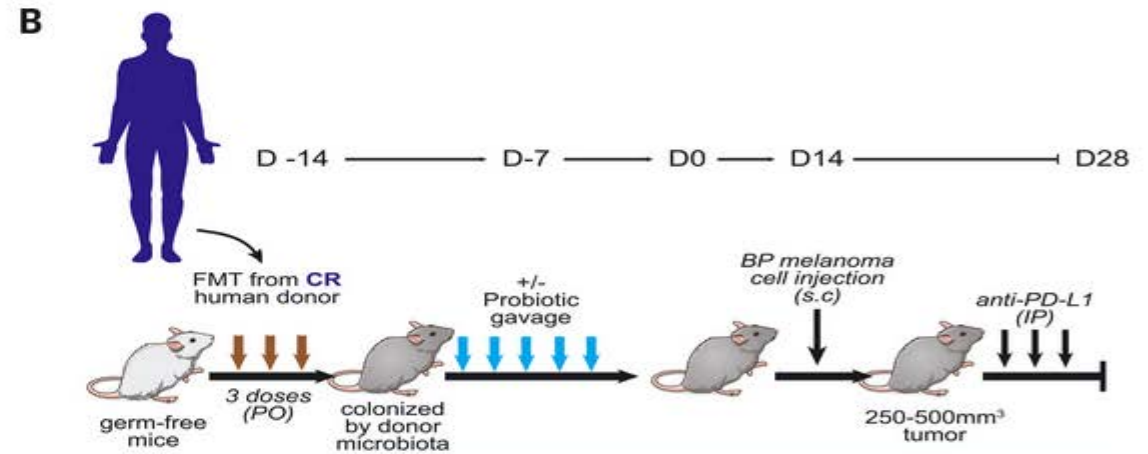
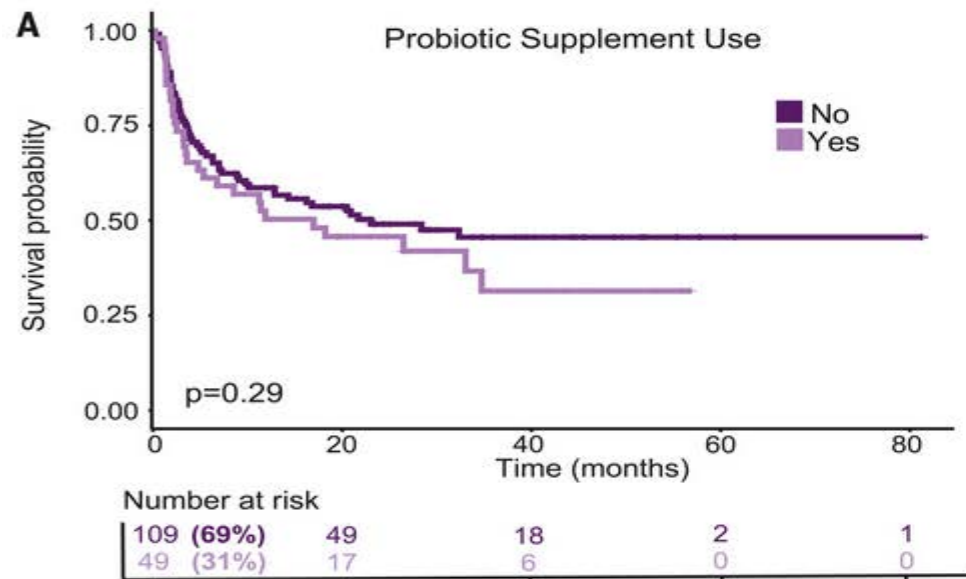


# Antibiotic Ablation of the Gut Microbiome Reduces CLL Progression

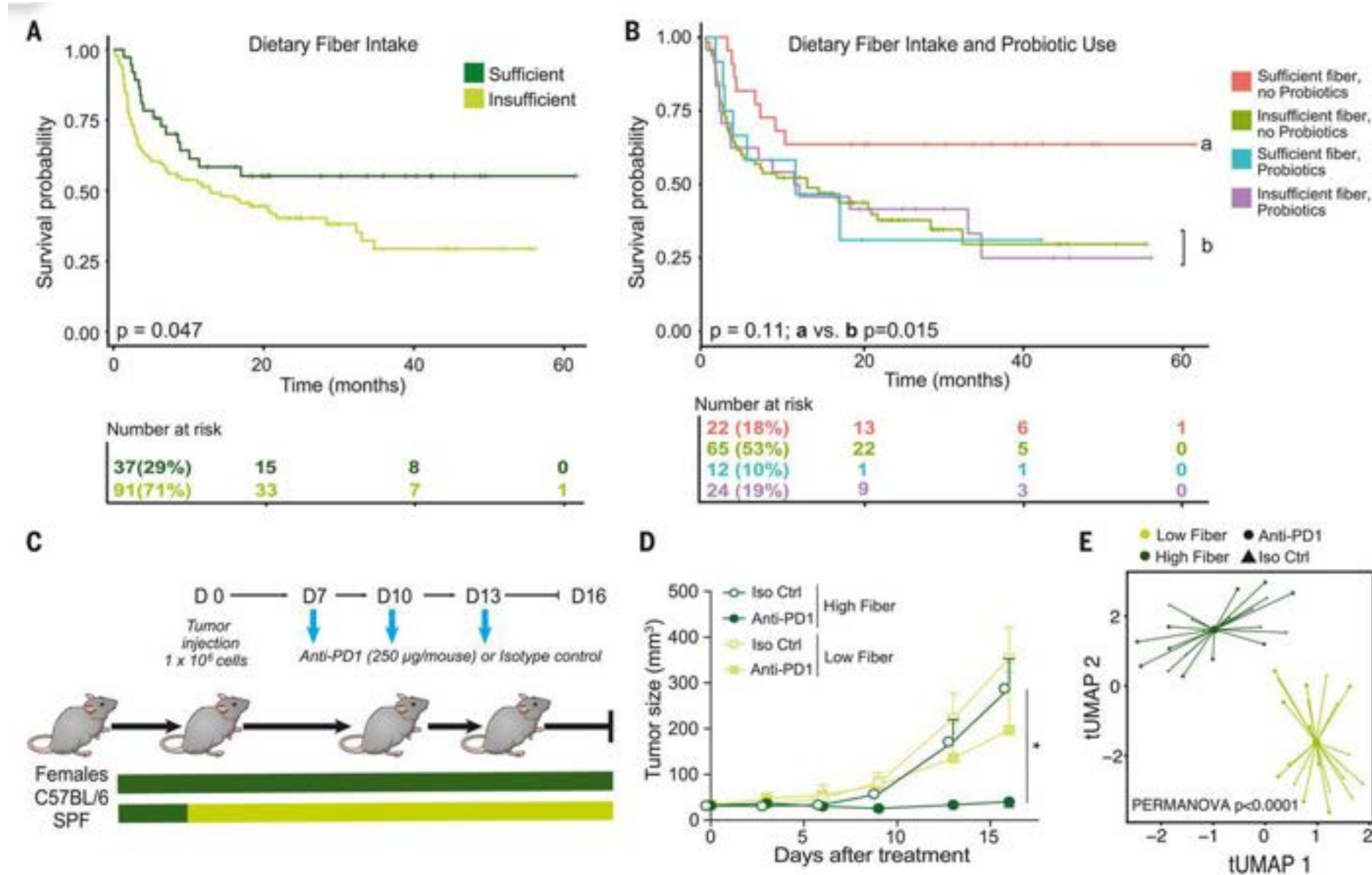
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# Targeting Gut Microbiota: Probiotics

