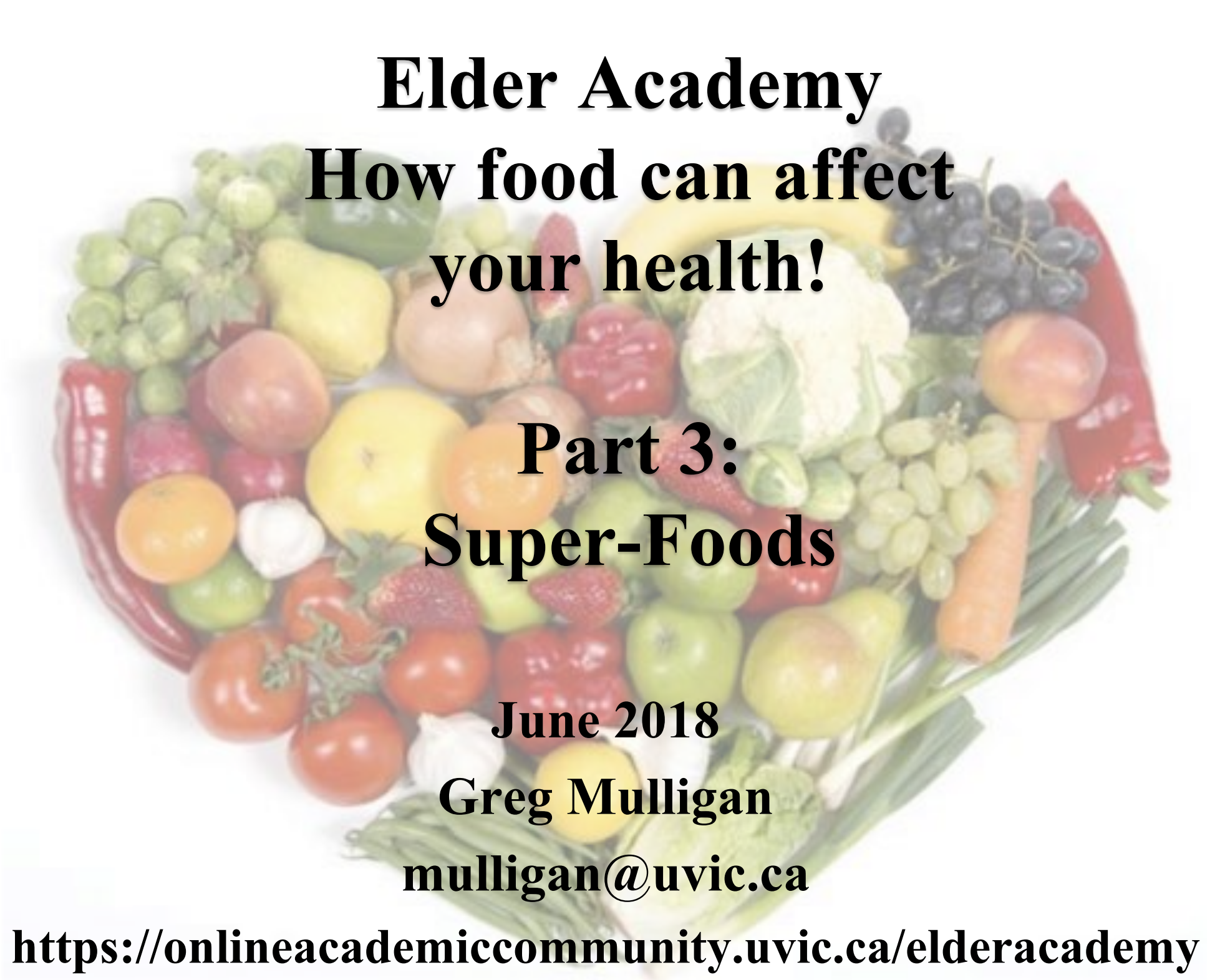

Elder Academy
How food can affect your health!

