

BI 121 Lecture 5



...DietController!
More fun in Lab!!



I. Announcements Nutrition Analyses this Thursday!
Please record diet on p 3-7 LM. Bring flash drive. Q?

II. Genetics Connections LS 2012 ch 2 p 20-1 + Appendix C

A. How & where are proteins made? fig C-7, C-9

B. Class skit: Making proteins @ ribosomes!

III. Nutrition Primer DC Module 2, S&W Price Science Library

A. Essential Nutrients: H₂O, 1^o Carbohydrates, 2^o Fats, 3^o Proteins, Vitamins, Minerals; Macro- vs Micro-?

B. Dietary Guidelines: HHS-USDA, AICR, Eat the **Rainbow!**

C. Blue Zones? Habits on longest-lived people?

D. Okinawan Longevity Diet?

E. Pondering Paleo, Marlene Zuk, U Minn

F. How much protein? Protein & disease?

G. TMAO, Neu5GC & inflammation?

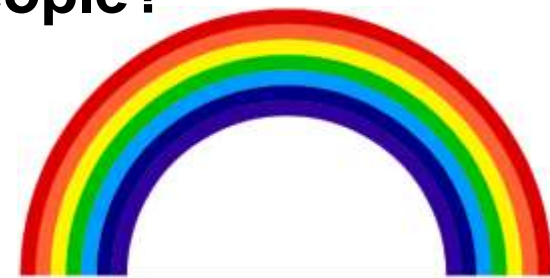
H. Carbohydrate confusion. Why plants & whole grains?

I. Exercise, carbohydrates & fats

J. Fasting? Intermittent fasting?

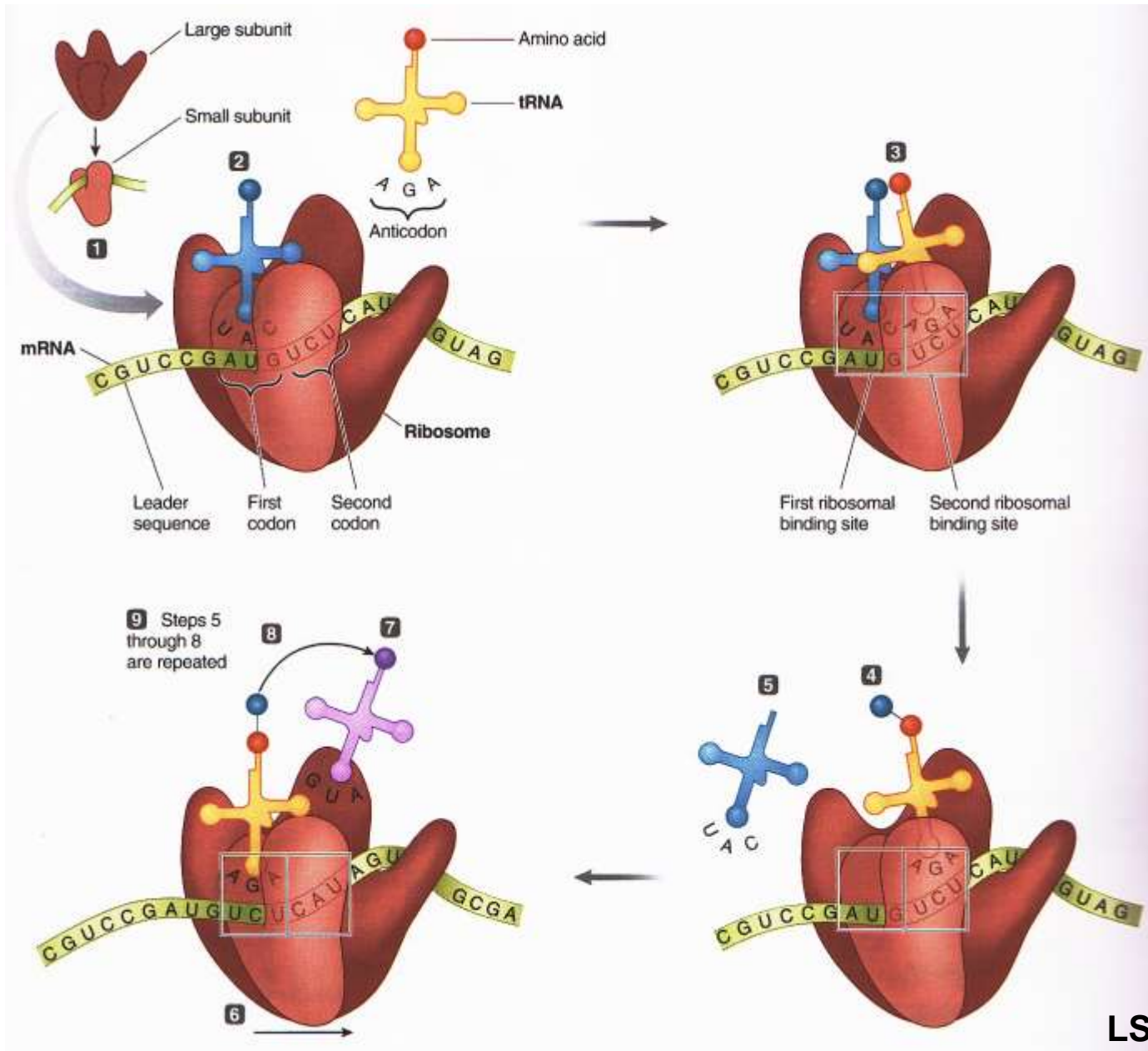
K. Successful dieting? National Weight Control Registry