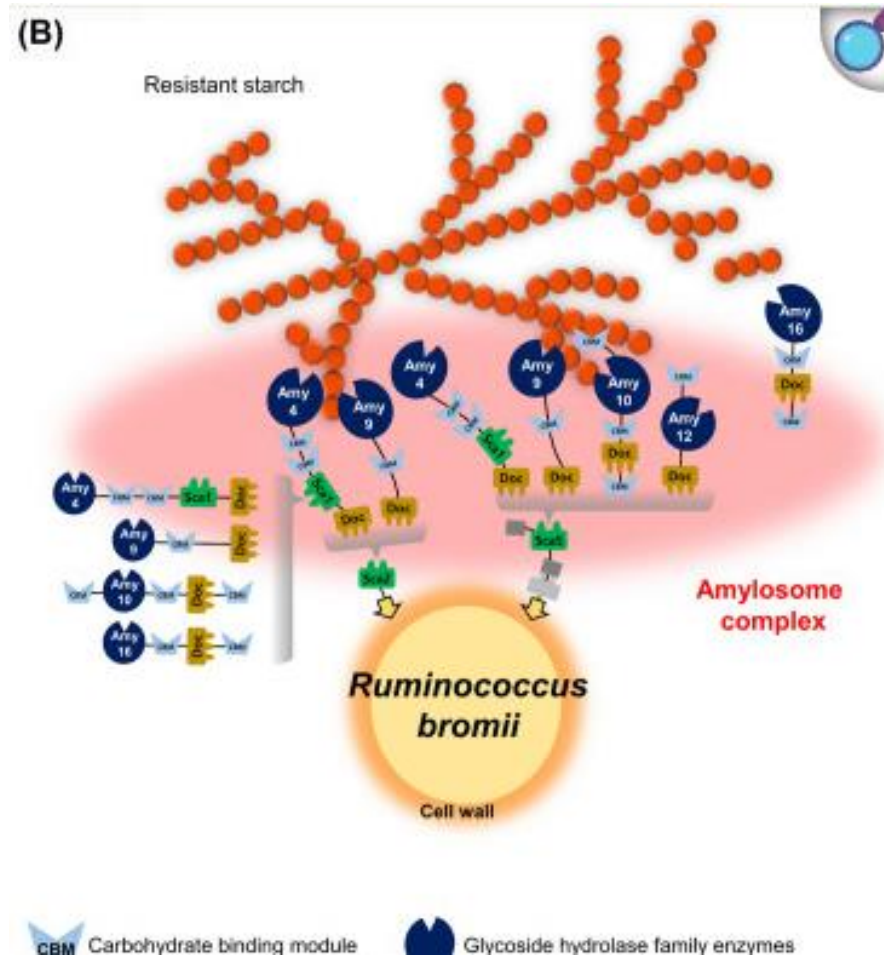


# Targeting Gut Microbiota: Prebiotics



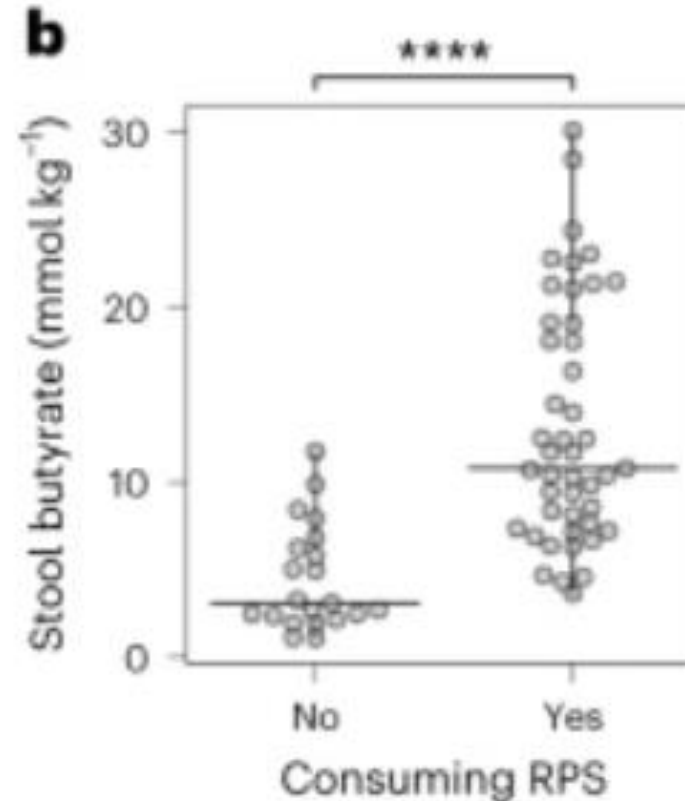
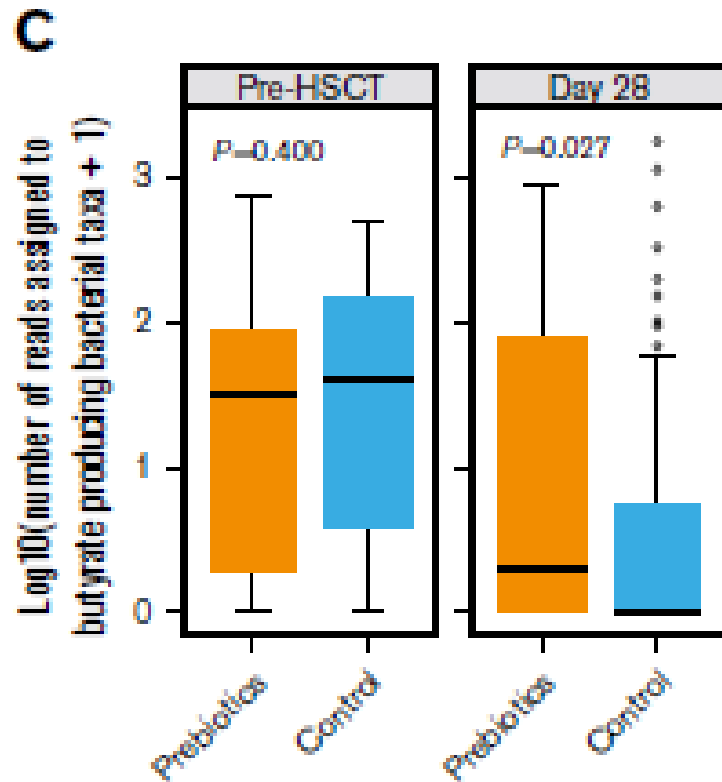
# Targeting microbiome: prebiotic -> Resistant Starch

