Food’s Protective Power Against Disease

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Disclosures

- Consultant to Genentech/Roche, SonomaBio
- Research funding: Sanofi
- Unrestricted gift: Beyond Meat
• What is inflammation, and why do I need to care about it?

• What is an anti-inflammatory diet, and why should we eat this way?

• What does diet have to do with planetary health?
Arthritis will increase as the population ages and grows

~21% of U.S. adults have some form of arthritis, including rheumatoid arthritis, gout, lupus, or fibromyalgia

Source: National Health Interview Survey 2013-2015
“Plants For Joints” (PFJ) intervention of whole food plant-based diet and lifestyle interventions: improved arthritis

“Plants For Joints” (PFJ) intervention of whole food plant-based diet and lifestyle interventions: improved arthritis

![Graph showing WOMAC total score over time with PFJ intervention showing a significant improvement compared to control.](image-url)

Many chronic diseases are caused by a short list of high-risk behaviors:

- Poor nutrition
- Tobacco use
- Physical inactivity
- Excessive alcohol use

Source: CDC
Standard American Diet: fruit and vegetable consumption

<table>
<thead>
<tr>
<th></th>
<th>Adults</th>
<th>Adolescents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits</td>
<td>12.3%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Vegetables</td>
<td>10%</td>
<td>2%</td>
</tr>
</tbody>
</table>

% who consume the recommended daily minimum amounts

Source: Morbidity and Mortality Weekly Report 2022 and CDC
Standard American Diet: “SAD”

- High in ultra-processed foods
- High in animal products
- Highly inflammatory

Source: Morbidity and Mortality Weekly Report 2022
Public health crisis:
~72% of Americans are overweight or obese

Source: NIH
Meningioma
Adenocarcinoma of the esophagus
Multiple myeloma
Kidney
Endometrium
Ovary
Thyroid
Breast
Liver
Gallbladder
Upper stomach
Pancreas
Colon and rectum
Source: Cancer.gov
Systemic chronic inflammation (SCI)

Source: Furman D et al. 2019 Nature Medicine
<table>
<thead>
<tr>
<th>minimally processed</th>
<th>processed</th>
<th>ultra-processed</th>
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<td><img src="image1.png" alt="Minimally Processed" /></td>
<td><img src="image2.png" alt="Processed" /></td>
<td><img src="image3.png" alt="Ultra-Processed" /></td>
</tr>
</tbody>
</table>

Try to limit
Ultra-processed foods and additives:

Inflammatory impact on gut health and disease

Source: Whelan K et al. Nature Reviews Gastroenterology and Hepatology 2024
• What is inflammation, and why do I need to care about it?

• **What is an anti-inflammatory diet, and why should we eat this way?**

• What does diet have to do with planetary health?
Dr. Andrew Weil’s Anti-Inflammatory Pyramid

- **Vegetables**: 4-5 per day
- **Fruits**: 3-5 per day
- **Whole grains**: 4-5 per day
- **Beans & legumes**: 1-2 per day
- **Healthy fats**: 5-7 per day
- **Fish & seafood**: 2-6 per week
- **Other protein**: 1-2 per week
- **Healthy herbs & spices**: unlimited
- **Tea**: 2-4 cups per day
- **Supplements**: daily
- **Healthy sweets**: sparingly
- **Red wine**: no more than 1-2 glasses per day
- **Whole soy foods**: 1-2 per day
- **Other protein**: 1-2 per week

Source: Weil
Five regions with the highest concentration of residents living to be over 100 years old:

- Loma Linda, United States
- Sardinia, Italy
- Nicoya Peninsula, Costa Rica
- Icaria, Greece
- Okinawa, Japan

95–100% plant-based diets

Source: Buettner D, The Blue Zones. National Geographic 2012
Blue Zones Diet

**DAILY**
- Nuts: 1-2 handfuls
- Drinks: 6 glasses of water and coffee/tea/wine in moderation
- **Beans/legumes:** ½ to 1 cup
- Whole ingredients

**WEEKLY**
- Refined sugar: max 7 tsp
- Eggs: < 3 times
- Fish: < 80g, max 3 times

**MONTHLY**
- Meat: < 5 times
- Dairy products: < 5 times

Source: https://yoursuper.eu/blogs/articles/blue-zones-diet
Lessons from Adventist Health Studies
Prospective cohort studies of Adventists (n >100,000)

Key findings

• Vegetarians (compared with meat eaters) had a lower risk of cardiovascular disease, hypertension, hyperlipidemia, diabetes, cancers (including ovarian, colon, prostate, lung, bladder), degenerative arthritis

• Almost all risk factors and disease incidences were further improved with a vegan diet (compared with ovo-lacto vegetarian diet)

Fraser G et al. Publ Health Nutr 2015;18(3):537
Le LT et al. Nutrients 2014;6(6):2131
Health benefits of whole-food plant-based diets