Part 3: Super-Foods

June 2018

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https://onlineacademiccommunity.uvic.ca/elderacademy

Topics for the Day

- Recap from Part 2
- Gluten-Free (from Part 2)
- Probiotics & Prebiotics
- Omega Fats
- Algae & Sea Vegetables
- Brassicas
- Phytochemicals
- Supplements

Fermentation

A metabolic process that converts a *sugar* to;

- *acids*, *gases*, or *alcohol*

Occurs in;

- Yeast
- Bacteria
- Oxygen-starved muscle cells (lactic acid)

Examples – Alcohol, bread, yogurt, cheese, kimchi, sauerkraut, soya sauce, kombucha, kefir, etc

Sarao & Arora, 2015

Fermentation Types (simplified)

Alcohol Fermentation

- Glucose into alcohol (ethanol) & carbon dioxide

$$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$$

Lactic Acid Fermentation

- Lactose into Glucose

$$C_{12}H_{22}O_{11} + H_2O \rightarrow 2\ C_6H_{12}O_6$$

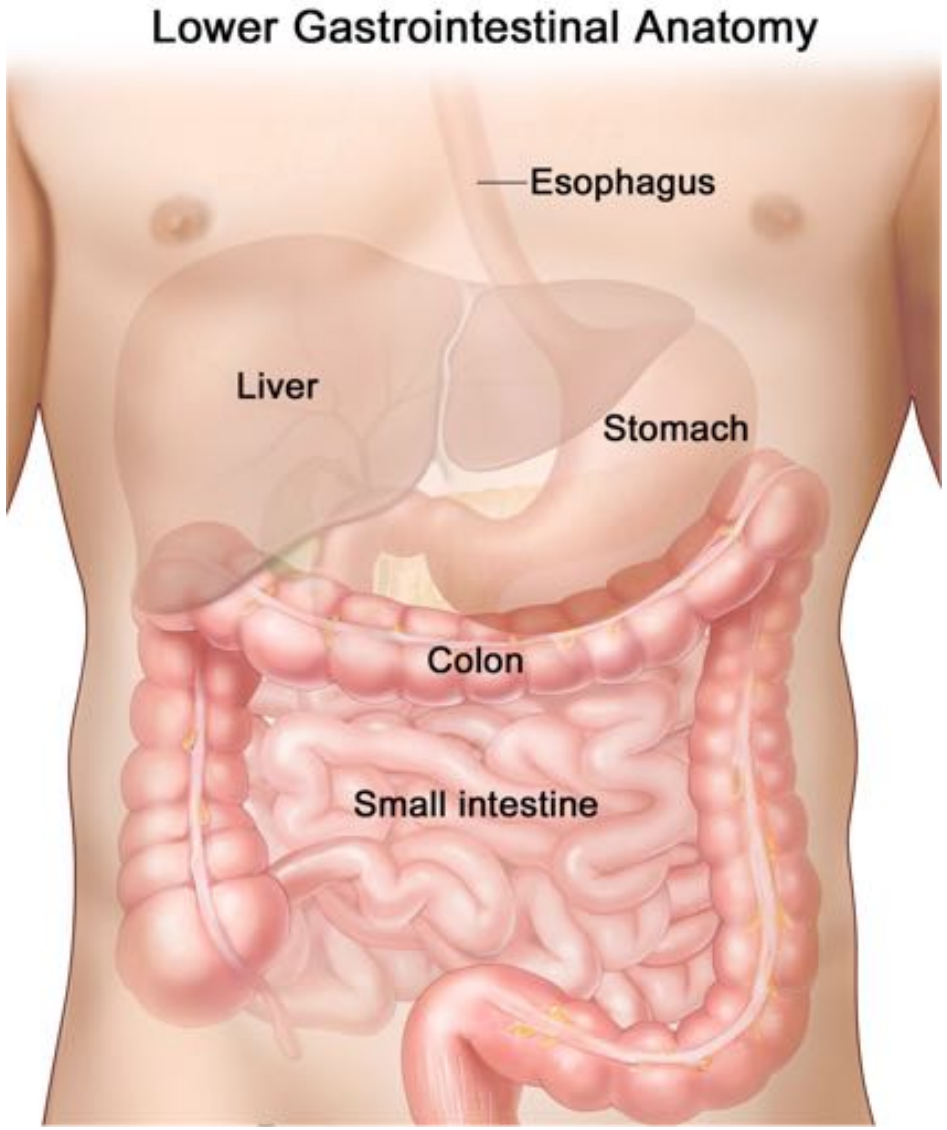
- Glucose into Lactic Acid

$$C_6H_{12}O_6 \rightarrow 2\ CH_3CHOHCOOH$$

Sarao & Arora, 2015

Photo by Andrew Hendrickson

Fermentation In Your Body



Occurs in some types of *bacteria* (such as lactobacilli)

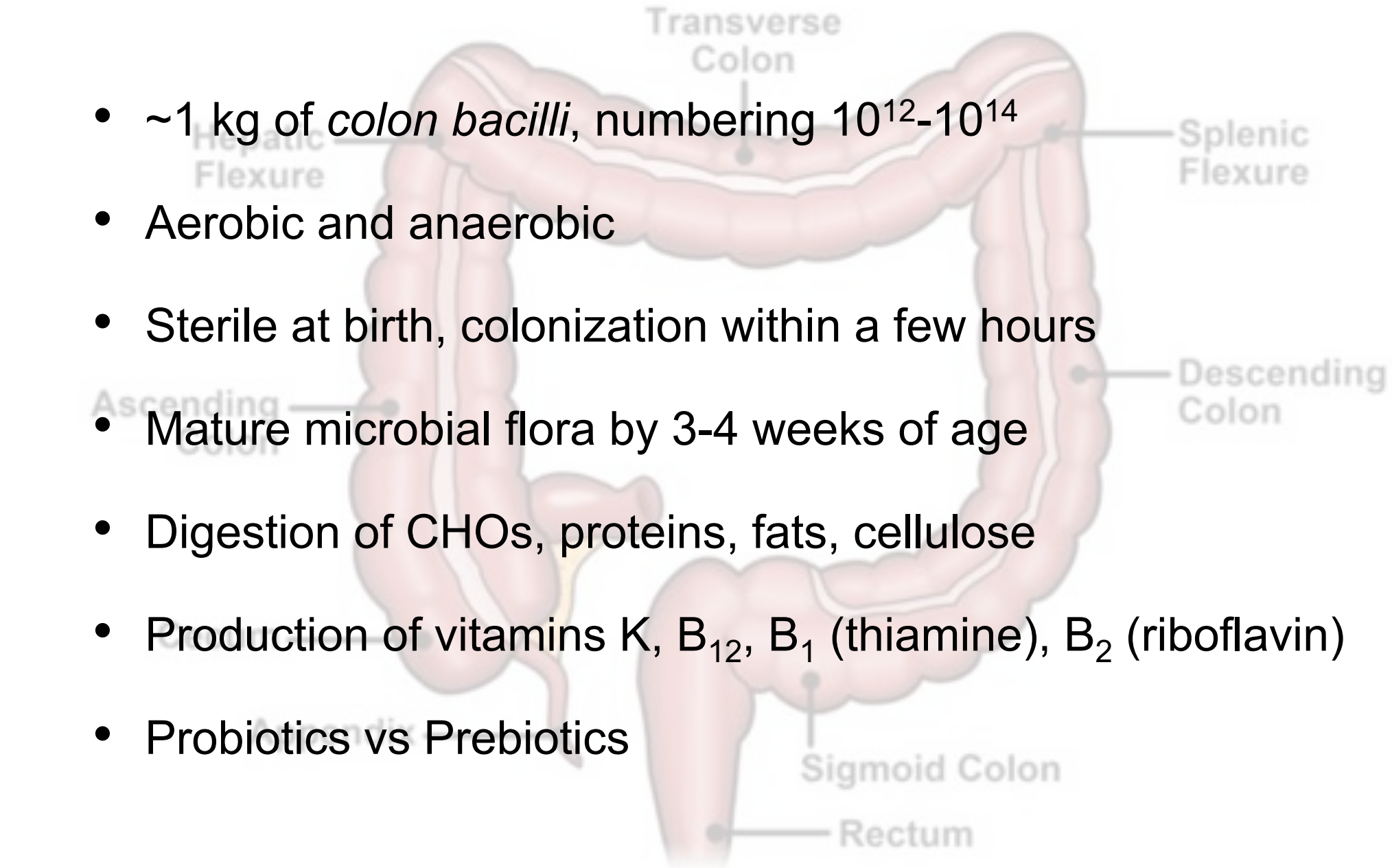
And some *fungi* (baker or brewers yeasts)