- Degraded by ruminococcus + others species that serves as SCFA source for other gut microbes



# Targeting microbiome: prebiotic -> Resistant Starch

- Traits: inc butyrate, inc probiotic populations (bifidobacterium)
- Bob's Red Mill Potato starch



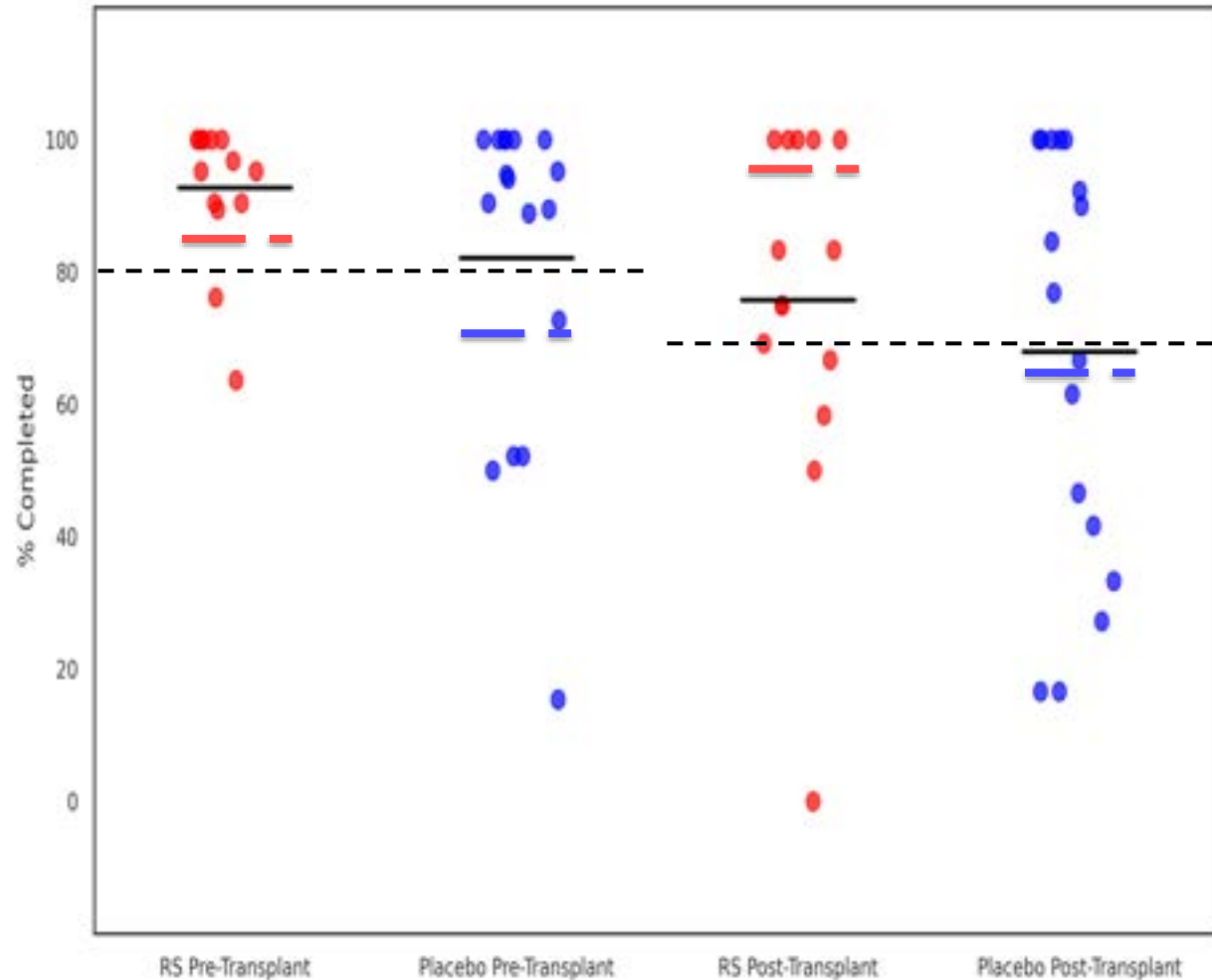
# Targeting Gut Microbiota: Prebiotics

- PRIMAL Trial
  - An IIT developed at UNMC
  - Using prebiotic (resistant starch) to prime the microbiome during auto transplant
  - New cohort open now for CAR T-cell recipients