- Decreases in all-cause mortality
- Weight loss and favorable changes in lipid profiles
- Decreased risk, and even reversal, of cardiovascular disease
- Decreased risk of several cancers
- Decreased risk of diabetes and improved glycemic control or normalized blood glucose for those with diabetes
- Improved migraine symptoms
- Hot off the press: genetically identical twin study showing benefits of vegan diet over omnivorous diet
- Numerous other benefits, with new studies coming out regularly
The many benefits of fiber

- Increases satiety without extra calories:
  - Adding 14 g fiber/day = 10-18% lower calorie intake

- Whole grain fiber increases metabolic rate and promotes loss of calories in stool

- Promotes beneficial gut microbiome and production of short chain fatty acids (SCFAs)

- Improves blood sugar response to food

- Reduces heart disease, diabetes, and cancer risk

### Fiber Content

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Example</th>
<th>Fiber Content</th>
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</thead>
<tbody>
<tr>
<td>Legumes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red lentils</td>
<td>1/2 cup</td>
<td>7.1g</td>
</tr>
<tr>
<td>Black beans</td>
<td>1/2 cup</td>
<td>7.7g</td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broccoli</td>
<td>1 cup</td>
<td>5.1g</td>
</tr>
<tr>
<td>Carrots</td>
<td>1 cup</td>
<td>4.7g</td>
</tr>
<tr>
<td>Fruits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Blackberries</td>
<td>1 cup</td>
<td>7.6g</td>
</tr>
<tr>
<td>Apples</td>
<td>1 medium</td>
<td>4.4g</td>
</tr>
<tr>
<td>Whole grains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quinoa</td>
<td>1 cup</td>
<td>5.2g</td>
</tr>
<tr>
<td>Steel cut oatmeal</td>
<td>1 cup</td>
<td>5g</td>
</tr>
</tbody>
</table>

Source: American College of Lifestyle Medicine: Food as Medicine educational module
How can I get enough protein?

### Plant proteins
- **Red lentils** 18g
- **Tempeh** 17g
- **Black beans** 15g
- **Chickpeas** 12g
- **Tofu** 12g
- **Quinoa** 9g
- **Soy milk** 9g
- **Peanut butter** 8g
- **Oats** 7g

### Animal proteins
- **Steak** 25g
- **Chicken** 25g
- **Salmon** 20g
- **Egg** 6g

Average individual needs:
- ~0.8g protein per kg or ~0.36g protein per lb = **54g per day** for a 150 lb sedentary person

Source: American College of Lifestyle Medicine: Food as Medicine educational module
Foods to consider including in your diet

**Whole grains**
- Oats
- Bulgur
- Farro
- Brown rice
- Whole corn
- Millet
- Whole wheat
- Whole wheat couscous

**Foods high in omega-3 fatty acids**
- Chia seeds
- Flax seeds

**Nutrients of interest for plant-based diets**
- Vitamin B12, vitamin D (supplement if fully vegan)
- Iron, zinc, calcium, omega-3 fatty acids

Source: Esquivel MK. Amer J Lifestyle Med 2022 | Neufingerl N and Eilander A. Nutrients 2022
Fermented foods can be anti-inflammatory

- Sauerkraut
- Kombucha
- Kimchi
- Miso & natto
- Yogurt
- Kefir
- Apple cider vinegar

Source: Wastyk HC et al. 2021 Cell
Dirty Dozen

1. Strawberries
2. Spinach
3. Kale, collard & mustard greens
4. Grapes
5. Peaches
6. Pears
7. Nectarines
8. Apples
9. Bell & hot peppers
10. Cherries
11. Blueberries
12. Green beans

Buy organic whenever possible

Clean Fifteen

1. Avocado
2. Sweet corn
3. Pineapple
4. Onions
5. Papaya
6. Sweet peas
7. Asparagus
8. Honeydew melon
9. Kiwi
10. Cabbage
11. Mushrooms
12. Carrots
13. Mango
14. Watermelon
15. Sweet potato

Helpful resource: ewg.org

Source: Environmental Working Group
Eat food. 
Not too much. 
Mostly plants.

MICHAEL POLLAN
• What is inflammation, and why do I need to care about it?

• What is an anti-inflammatory diet, and why should we eat this way?

• **What does diet have to do with planetary health?**
Climate change: ocean temperatures at record levels

Daily average sea surface temperature between 60° North and 60° South, 1979-2024

Source: ERA5, C3S/ECMWF
Electricity production: 25%
Food, agriculture, land use: 24%
Industry: 21%
Transportation: 14%
Buildings: 6%
Other: 10%

Source: Project Drawdown
Helpful resource: drawdown.org

Source: Project Drawdown
Meat and dairy production...