L. Exercise vs. Diet vs. Combination, Zuti & Golding

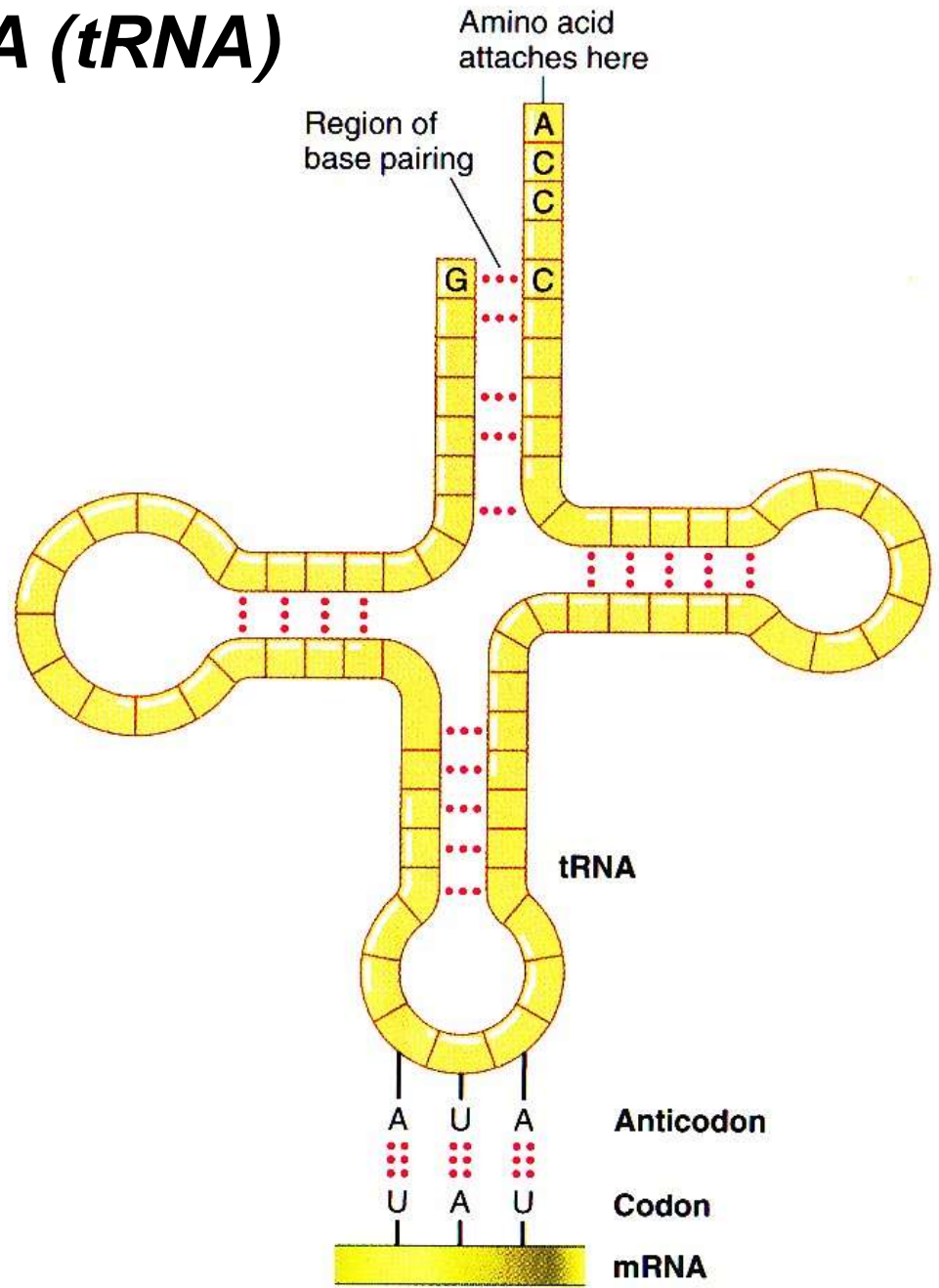


		Second base of codon				
		U	C	A	G	
First base of codon	U	UUU } Phe UUC } UUA } Leu UUG }	UCU } Ser UCC } UCA } UCG }	UAU } Tyr UAC } UAA } Stop UAG } Stop	UGU } Cys UGC } UGA } Stop UGG } Trp	U
	C	CUU } Leu CUC } CUA } CUG }	CCU } Pro CCC } CCA } CCG }	CAU } His CAC } CAA } Gln CAG }	CGU } Arg CGC } CGA } CGG }	C
	A	AUU } Ile AUC } AUA } AUG } Met Start	ACU } Thr ACC } ACA } ACG }	AAU } Asn AAC } AAA } Lys AAG }	AGU } Ser AGC } AGA } Arg AGG }	A
	G	GUU } Val GUC } GUA } GUG }	GCU } Ala GCC } GCA } GCG }	GAU } Asp GAC } GAA } Glu GAG }	GGU } Gly GGC } GGA } GGG }	G
						Third base of codon
						U
						C
						A
						G

Translation? Ribosomes Make Proteins

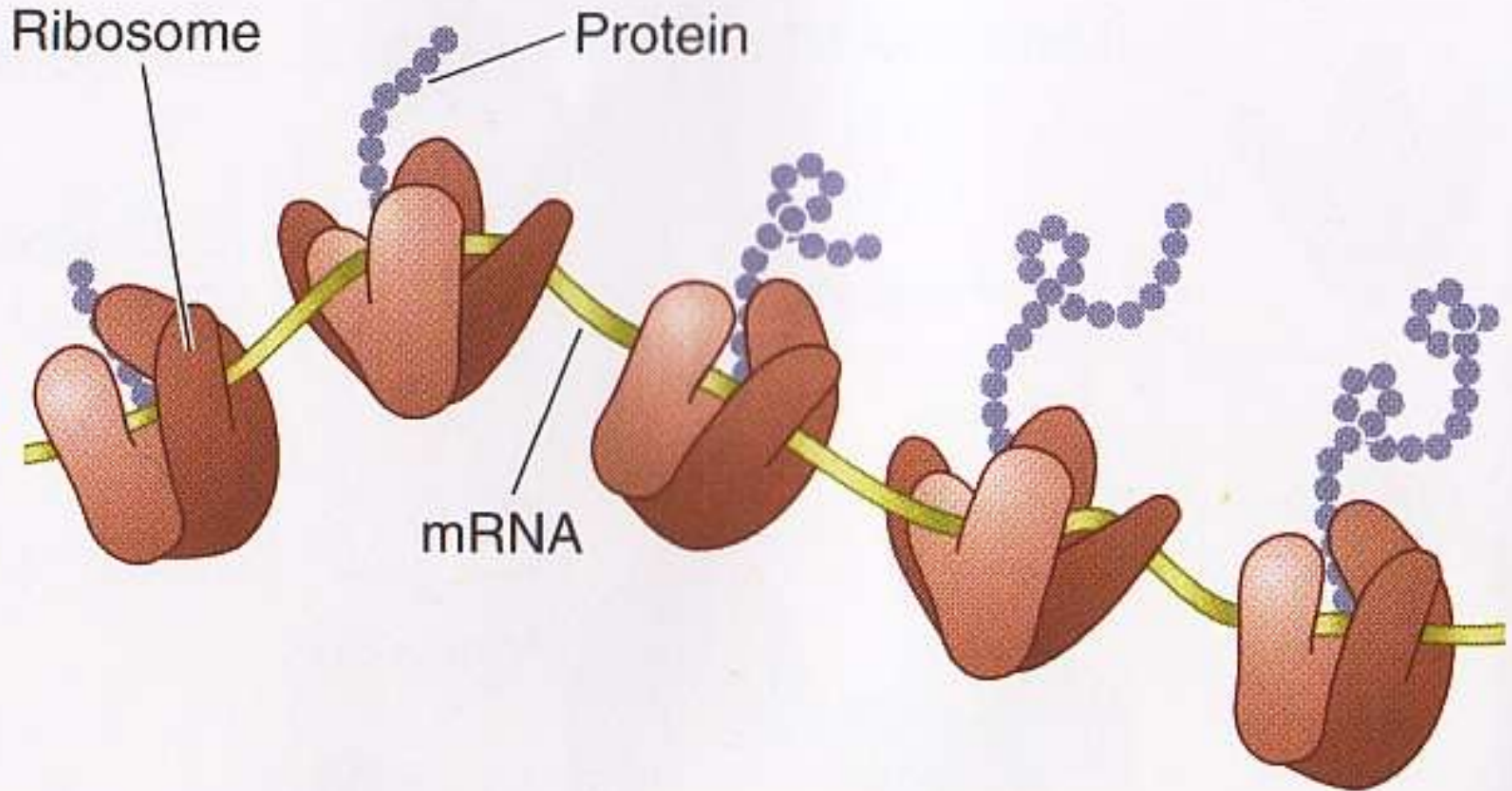


Transfer RNA (tRNA)



LS fig C-8

A Polyribosome. Which Way is Synthesis?



Class Skit on Translation!



A *protein* synthesizing factory, where *translation* takes place!

What's a ribosome?



You rock, baby!



Questions + Discussion



Macronutrients & Micronutrients Essential for Life

Macronutrients

H₂O/Water

✓ 1^o Carbohydrates

✓ 2^o Fats/Triglycerides/Lipids

✓ 3^o Proteins

Micronutrients

Vitamins (A, D, E, K; C + B)

Minerals (K⁺, Na⁺, Ca²⁺, Mg²⁺,
Fe²⁺, Zn²⁺,...)

✓ *Energy nutrients = yield ATP*

Sample Food Sources

Water, other drinks, fruits
& vegetables

Grains, vegetables, fruits,
dairy products

Meats, full-fat dairy
products, oils

Meats, legumes, dairy
vegetables

NB: Need only minute quantities!

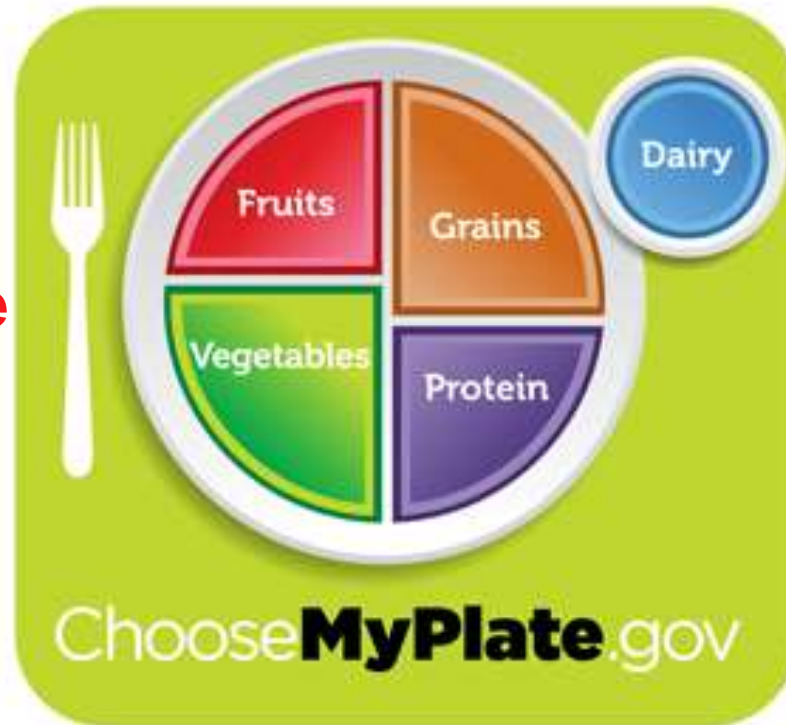
Vegetables, vegetable oils,
fruits, citrus, grains, dairy

Fruits, vegetables, grains,
nuts, dairy, meats,
processed foods



MyPlate launched June 2, 2011

2. Focus on fruits.
Whole fruit preferable to juice, but any fruit counts!
Fill $\frac{1}{2}$ your plate with fruits & vegetables!