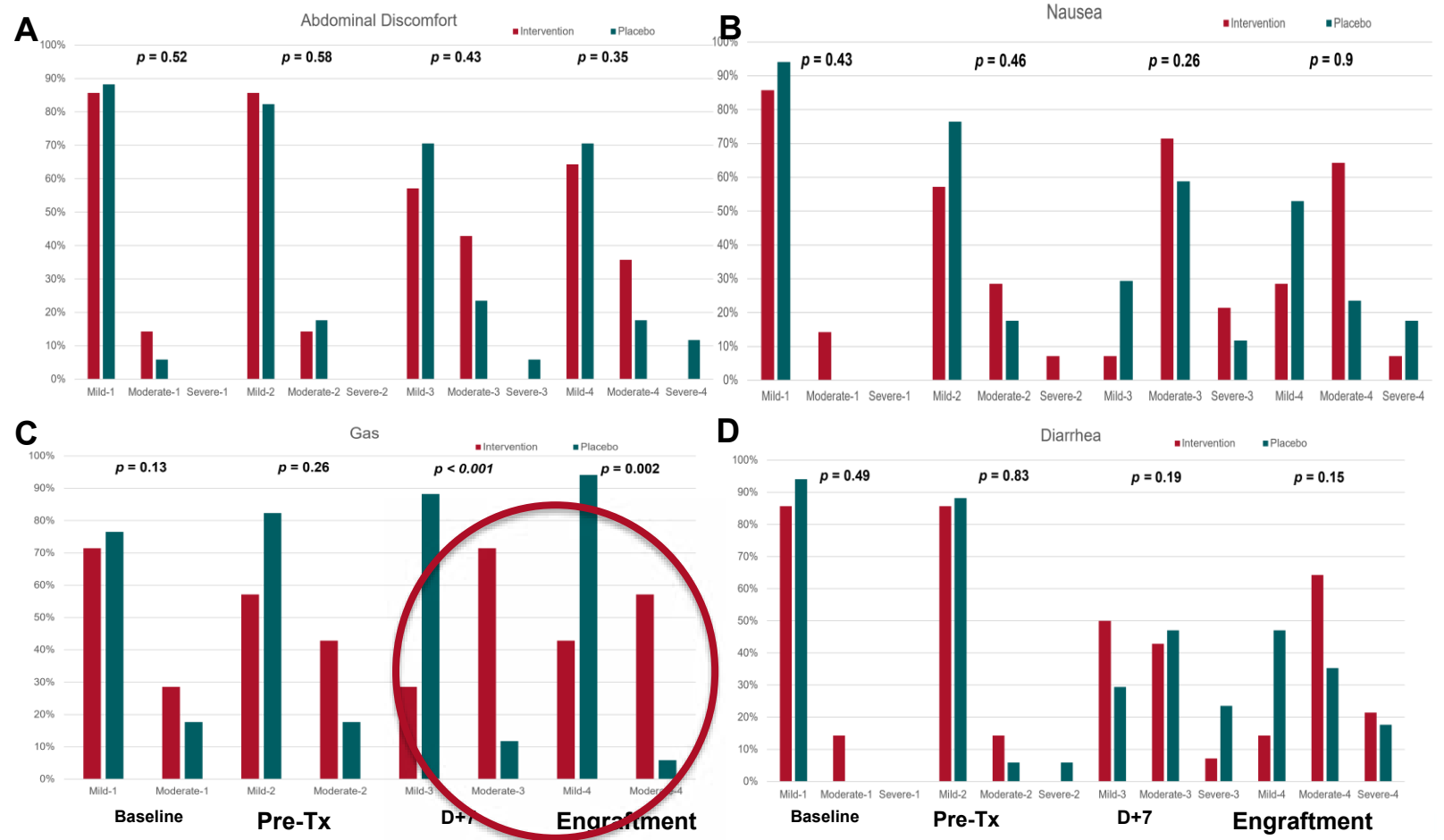
# PRIMAL feasibility

RS exposure exceeded pre-defined feasibility thresholds



# PRIMAL tolerability

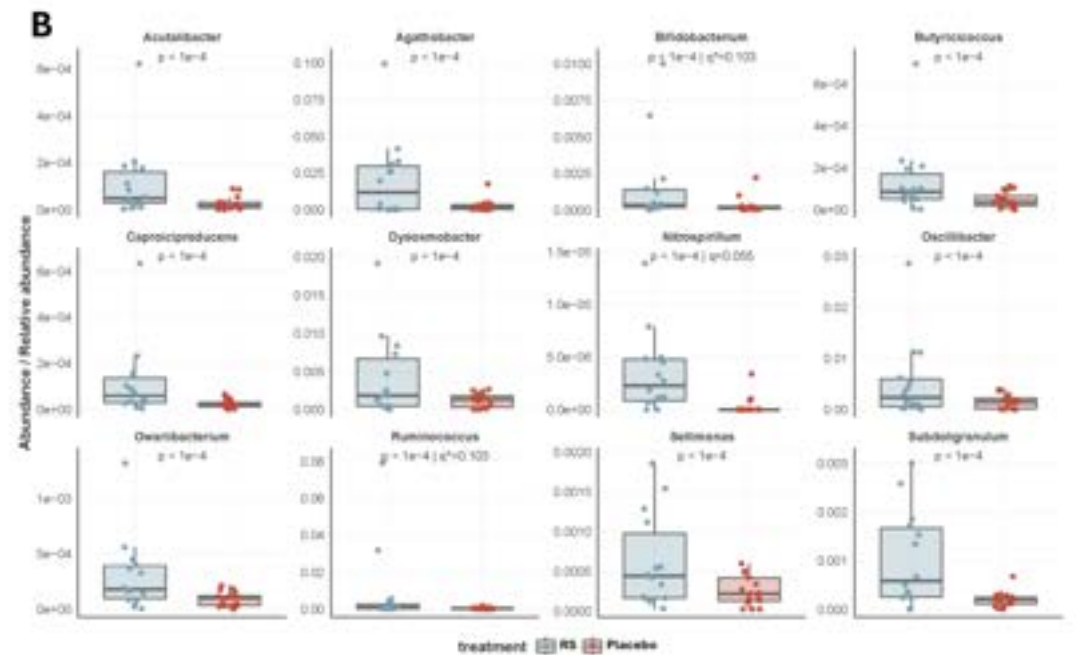
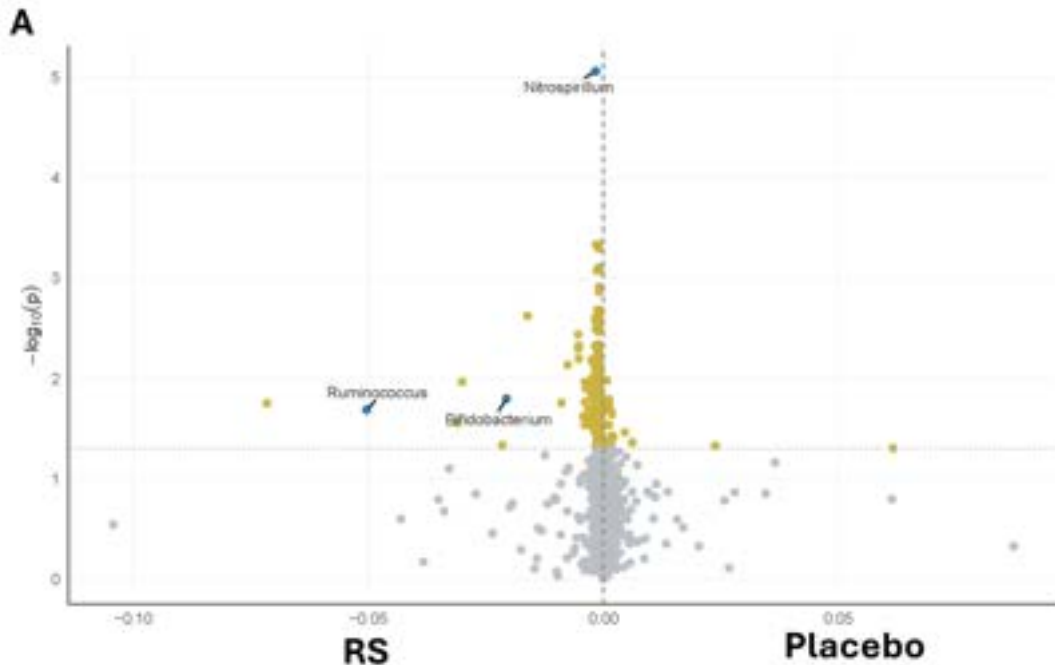
RS was well tolerated....  
Except for gas