- Uses 83% of farmland – including growth of crops to feed animals
- Causes 60% of agricultural GHG emissions
- But provides only 18% of calories and 37% of protein in our diets

Source: Poore and Nemecek (2018)
<table>
<thead>
<tr>
<th>Year</th>
<th>U.S. per capita meat intake (lb)</th>
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</thead>
<tbody>
<tr>
<td>1909</td>
<td>123.9 lb</td>
</tr>
<tr>
<td>2004</td>
<td>201.5 lb</td>
</tr>
<tr>
<td>2012</td>
<td>181.5 lb</td>
</tr>
<tr>
<td>2017</td>
<td>195.1 lb</td>
</tr>
</tbody>
</table>

Includes red meat, poultry, and fish

Source: U.S. Department of Agriculture, Economic Research Service
U.S. per capita chicken intake (lb)

- 1909: 10.4 lb
- 2006: 60.9 lb
- 2012: 56.6 lb
- 2017: 64.1 lb

Source: U.S. Department of Agriculture, Economic Research Service
U.S. per capita cheese intake (lb)

Source: U.S. Department of Agriculture, Economic Research Service
Some foods can be addictive, but that doesn’t mean they are good for you!
How much would going plant-based help the environment?

Going vegan for two-thirds of meals could cut food-related carbon emissions by 60%

100% vegan → ~85% decrease
Processed meat and red meat are associated with cancer risk

**GROUP 1 CARCINOGEN**

**Processed meat**
Hot dogs, ham, sausages, corned beef, jerky, canned meat

- Sufficient evidence of carcinogenicity in humans
- Strong associations with colorectal cancer

**GROUP 2A CARCINOGEN**

**Red meat**
Beef, veal, pork, lamb, mutton, horse, goat

- Limited evidence of associations with colorectal cancer in humans
- Strong mechanistic evidence for carcinogenicity

Source: WHO
High-impact climate actions for households and individuals

- Reduced food waste
- Plant-rich diets
- Solar
- LED lighting
- Recycling
- Electric cars
- Reduced plastic

The data presented here represents cumulative Gt CO2-eq over 30-year period.

**BY SECTOR**

Together, the individual and household actions presented here have the potential to produce roughly 25-30 percent of the total emissions reductions needed to avoid dangerous climate change (1.5°C rise).

<table>
<thead>
<tr>
<th>Sector</th>
<th>Reduction</th>
</tr>
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<tbody>
<tr>
<td>Food</td>
<td>12.4%</td>
</tr>
<tr>
<td>Energy</td>
<td>8.6%</td>
</tr>
<tr>
<td>Travel</td>
<td>2.8%</td>
</tr>
<tr>
<td>Waste</td>
<td>1.3%</td>
</tr>
</tbody>
</table>

Source: Project Drawdown
What about plant-based meats?

<table>
<thead>
<tr>
<th></th>
<th>Production and supply chain emissions</th>
<th>Carbon opportunity cost of land</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef</td>
<td>165 kg</td>
<td>165 kg</td>
</tr>
<tr>
<td>Lamb</td>
<td>158 kg</td>
<td>158 kg</td>
</tr>
<tr>
<td>Chicken</td>
<td>15 kg</td>
<td>15 kg</td>
</tr>
<tr>
<td>Tofu</td>
<td>4.6 kg</td>
<td>4.6 kg</td>
</tr>
<tr>
<td>Beyond Meat</td>
<td>4.6 kg</td>
<td>4.6 kg</td>
</tr>
<tr>
<td>Impossible Burger</td>
<td>4.5 kg</td>
<td>4.5 kg</td>
</tr>
</tbody>
</table>

~36x less carbon footprint

Source: Our World in Data based on certified LCA reports; Poore and Nemecek (2018)
If the world’s 2 billion high consumers cut their meat and dairy consumption by 40%...

Source: Kozicka M et al. 2023 Nat Comm | wri.org/shiftingdiets
What America actually eats…
Standard American Diet (SAD)

- Processed food: 63%
- Animal food: 25%
- Processed plant food: 6%
- Whole plant food: 6%

Source: healthylunches.org
EAT Lancet Commission
Planetary Health Diet (2500 kcal/day)
The PLANT Study

PROVIDERS LEARNING ABOUT NUTRITION TOGETHER

Co-Principal Investigators:
Tamiko Katsumoto, MD, Neha Shah, MD, Maryam Makowski, PhD
Hypothesis

Health care professionals (HCPs) exposed to a 6-week nutritional educational intervention on whole food plant-based diets (WFPBD) will be more likely to adopt a WFPBD and feel more confident in recommending it to their patients.
Enrolled 102 health care providers at Stanford

- Completed 6-week intervention for Group A and Group B, including 2 cooking classes

Promising results

- Significant increase in **readiness to change** to a WFPBD and in **level of confidence to discuss WFPBD with patients** in the early intervention group (compared to delayed intervention group)

Next steps

- Scaling this study to reach a broader, more diverse set of providers
- Creating educational resources for providers and patients
Final thoughts

Eating a more sustainable, anti-inflammatory whole food plant-based diet will reduce our chances of chronic inflammatory diseases and is good for the planet.
Acknowledgements

- My patients
- The PLANT Study team
  Including Neha Shah, Maryam Makowski, Carlie Arbaugh, Uma Ayachit
- Christopher Gardner and team
- The Plant Based Diet Initiative
- My family, friends, and other colleagues who have supported me
- All of YOU, for being here!
Thank you!