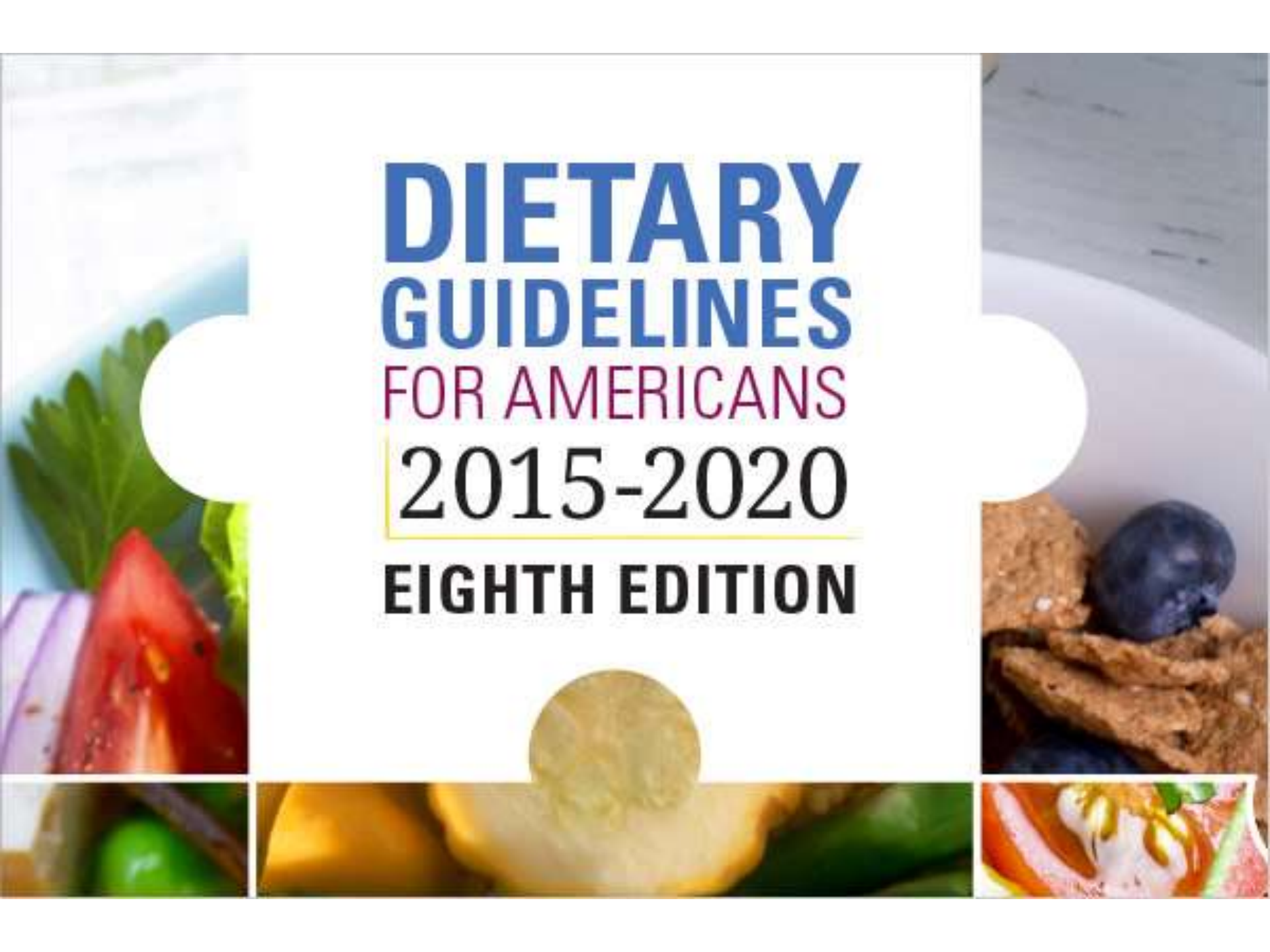


3. Make at least $\frac{1}{2}$ of your grains whole grains!

5. Get your calcium-rich foods. Buy skim or 1% milk. Go easy on cheese!

1. Vary your veggies.
Fill $\frac{1}{2}$ your plate with fruits & vegetables!

4. Go lean with protein. Keep protein to $< \frac{1}{4}$ plate! Nuts, beans, peas, seeds, poultry, lean meat, seafood,...



**DIETARY
GUIDELINES**
FOR AMERICANS
2015-2020
EIGHTH EDITION

Dietary Guidelines for Americans 2015-2020

Released January 7, 2016

A healthy eating pattern includes:

- **Variety of vegetables** from all subgroups: dark green, red & orange, legumes, starchy & other
- **Fruits**, especially whole fruits
- **Grains**, at least half of which are whole grains
- **Fat-free or low-fat dairy**, including milk, yogurt, cheese &/or fortified soy beverages
- **Variety of protein foods** including seafood, lean meats & poultry, eggs, legumes & nuts, seeds & soy products
- **Oils** (healthy)

A healthy eating pattern limits:

- **Saturated fats** & **trans fats**, added **sugars** & **sodium**
- **Balance calories with physical activity** to manage weight.

<http://health.gov/dietaryguidelines/2015/>

Diet & Health Guidelines for Cancer Prevention

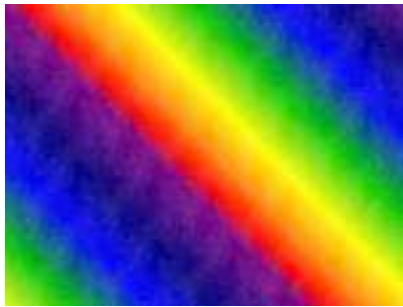
- 1. Choose a diet rich in variety of plant-based foods.**
- 2. Eat plenty of vegetables & fruits.**
- 3. Maintain a healthy weight & be physically active.**
- 4. Drink alcohol only in moderation, if at all.**
- 5. Select foods low in fat & salt.**
- 6. Prepare & store food safely.**

And always, remember...

Do not smoke or use tobacco in any form.



American Institute for Cancer Research (AICR)



Eating the Rainbow Hawaiian Style!!



Your plate should be the size of a Frisbee, not a manhole cover.

When it comes to colorful foods, Fruit Loops don't count.

A surprising number of people get 1/5 of their calories from sodas or other liquids.

If you look at the label & need a chemistry degree to read it, put the item back on the shelf!



SOURCE: P. Rath, *Honolulu Advertiser*, Sept 11, 2008 citing D. Chong & N. Kerr.



The World's Longest-Lived People!

○ Blue Zones! ○



<https://www.cbsnews.com/news/blue-zones-do-people-who-live-in-certain-areas-live-longer/>, Aug 2013.

Buettner, D. *National Geographic*, Nov 2005.

M Poulain & Coworkers. *Experimental Gerontology*, Sep 2004

Loma Linda, United States

Plant-based!