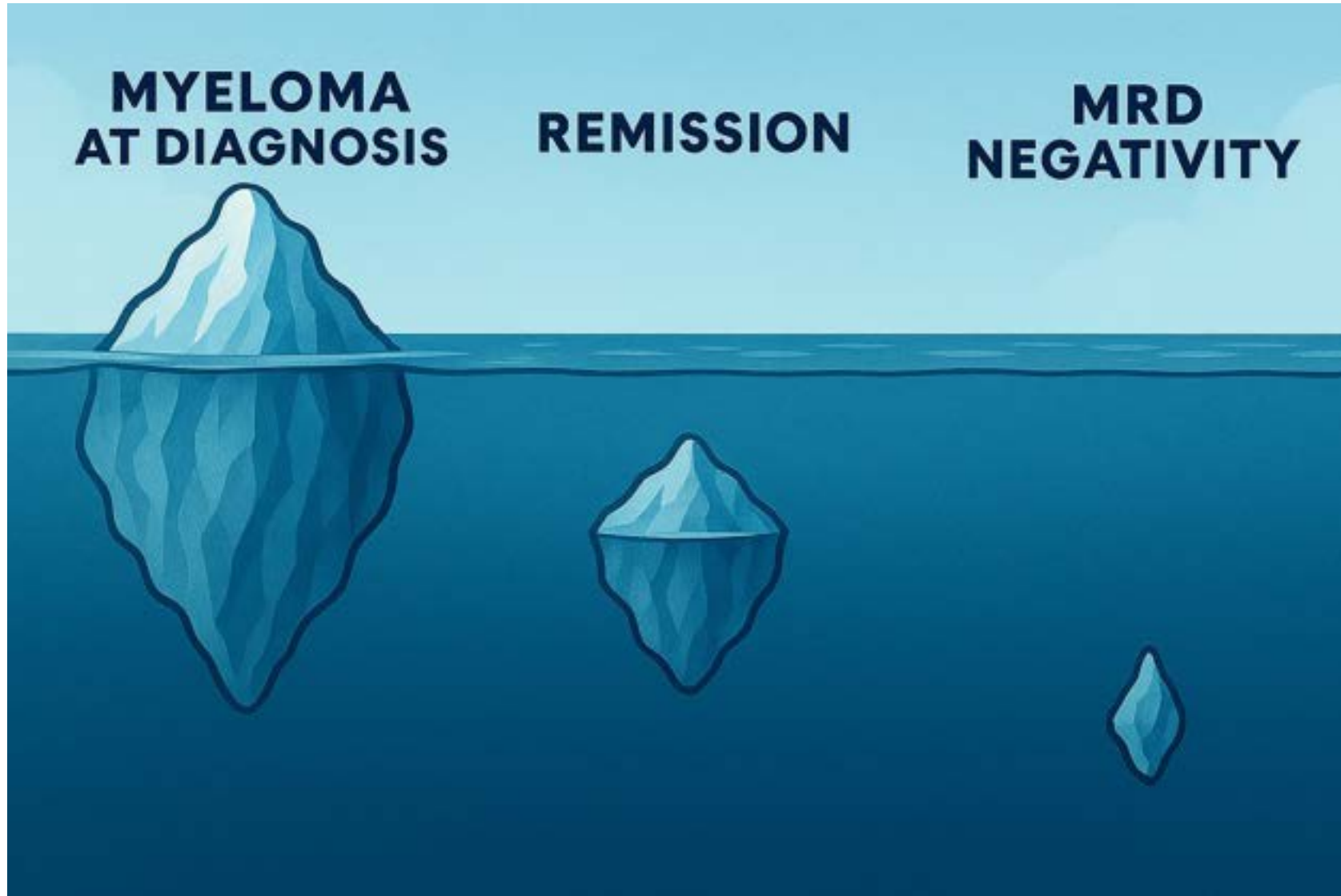
# PRIMAL efficacy

Post transplant improvements in RS degraders, butyrate producers, beneficial microbes- many associated with health improvements in other studies

D+7 Timepoint



# Measurable Residual Disease and Myeloma



# Microbiome and sustained MRD

## A. Diversity

Variable	OR (95% CI)	P-value
$\alpha$ -Diversity	1.02 (1.01-1.04)	0.004
Transplant (Yes vs No)	0.93 (0.68-1.26)	0.62
Age (>65 vs 65<)	0.82 (0.61-1.1)	0.2
Gender (M vs F)	1.06 (0.78-1.43)	0.72
Cytogenetics (S vs H)	1.24 (0.92-1.67)	0.17

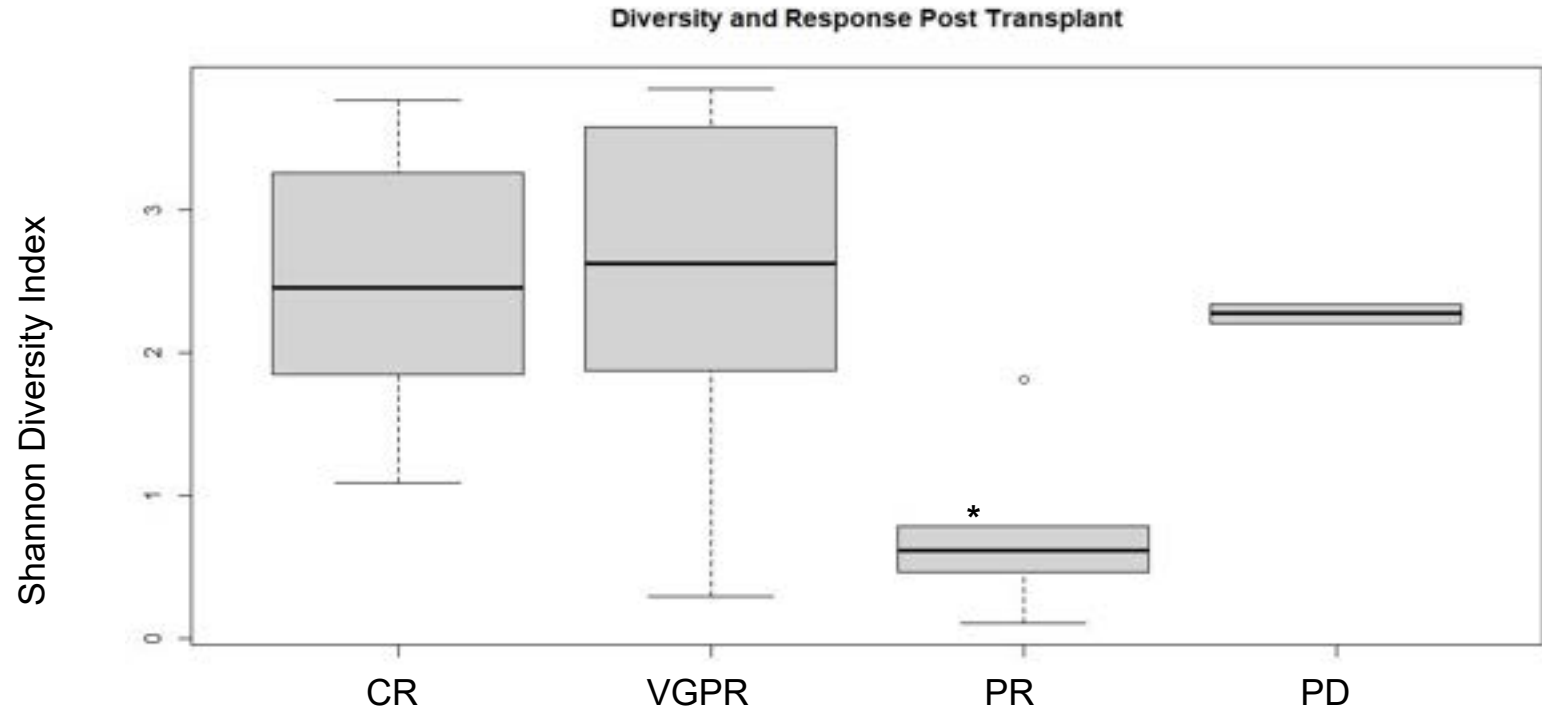
## B. Relative Abundance of Butyrate Producers

Variable	OR (95% CI)	P-value
Butyrate Abundance	64.82 (1.61-2613.3)	0.03
Transplant (Yes vs No)	1 (0.72-1.38)	0.99
Age (>65 vs 65<)	0.84 (0.61-1.14)	0.27
Gender (M vs F)	1.26 (0.92-1.73)	0.16
Cytogenetics (S vs H)	1.23 (0.9-1.68)	0.21



# Engraftment Diversity is associated with D+100 response to ASCT

- Response assessed at D+100 per IMWG response criteria
- 29/30 subjects available for response
- Higher diversity was associated with CR/VGPR compared to PR
- \*



D'Angelo et al, Leukemia/Lymphoma 2022

**Maybe a link is forming -> antibiotic exposure -> microbiome loss during transplant -> impaired response -> reduced PFS -> reduced OS**



# Targeting Gut Microbiota: Diet

- Nutrivention3: smoldering myeloma
- 12 weeks of plant-based diet vs placebo
- Preliminary Nutrivention data identified subjects with **drops** in M-protein using diet strategies
- PI: Dr. Urvi Shah

RECRUITING ⓘ

**A Study Comparing a Plant-Based Diet With Supplements and Placebo in People With Monoclonal Gammopathy of Undetermined Significance (MGUS) or Smoldering Multiple Myeloma (SMM)**

ClinicalTrials.gov ID ⓘ NCT05640843

Sponsor ⓘ Memorial Sloan Kettering Cancer Center

Information provided by ⓘ Memorial Sloan Kettering Cancer Center (Responsible Party)