1. Eat a little bit better!
2. Move a little bit more!
3. Socialize more!
4. Strong sense of purpose!



Sardinia,
Italy

Okinawa,
Japan

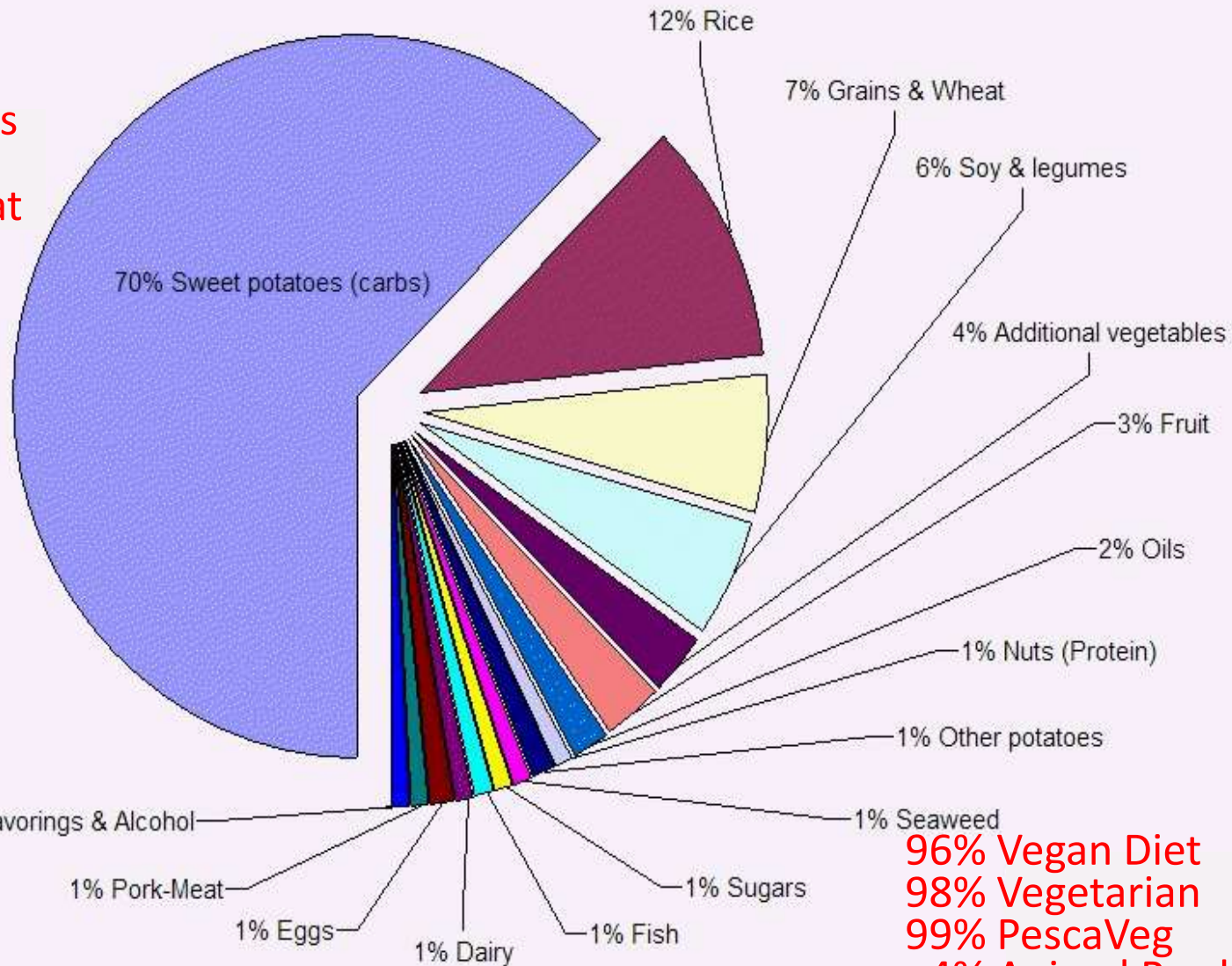
https://en.wikipedia.org/wiki/Blue_Zone

<https://bluezones.com/>

<http://www.sciencedirect.com/science/article/pii/S0531556504002141>

OKINAWA LONGEVITY DIET

- 70% Sweet Potatoes
- 12% Rice
- 7% Grains & Wheat
- 6% Soy & legumes
- 4% Additional vegetables
- 3% Fruit
- 2% Oils
- 1% Nuts (Protein)
- 1% Other potatoes
- 1% Seaweed
- 1% Sugars
- 1% Fish
- 1% Dairy
- 1% Eggs
- 1% Pork-Meat
- 1% Flavorings & Alcohol



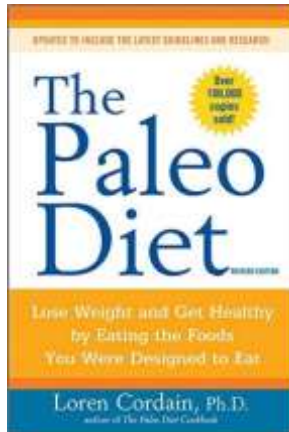
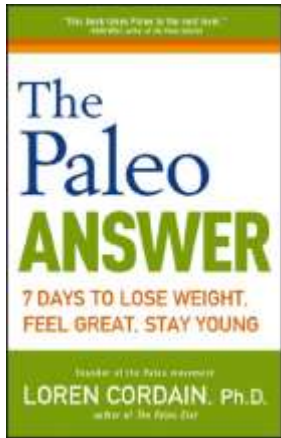
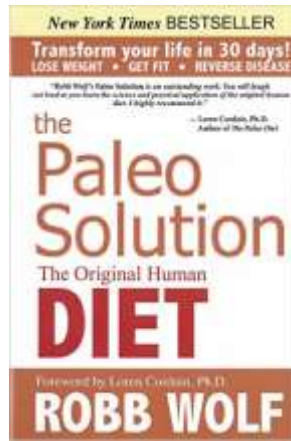
85% Carbohydrates
 9% Protein
 6% Fat
 85-10-5
 1785 Calories

96% Vegan Diet
 98% Vegetarian
 99% PescaVeg
 <4% Animal Prod
 <1% Fish
 <1% Meat-Pork

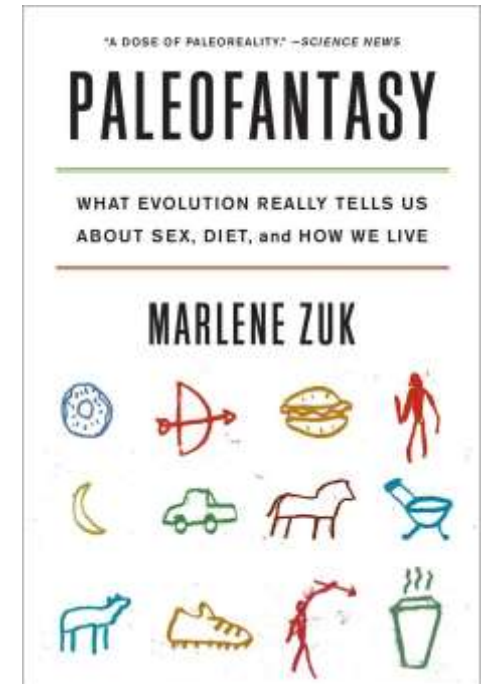
SCIENTIFIC STUDY: "The Diet of the World's Longest-Lived People and Its Potential Impact on Morbidity and Life Span"
 JOURNAL: Annals of the Academy of Sciences - Volume 1114: 434-455 (2007).

Note: These are the Actual Food Measurements of the Centenarians, not the diet of All island Okinawans or the ones who died, but the ones who lived.

Pondering Paleo?



**Evolutionary Biologist
Behavioral Ecologist
U Minnesota**



<http://www.nutritionaction.com/daily/how-to-diet/pondering-paleo/>

How much protein do you need?

Not much! 0.8 g/kg or 0.36 g/lb of body wt/d

50 kg or 110 lb female ? ~ 40 g/d

80 kg or 176 lb male ? ~ 64 g/d



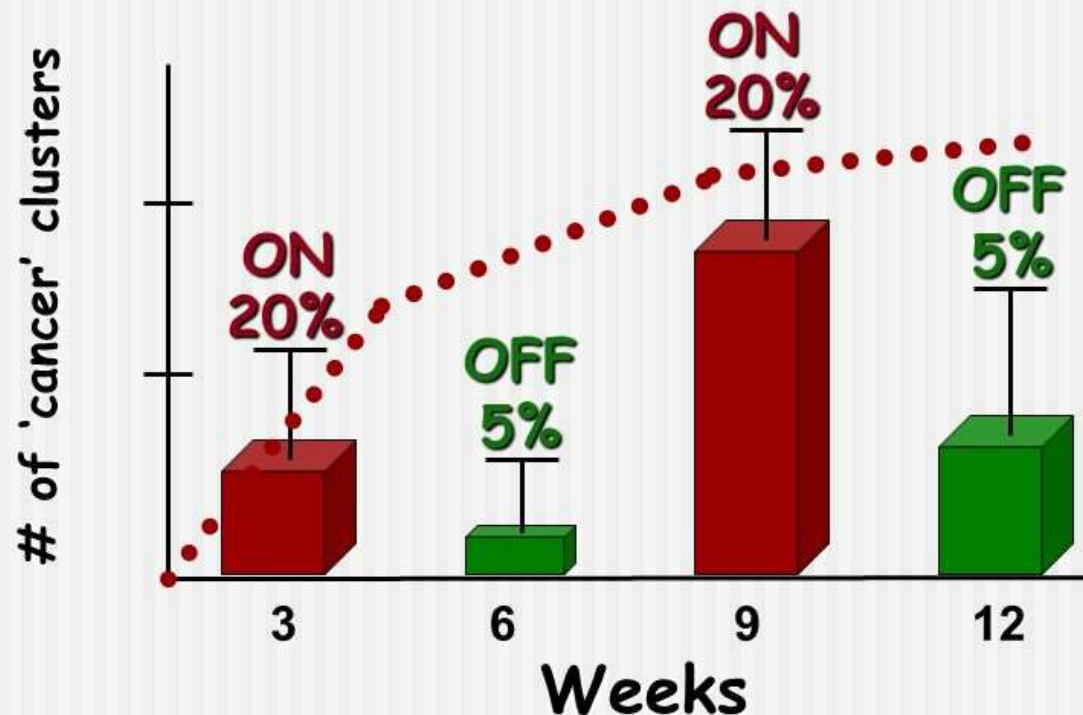
**Boneless,
skinless,
cooked
chicken
breast 6-8 oz,
53 -70 g of
protein!**

**Average US woman gets 35% > RDA!
Average US man 65% >RDA!**

Dietary Protein, Shakes, Supplements &...?