Last Update Posted ⓘ 2024-08-22

Shah et al, *Blood*, 2023

# Targeting microbiome: immune foods

## Gut-microbiota-targeted diets modulate human immune status

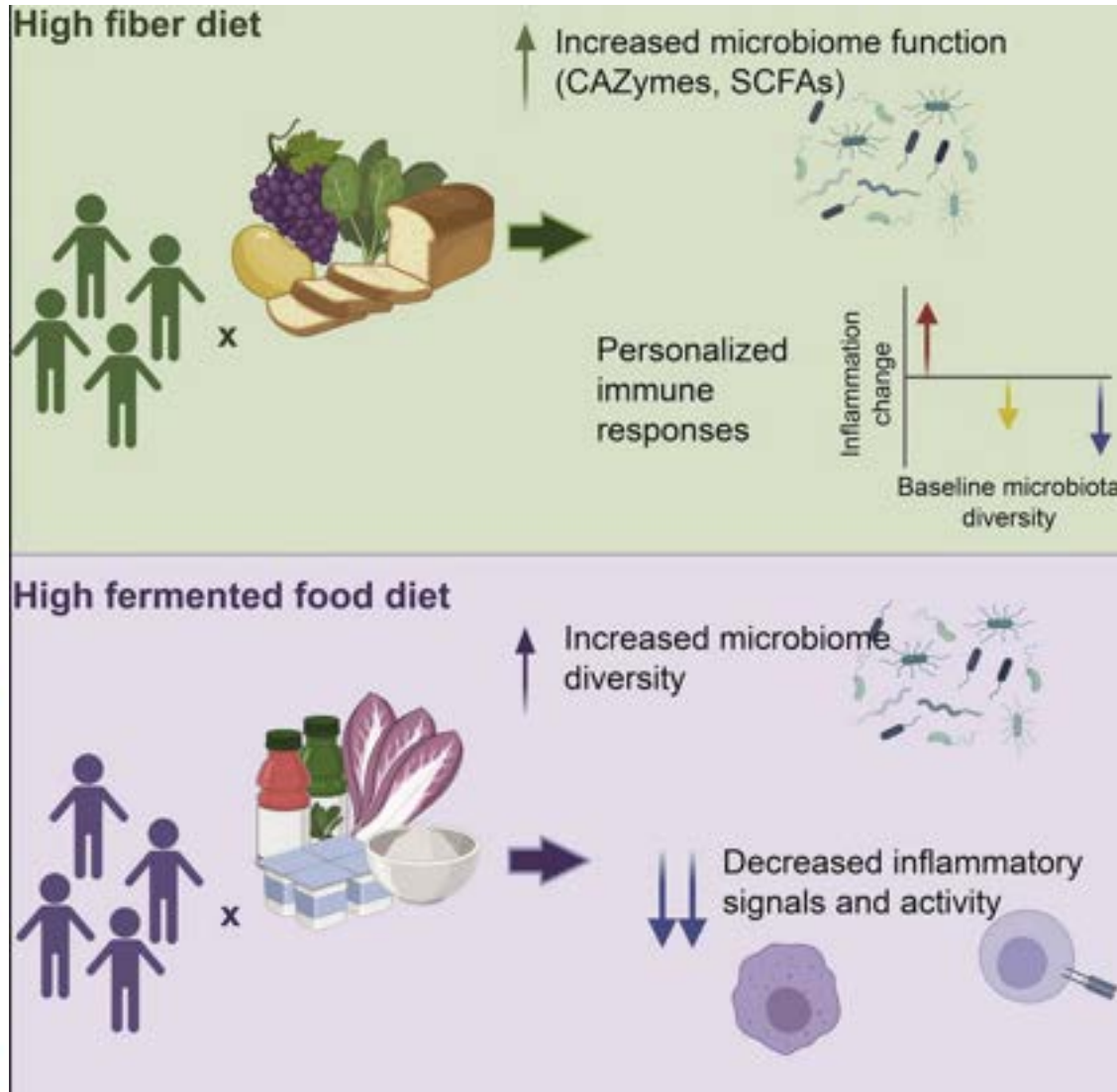
[Hannah C. Wastyk](#)<sup>2,7</sup> · [Gabriela K. Fragiadakis](#)<sup>1,7</sup> · [Dalia Perelman](#)<sup>3</sup> · ... ·

[Erica D. Sonnenburg](#) <sup>1,6</sup>  · [Christopher D. Gardner](#) <sup>3</sup>  · [Justin L. Sonnenburg](#) <sup>1,6,8</sup> 

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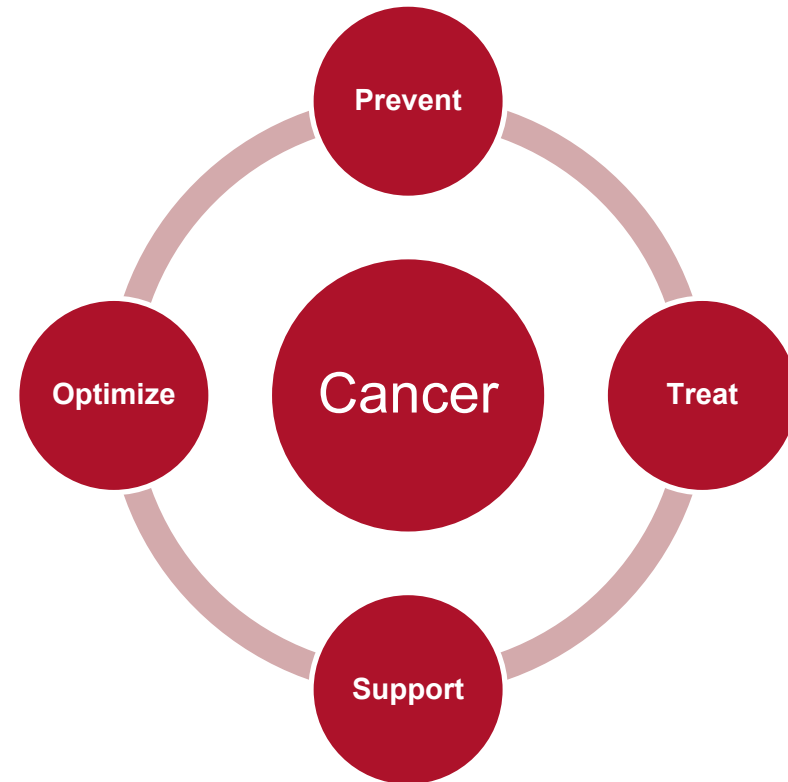
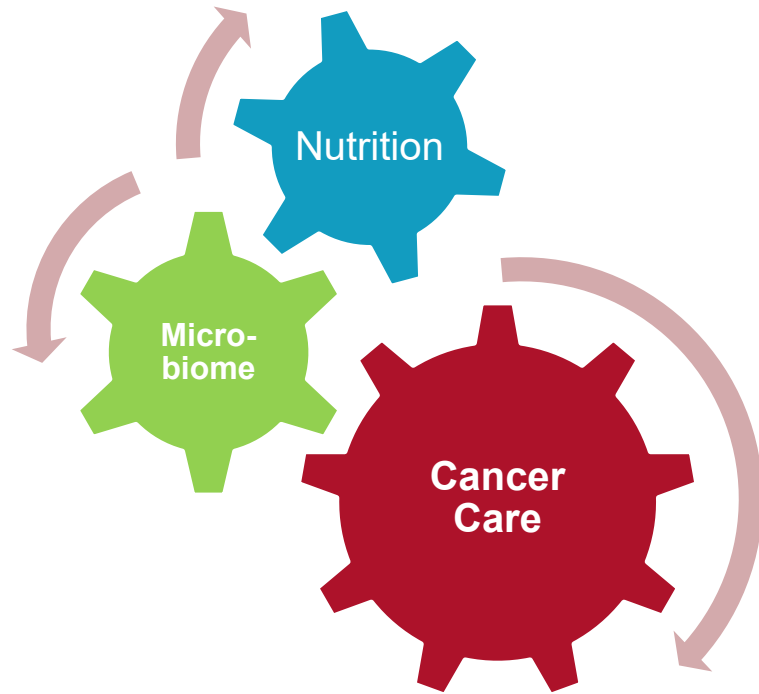
# Fiber and Fermented Foods



- 36 pts, RCT
- Fermented foods: kimchi, kombucha, yogurt



# Practical Tips to Take home



# What to do with all this new info??

## DO

- Be curious
- Participate in clinical trials
- Ask you doctor about nutrition, dietician referral
- Eat more fiber, slow positive diet changes!