Dietary Protein and EARLY Cancer

(Youngman and Campbell, *J. Nutr.*, 1991, *Nutr. Cancer*, 1992)



copyright T. Colin Campbell 2010

9

<http://www.aicr.org/about/advocacy/the-china-study.html>

<http://www.nutritionfacts.org/>

Red Meat, Processed Meat & Cancer Incidence



Total cancer mortality & cancers of:

Colon & rectum
Esophagus
Liver
Pancreas
Kidney
Prostate
Lung
Breast



SOURCES: Rodriguez Hernandez 2015, Abid 2014, Larsson 2014, Pericleous 2014, Zhu 2014, Aune 2013, Ferlay 2013, Kim 2013, Freedman 2010, Alexander 2010, Alexander 2009



John Swartzberg, M.D.
Chair, Editorial Board

WHO says to cut down on meat?

When I saw the headlines in October that meat was linked to cancer, I braced myself for the inevitable brouhaha. The news was that the International Agency for Research on Cancer (IARC), part of the World Health Organization (WHO), concluded that processed meats like hot dogs, bacon, and ham almost certainly increase the risk of colorectal cancer—by 18% per daily serving—and that red meat probably does as well.

But we've heard about this link many times before. Over the past 20 years, many observational studies have found that people who regularly eat red or processed meats have higher rates of several cancers, notably of the colon and rectum. And lab studies have shown that compounds formed when meat is processed (that is, smoked, salted, or cured) or cooked at high temperatures can cause cancer in animals or cells. All that research served as the basis of the IARC conclusions. But even in 2007 the World Cancer Research Fund, another key group of experts, concluded that there was "convincing" evidence that these meats increase the risk of colorectal cancer. And since 2002, WHO has advised people to moderate their consumption of processed meat, as do the still-pending 2015 Dietary Guidelines for Americans.

What elicited the most heated reaction in the press and blogosphere and especially from the meat industry was the fact that the IARC put processed meats in its Group 1—"carcinogenic to humans"—which includes tobacco smoking and asbestos. (It put red meats in Group 2A—"probably carcinogenic.") The IARC clearly explained that this classification merely indicates the strength of the evidence that something causes cancer, not the *degree* of risk. In fact, it said that the increased risk

from red or processed meat is "small" for individuals, though potentially important for public health since so many people eat meat.

What about that 18% increase in risk? The IARC estimated that for every serving of processed meat (just under 2 ounces) or red meat (3½ ounces) eaten daily for years, the lifetime risk of colorectal cancer goes up by about 18%. But this is what's known as relative risk, which can be misleading. For instance, the lifetime risk of developing colorectal cancer in the U.S. is about 5%. An 18% increase does not mean $5\% + 18\% = 23\%$, but rather $5\% + (18\% \text{ of } 5\%) = 6\%$. That means one extra case of colorectal cancer per 100 meat eaters. In contrast, smoking increases the lifetime risk of lung cancer by roughly 2,000%—from about 1 per 100 people to about 20 per 100. So while IARC may classify both processed meat and smoking as Group 1 carcinogens, there's no comparison in their risks.

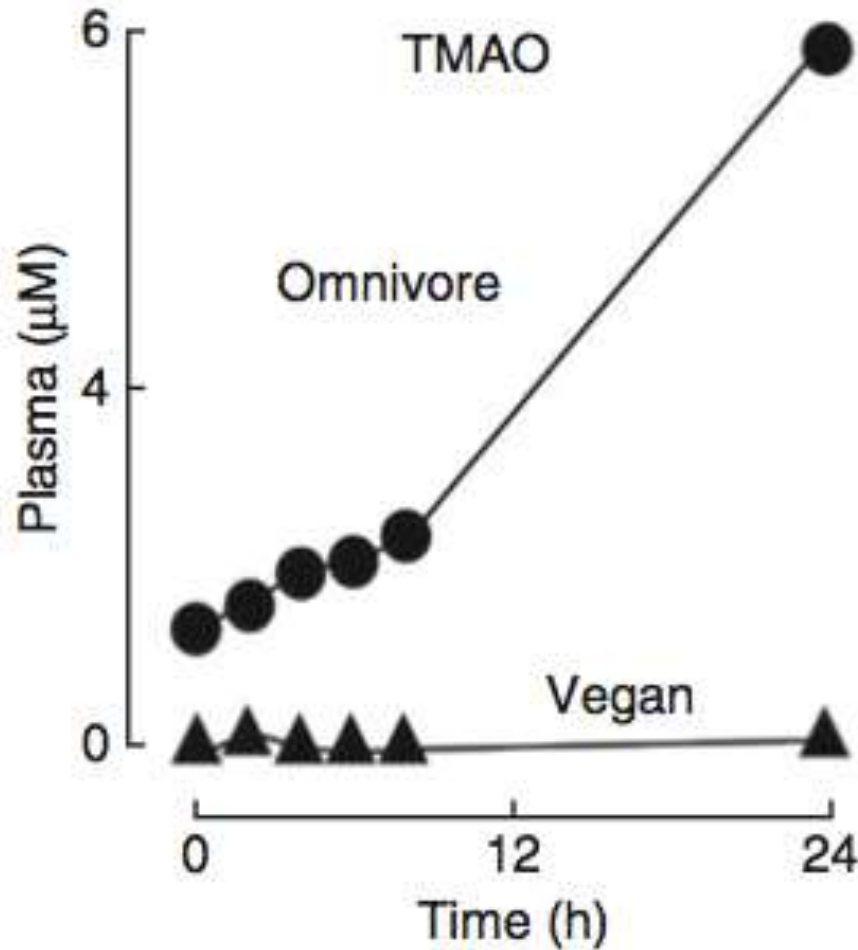
In fact, IARC cited estimates that 34,000 cancer deaths per year worldwide can be attributed to diets high in processed meat. In contrast, tobacco causes nearly 2 million cancer deaths per year.

I should add that I don't think it has been clearly established that meat causes cancer. Proving that foods cause or help prevent cancer is difficult for many reasons. Notably, the observational studies upon which the IARC classifications were largely based can only find associations—they cannot prove cause and effect.

That said, there are plenty of other reasons to moderate your intake of red meats and limit processed ones. There's strong evidence linking them to cardiovascular disease and a variety of other disorders, though it's not clear which compounds in them are the possible culprits. What's more, eating more plant-based foods and less meat is better for the planet, resulting in less greenhouse gas production.

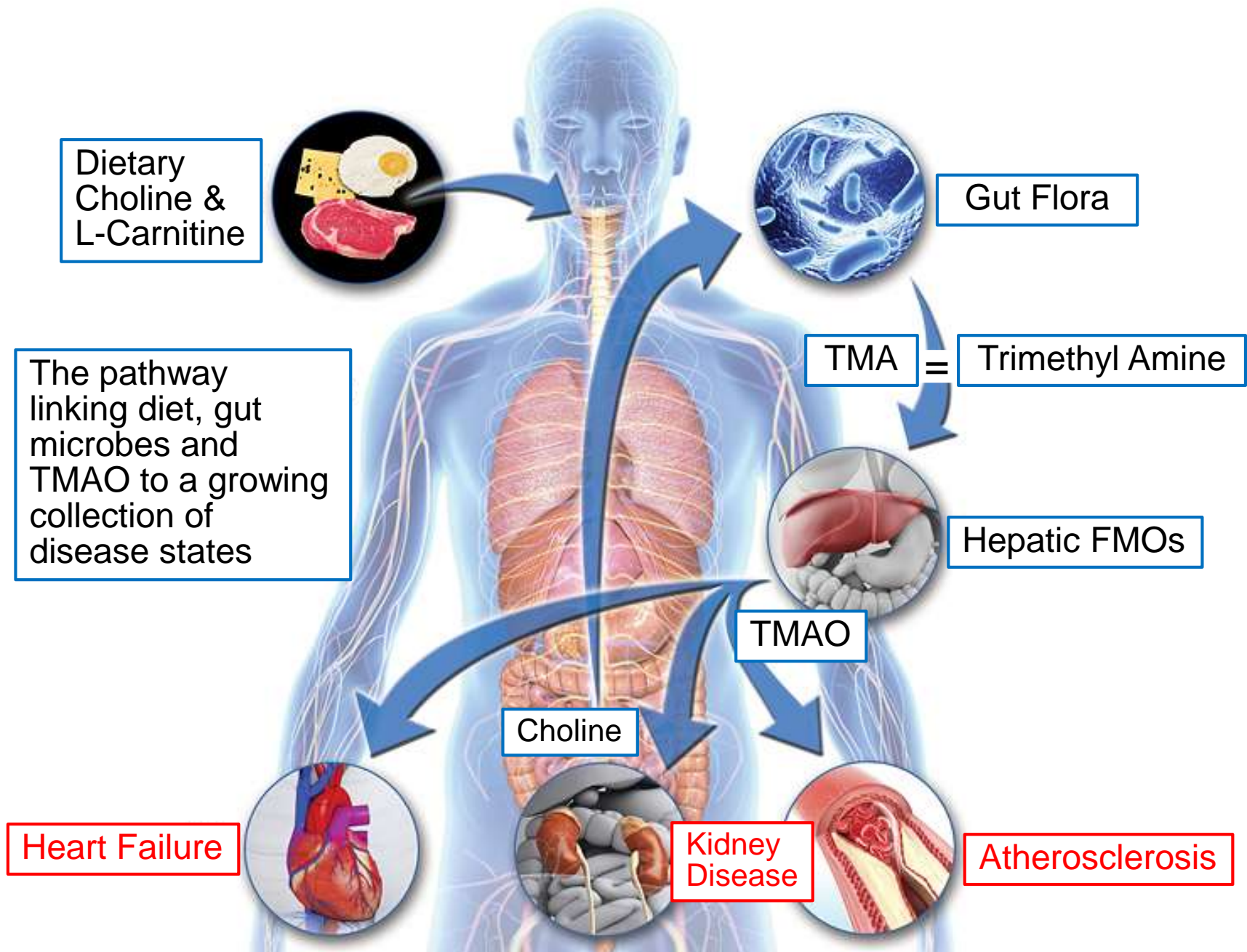
And there's a far surer way to reduce the risk of colorectal cancer than tinkering with your diet: Get screened.