## DON'T (at least not yet)

- Order a home microbiome kit
- Stress about antibiotics



# Fiber Requirements (example)

Recommended daily intake = 30 grams  
(Males = 38 grams;  
Females = 25 grams)

Fiber	Western diet
<b>Breakfast</b>	1 egg = 0g 3 strips bacon = 0g 1 slice wheat bread = 1g
<b>Lunch</b>	Small chicken breast = 0g 1 bag frozen broccoli = 12g
<b>Dinner</b>	Beef 1 serving = 0g 1 cup white rice = 1g 1 baked potato = 3g
<b>Snack</b>	1 cup yogurt = 0g 1 slice cheese = 0g
<b>TOTAL fiber</b>	17g



# Fiber Requirements (example)

Recommended daily intake = 30 grams  
(Males = 38 grams;  
Females = 25 grams)

Fiber	Western diet	High fiber diet
<b>Breakfast</b>	1 egg = 0g 3 strips bacon = 0g 1 slice wheat bread = 1g	1 cup cooked oatmeal = 4g 1 tbsp peanut butter = 1g
<b>Lunch</b>	Small chicken breast = 0g 1 bag frozen broccoli = 12g	1 bag frozen broccoli = 12g 1 cup lentils = 16g 1 cup brown rice = 4g
<b>Dinner</b>	Beef 1 serving = 0g 1 cup white rice = 1g 1 baked potato = 3g	1 cup black beans = 15g 1 medium ear corn = 2g 1 avocado = 9g
<b>Snack</b>	1 cup yogurt = 0g 1 slice cheese = 0g	1/4 cup almonds = 5g 1 banana = 3g
<b>TOTAL fiber</b>	17g	71g



# Protein Requirements (example)

Recommended daily intake  
= 0.8-1.2 g/kg  
60 kg person  
= 48-72 grams

Protein	Western diet
<b>Breakfast</b>	1 egg = 6g 3 strips bacon = 12g 1 slice wheat bread = 3g
<b>Lunch</b>	Small chicken breast = 23g 1 bag frozen broccoli = 7g
<b>Dinner</b>	Beef 1 serving = 34g 1 cup white rice = 4g 1 baked potato = 4g
<b>Snack</b>	1 cup yogurt = 9g 1 slice cheese = 4g
<b>TOTAL protein</b>	106g

Slides courtesy Dr. Urvi Shah, Memorial Sloan Kettering



# Protein Requirements (example)

Recommended daily intake  
= 0.8-1.2 g/kg  
60 kg person  
= 48-72 grams

Protein	Western diet	High fiber diet
<b>Breakfast</b>	1 egg = 6g 3 strips bacon = 12g 1 slice wheat bread = 3g	1 cup cooked oatmeal = 6g 1 tbsp peanut butter = 4g
<b>Lunch</b>	Small chicken breast = 23g 1 bag frozen broccoli = 7g	1 bag frozen broccoli = 7g 1 cup lentils = 18g 1 cup brown rice = 4g
<b>Dinner</b>	Beef 1 serving = 34g 1 cup white rice = 4g 1 baked potato = 4g	1 cup black beans = 15g 1 corn on the cob = 5g 1 avocado = 3g
<b>Snack</b>	1 cup yogurt = 9g 1 slice cheese = 4g	1/4 cup almonds = 8g 1 banana = 1.5g
<b>TOTAL protein</b>	106g	72g



# Some Practical Dietary Tips to Consider Incorporating

## **Carbohydrates** – ↑ whole, unrefined

- ↑ Whole grains (>3 servings/day)
- ↓ Unprocessed/refined carbs/foods
- ↓↓ Sugary foods/drinks

## **Fiber** (↑ >30 grams/day)

- ↑ Fruits/Vegetables (>5-6 servings/day)
- ↑ Diversity of plant foods (>30 types/week)

## **Protein** - Plant >> Animal sources

- ↑ Beans/Tofu/Tempeh
- ↓ Red/processed meats

## **Fermented Foods:** ↑ ↑

## **Fats** – ↑ Unsaturated fats

- ↑ Nuts/Seeds, fish, olive oil, avocados
- ↓ Fried foods
- ↓ Dairy/Cheese
- Regular omega 3 fatty acids
- Vitamin D (>30 ng/mL)

- Calorie counting/restriction are difficult to sustain long term
- Meal planning and preparation in advance
- Regular mealtimes not waiting until one is starving
- Ensure adequate hydration
- Learning to read ingredient lists and nutrition labels
- Gradual changes are more sustainable
- Making healthy swaps
- Make it a lifestyle and not a diet
- Frozen fruits/vegetable bags are just as healthy
- Doesn't have to be raw salads. Cooked foods healthy too



# Individualizing Nutrition Changes

- Disease Stage – Newly diagnosed, on maintenance, relapsed
- Patient Choice – Receptive to hearing about this and empowered by it or overwhelmed to hear about it and would not help
- Medical issues related to the cancer – Is there significant weight loss from the cancer and side effects to treatment like nausea and diarrhea that they aren't tolerating most foods.
- Medical issues related to metabolic health – Obesity, diabetes, cardiovascular disease, high cholesterol
- Gradual versus drastic changes to habits



pictures from American College of Lifestyle Medicine

It doesn't have to be salads & raw vegetables/fruits alone.




# Summary

- Our patients are interested in nutrition guidance from us
  - If we don't step up, the **void** may be filled by opportunists
- Nutrition may prevent certain cancers
  - Guidelines exist for best current recommendations: AICR
- Microbiome may interface between nutrition and cancer
  - Pivot toward immune oncology highlights potential
- Simple advice can be given to start to guide patients
  - Consider small changes and substitutes



**C-3PO: Sir, the odds of successfully navigating an asteroid field are approximately 3,720 to 1.**

**Han: Never tell me the odds!**



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**Thank you for your Attention!!!**  
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