Gut Bacteria Involved in **Inflammation & Atherosclerosis**?

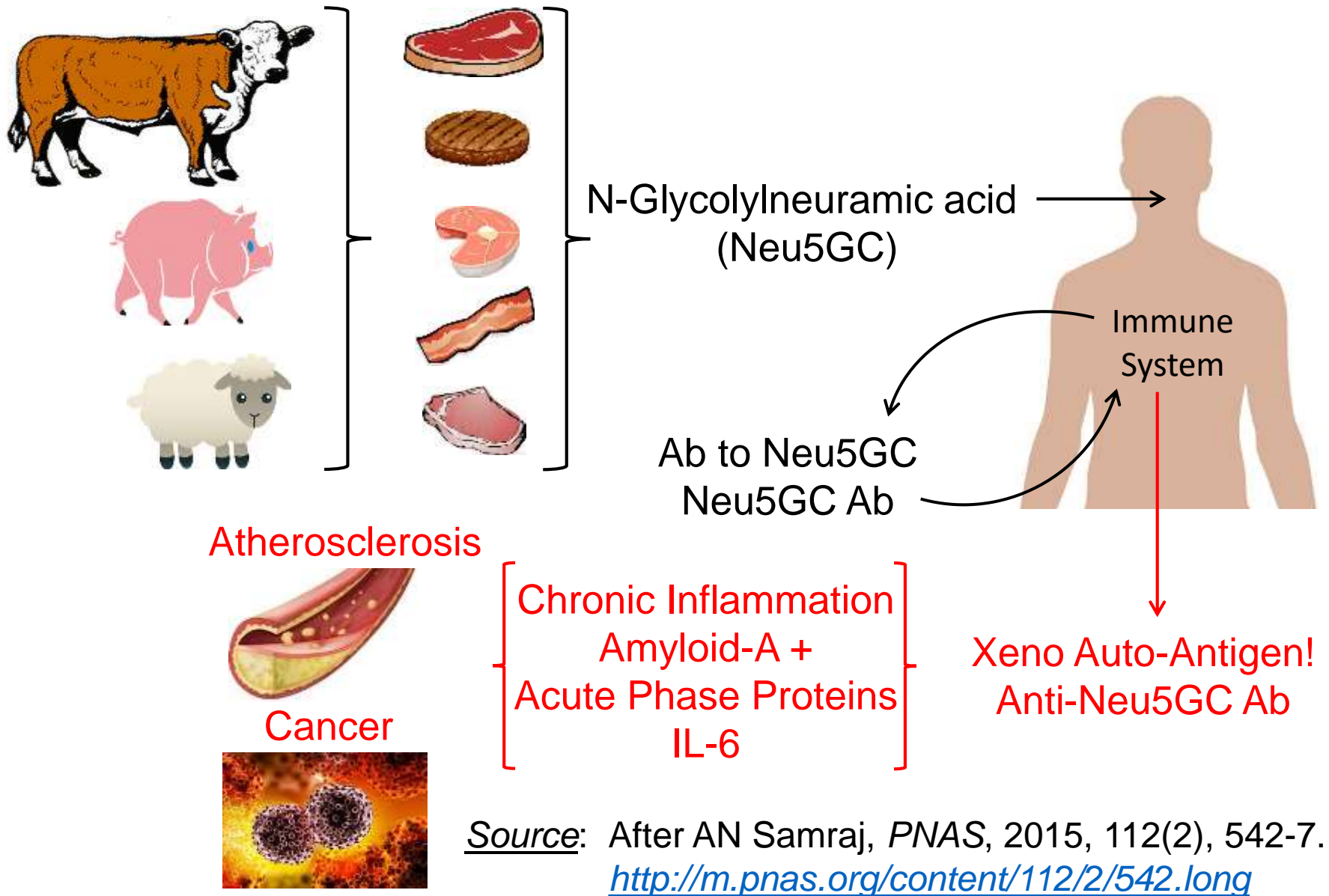


Meat & Eggs → L-Carnitine & Choline → Trimethyl Amine (TMA) →
TMAO → **Inflammation & Atherosclerosis**

<https://consultqd.clevelandclinic.org/2015/02/gut-flora-dependent-tmao-new-studies-extend-its-reach-beyond-the-arteries-to-the-heart-and-kidneys/>



Red Meat-Derived Glycan Promotes Inflammation & Disease



Source: After AN Samraj, *PNAS*, 2015, 112(2), 542-7.
<http://m.pnas.org/content/112/2/542.long>

Environmental Impact

Grain required for:



~61 kg

1 kg of Beef



~38 kg

1 kg of Pork



~13 kg

1 kg of Fish



~33% of H₂O farm animal footprint
due to beef production

SOURCE: SM Downs & J Fanzo. Curr Nutr Rep, 2015, 4:313-22

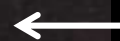
Nutrition Action

OCTOBER 2018 \$2.50

HEALTH LETTERSM
CENTER FOR SCIENCE IN THE PUBLIC INTEREST

Carbohydrate Confusion

Should you avoid carbs
at all costs?



No, ↑ *complex*
↓ *simple!*
Emphasize a
plant-based
diet!

Our Planet
AT RISK

The Best
SPREADS

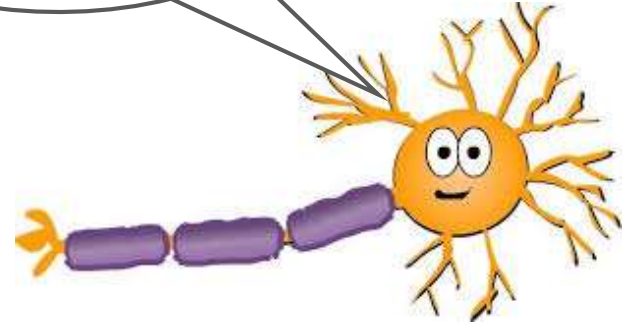
3 Veggie
Dips

Actor Halle Berry "wears by the ketogenic diet,"
according to *Women's Health* magazine.

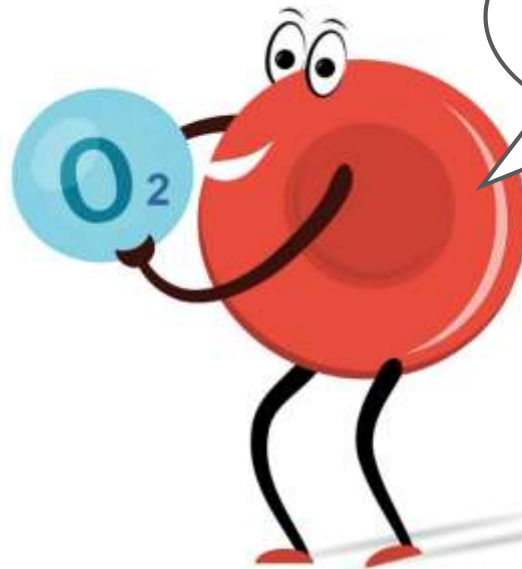
I prefer
glucose!



Me three!



Me too!



Potential regulators
of health!

10s of thousands!

① Anti-oxidants
protect DNA from
oxidative damage

② Protein synthesis
regulation/control

③ Hormone-like
action
endocrine mimicry

④ Blood effects
modify blood chemistry

Phytochemicals ≡ Plant chemicals

aroma, color, taste



*Broccoli sprouts may contain
~ 10,000 unique phytochemicals!*



≥ 5 tomato-containing meals per week may protect from cancers of the esophagus, stomach & prostate !



...but, the phytochemical candidate, lycopene with anti-oxidant activity is also in guava, papaya, pink grapefruit & watermelon!



Why Eat Whole Grains?



Based on existing evidence, eating whole grains is definitely good for our health.

Shengmin Sang, Professor of Food Science & Human Health North Carolina A&T

Fiber ↑ fullness, motility, beneficial bacteria, wt control
↓ cholesterol, insulin response, inflammation, diabetes and CVD risk...



B-vitamins thiamin, niacin, riboflavin ↑ energy metabolism

Folate ↑ red blood cells, ↓ neural tube defects

Iron ↑ O₂ carrying, ↓ iron-deficiency anemia in women

Magnesium ↑ bone building & muscle energy release

Selenium an anti-oxidant, protects body cells & ensures a healthy immune system...



**[https://www.choosemyplate.gov/
grains-nutrients-health](https://www.choosemyplate.gov/grains-nutrients-health)**



Nutrition Action

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HEALTH LETTER®

CENTER FOR SCIENCE IN THE PUBLIC INTEREST

Eat Real, America!

"With the right food choices, physical activity, and not smoking, we could prevent about 80 percent of heart disease, about 90 percent of diabetes, and 70 percent of stroke," says Walter Willett, chair of the nutrition department at the Harvard School of Public Health in Boston. "Those are the three pillars. They really do make a difference."

The right food choices are simple: Eat less red meat, sweets, refined grains, and salt, and drink fewer sugary beverages. Replace unhealthy foods with vegetables, fruit, beans, and whole grains, and with smaller amounts of fish, poultry, and low-fat dairy. Those foods aren't just good for our health. They can also help protect the Earth.

Here's why—and how—to eat real.

Continued on page 3.

With the right food choices, physical activity, and not smoking, we could prevent about 90% of diabetes, 80% of heart disease and 70% of strokes!

FOOD DAY

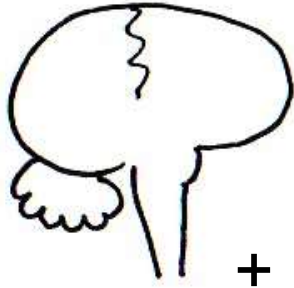
OCTOBER 24, 2011

JOIN US AT FOODDAY.ORG

40

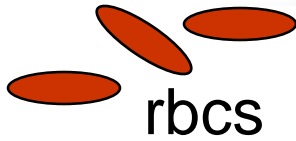
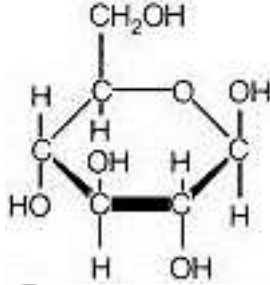
CSPI • 1971-2011

2



+

glucose



rbcs



1

Negative Effects of Low Carbohydrate

4



- ① ↑ fatigue/exhaustion central & peripheral!
- ② ↓ glucose – brain+spinal cord, rbcs thrive upon.
- ③ ↓ variety which reduces intake of phytochemicals, vitamins, minerals & fiber.
- ④ ↑ risk of respiratory infections.



+ gall stones,
↓ thermoregulation...

Dietary Composition & Physical Endurance

eg, Atkins!

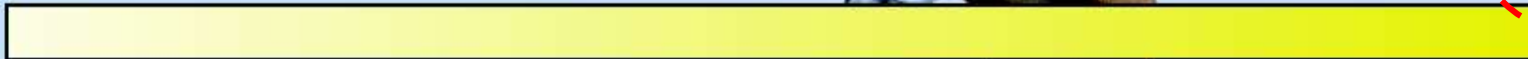
High-fat diet



Normal mixed diet



High-carbohydrate diet



~ 1/3 endurance!

Maximum endurance time:

57 min

114 min

167 min



American Institute for Cancer Research

10 CANCER PREVENTION RECOMMENDATIONS

- MAINTAIN A HEALTHY WEIGHT**
- MOVE MORE**
- EAT WELL**
- ENJOY A PLANT BASED DIET**
- REDUCE RED MEAT, AVOID PROCESSED MEAT**
- CUT DOWN ON ALCOHOL**
- EAT LESS SALT**
- AFTER TREATMENT, CANCER SURVIVORS SHOULD FOLLOW THE CANCER PREVENTION RECOMMENDATIONS**
- IF YOU CAN, BREASTFEED YOUR BABY**
- FOR CANCER PREVENTION DON'T USE SUPPLEMENTS**
- And always remember – do not smoke or chew tobacco.**

aicr.org

CANCER PREVENTION
Together We Can

We're better at storing fat vs carbohydrate!

Dietary Fat



3 % Kcal

Body Fat



23 % Kcal

**Dietary
Carbohydrate**



**To Help Lower Body Wt & %Fat
EXERCISE!! + *Minimize* These!!**

FAT 9 Kcal/g

ETOH 7 Kcal/g

CARB 4 Kcal/g

PRO 4 Kcal/g

**DIETFITS (2018)
+ Pounds Lost
Trial (2009)
indicate that
reducing overall
calories is more
important than
macronutrient
composition of
the diet!**

**NB: Minimize not Eliminate!
Moderation not Abstinence!!**

<https://www.ncbi.nlm.nih.gov/pubmed/29466592>

<https://www.ncbi.nlm.nih.gov/pubmed/19246357>

***I'm not sure I believe you!
Why can't I just starve to
lose weight?***



TOTAL FAST =
No Energy Nutrients
**(No Carbohydrates, Fats
or Proteins)**

ONLY

- 1. Water**
- 2. Vitamins**
- 3. Minerals**

60-day Fast???

Lost 60 lb!! Wow!!

Yet

26 lb Water

20 lb Lean Body Mass

14 lb Fat

Fat < $\frac{1}{4}$ total wt loss!

> $\frac{3}{4}$

***You can lose weight by
starving – but it's mostly
water & muscle! Also, there
can be complications!***



Potential Complications of Total Fasting

**Nausea, diarrhea, persistent vomiting,
postural hypotension, nutritional
deficiencies, menstrual irregularities,
and...sudden death.**

Positive Aspect??

**General loss of appetite within
first 2 days, maintained
throughout fasting period.**

The Filthy Food Act, p. 2

Vitamin D, calcium, & cancer, p. 8

Almond creamers, back cover

Nutrition Action

MAY 2017 \$2.50

HEALTH LETTER®

WITH FOOD SCIENCE IN THE PUBLIC INTEREST

APPLES TO
WATERMELON
Rating fruit

Two super
salads

Good for the
GUT?

An
Anti-Aging
Diet?



CALERIE STUDY

Comprehensive Assessment of Long-term
Effects of Reducing Intake of Energy



- 2-yr kcal restriction, assess biomarkers longer, healthier life
- 218 people, 21 – 51 yr, ½ ~ overweight, ½ normal wt
- Usual diet or cut kcal by 25% (achieved ~ 12% so < ½ goal)
- If cut calories, lost 10% body wt ~ 17 lb & kept off for 2 yr
- Cardiometabolic Δ s: ↓ Cholesterol, ↓ Inflammatory markers,
↑ control blood sugar control w/o
adverse sexual or immune function Δ s

Some bone loss, but attributed to weight loss.



National Institute
on Aging



Das SK, Roberts SB, Bhapkar MV & coworkers.
Am J Clin Nutr 2017 Apr, 105(4):913-927.

<https://www.ncbi.nlm.nih.gov/pubmed/28228420>

5:2 Intermittent “Fasting”

2 Days a Week

500-CALORIE DAY



Breakfast

*Plain low-fat yogurt
with berries*
200 calories



Dinner

*Mixed greens
with grilled chicken*
300 calories

NAHL 2017 May

5:2 Intermittent “Fasting”

600-CALORIE DAY



Dinner

*Baked salmon with
asparagus and
tomatoes*

350 calories

Breakfast

*Oatmeal with
peaches, berries,
and milk*

250 calories



Human Intermittent Fasting Studies

- ~100 overweight or obese women
- ½ cut 25% kcal every day
- ½ ate normally 5 d, but only 650 kcal/d for 2 d/wk
- After 3 – 6 mo, each group lost ~ same amount of wt but women on 5:2 diet had better insulin function!
- Likely easier for most humans to restrict for only 2 d/wk!

The Nightingale Centre
Wythenshawe Hospital
Southmoor Rd
Manchester
M23 9LT



UHSM
Your Hospital

Harvie M, Wright C, Pegington M and coworkers. *Br J Nutr* 2013 Oct,110(8): 1534-47. <https://www.ncbi.nlm.nih.gov/pubmed/23591120>

Harvie M, Peginton M, Mattson M and coworkers. *Int J Obes* (London), 2011 May, 35(5):714-27. <https://www.ncbi.nlm.nih.gov/pubmed/20921964>

Successful Dieting – National Weight Control Registry

- 5000 people, ≥ 30 lb weight loss, ≥ 5 yr
- High-carbohydrate (55-60%), low-fat (24%) diet with the rest (~ 16 -21%) from protein
- Wholesome vs. high-sugar carbohydrates including fruits, vegetables, high-fiber foods

- Conscious of calories knowing that total calories count, no matter what diet type

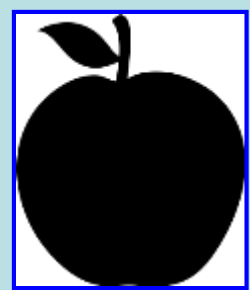
- Eight of 10 ate breakfast daily which may help better manage calories during the day

- Self-monitor, weigh themselves ≥ 1 x/wk & many still keep food dairies

- Much planned physical activity, 60-90 min/d, 1⁰ walking + looked for other ways to be active

<http://www.nwcr.ws/Research/published%20research.htm>

UC Berkeley Wellness Engagement Calendar, September 2013



Eat Breakfast, Eat Early, Downsize, Go Low!



Eating early & less late (< ~ 6:30 pm) may help insulin work efficiently!



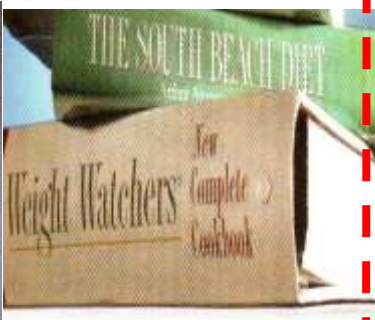
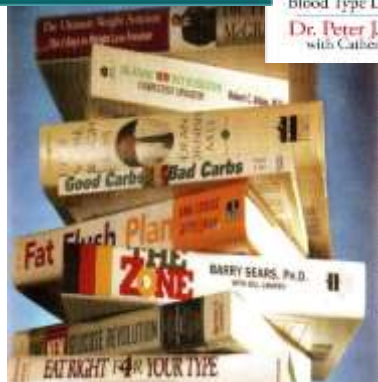
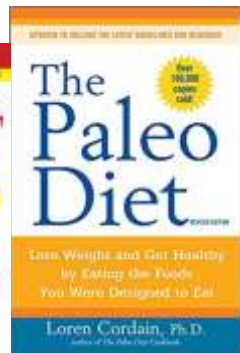
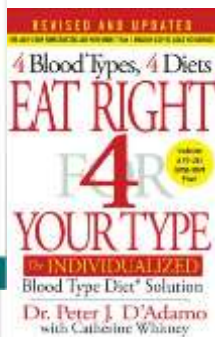
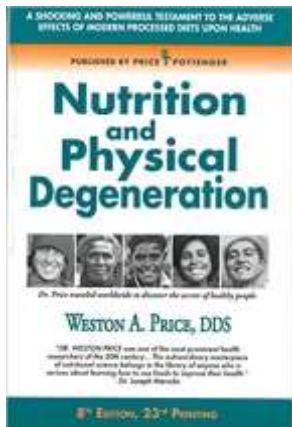
Smaller amount vs plate size!



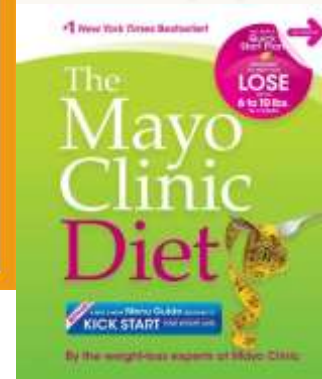
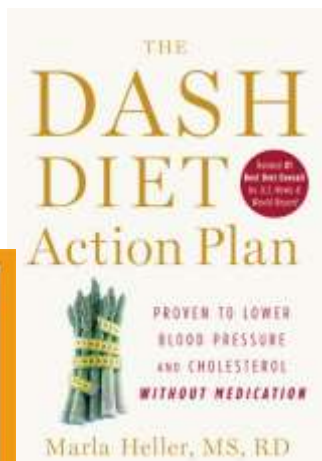
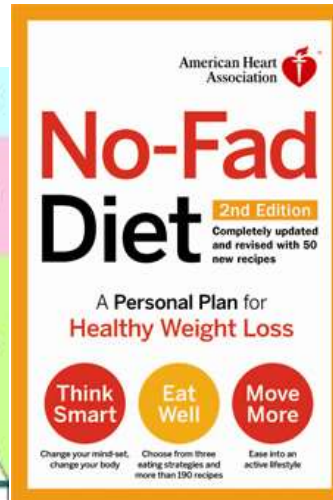
**Fruits & vegetables for
low-calorie density!**

SOURCE: Dow C. How to eat less. What works. What doesn't.
Nutrition Action Health Letter, 2018 Jul-Aug, 6-8.

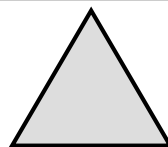
Which Diets are Best?



Mediterranean Diet



Not Plant-based
Lower Carbohydrate



Plant-based
Lower Fat



Not Peer-Reviewed =
Trade Book
→ Opinion



Peer-Reviewed =
Text Books
→ Research

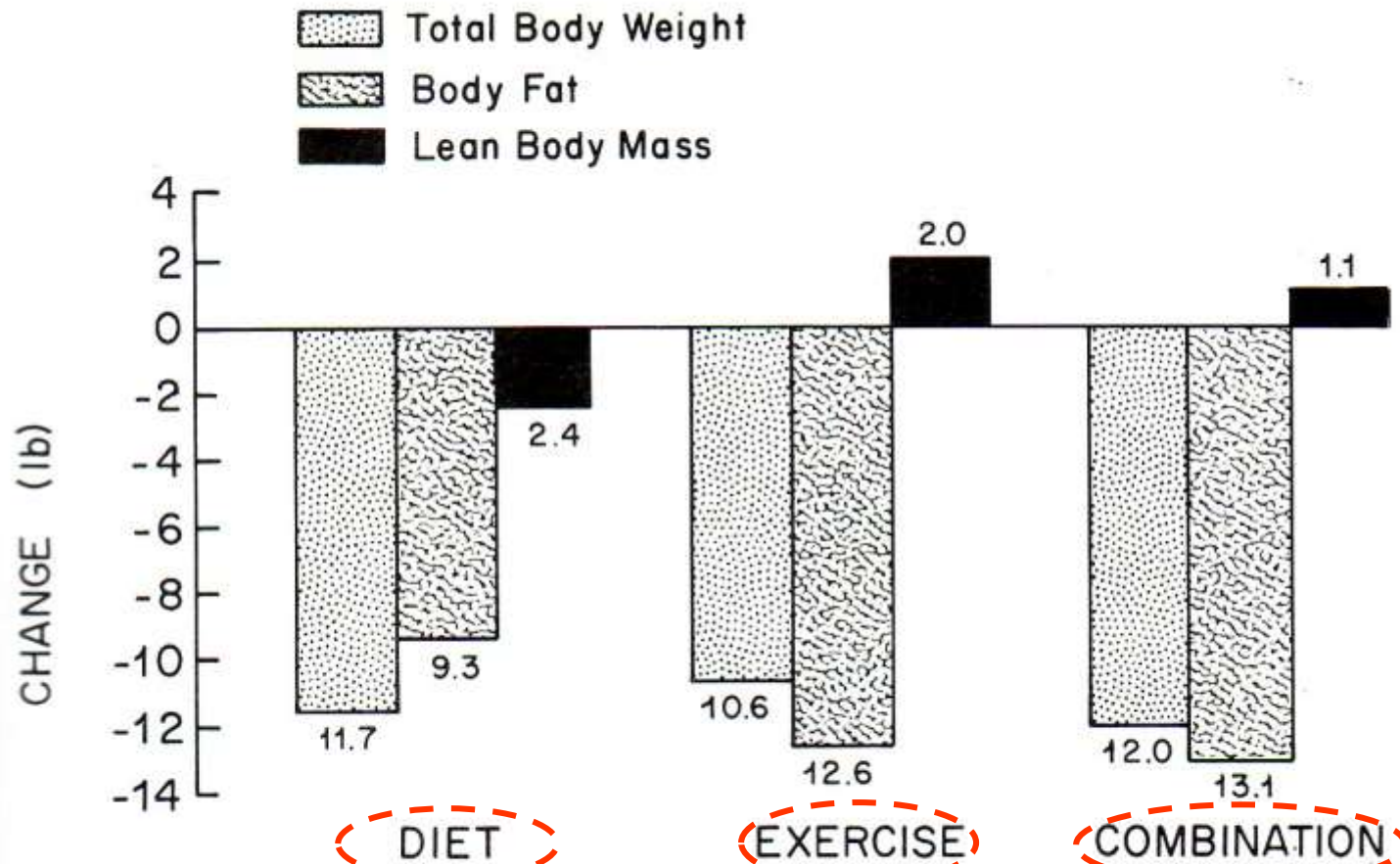


Figure 4-9. Changes in body weight, body fat, and lean body weight for diet, exercise, and combination groups. (From Zuti W. B., and Golding, L. A.: Comparing diet and exercise as weight reduction tools. *Phys. Sportsmed.* 4:49-53, 1976.)

NB: Each group 500 kcal deficit/day, 16 weeks



Exercise is better than dieting in lowering body fat & preserving muscles!



Questions + Discussion