These are *probiotics* that contribute to *gut microbiota* (good bacteria in the colon)

- ~1 kg or 10^{12}-10^{14} (a million-billion) bacteria

Sarao & Arora, 2015

(Pro)bacteria in the Colon



- ~1 kg of *colon bacilli*, numbering 10^{12}-10^{14}
- Aerobic and anaerobic
- Sterile at birth, colonization within a few hours
- Mature microbial flora by 3-4 weeks of age
- Digestion of CHOs, proteins, fats, cellulose
- Production of vitamins K, B_{12}, B_1 (thiamine), B_2 (riboflavin)
- Probiotics vs Prebiotics

(Pro)bacteria in the Colon

- Microbiota influence metabolism by playing a critical role in controlling our circadian clock
- The disruption of microbiota can result in altered corticosteroid levels and subsequent metabolic disorders.
- Microbiota can change quickly in response to dietary changes and be altered by consuming prebiotic fibres.
- A substance that has prebiotic activity is a substance that exhibits the selective stimulation of growth/activity of gut microbiota that benefits the health of the host.
- Consuming prebiotics and improving gut microbiota has been associated with physiological benefits such as the *improvement of laxation and digestive health*, *reduced risk of obesity*, *type 2 diabetes, and colon cancer*, as well as *improved mineral bioavailability*.

Dahl & Stewart, 2015

Fermentation in Your Body

Fermentation is *dependent* on Gut Microbiota

Probiotic Foods

- Yogurt, cheese, kimchi, sauerkraut, soya sauce, kombucha, kefir, etc
  - Mainly consist of *lactic acid* producing bacteria:
    - *lactobacilli, streptococci, enterococci, lactococci, bifidobacteria, bacillus*
  - Fungi such as *saccharomyces* & *aspergillus*

Dahl & Stewart, 2015


Sauerkraut
Choucrute
Sauerkraut
Choucrute
Paulsen
Sauerkraut
Choucrute
Paulsen
Sauerkraut
Choucrute
EDEN ORGANIC
EDEN ORGANIC
$ 4.27
$ 3.47
$ 3.97
2/$ 4.00
2/$ 4.00

Making Sauerkraut

Chop cabbage

Weigh cabbage

Weigh salt to equal 2% of cabbage weight

Massage the two together

Set aside for a half hour

Move to a *crock*

- could be a jar, use glass or clay
- avoid contamination
- avoid reactive material (metal)
- weigh it down
- use a little plate or bowl

Cover with coffee filter or napkin/towel and elastic

Avoid light, UV will degrade the food & kill the bacteria

4-6 weeks later – enjoy!

Practical Considerations

Once they are no longer consumed, *pro*biotics wash out of the system quite quickly

Growth of healthy bacteria can be promoted by consuming *pre*biotics

- cheap natural sources
- currently sold as supplements
- also in tube feeding formulas

Risk of using *pro*biotics or *pre*biotics are considered negligible

Fermentation in Your Body

Fermentation is Dependent on Gut Microbiota

Prebiotic Foods

- ***Onions, leeks, garlic, wheat, oats, chicory root, bananas, Jerusalem artichoke***
- Building evidence for:
  - ***Peas, nuts, rye, barley, wheat, lentils, chickpeas***

Dahl & Stewart, 2015

Fibre

- It doesn’t matter if fibre foods are mashed, chopped, cooked or raw...the fibre value is retained!

- What about the effect of cooking on other nutrients?

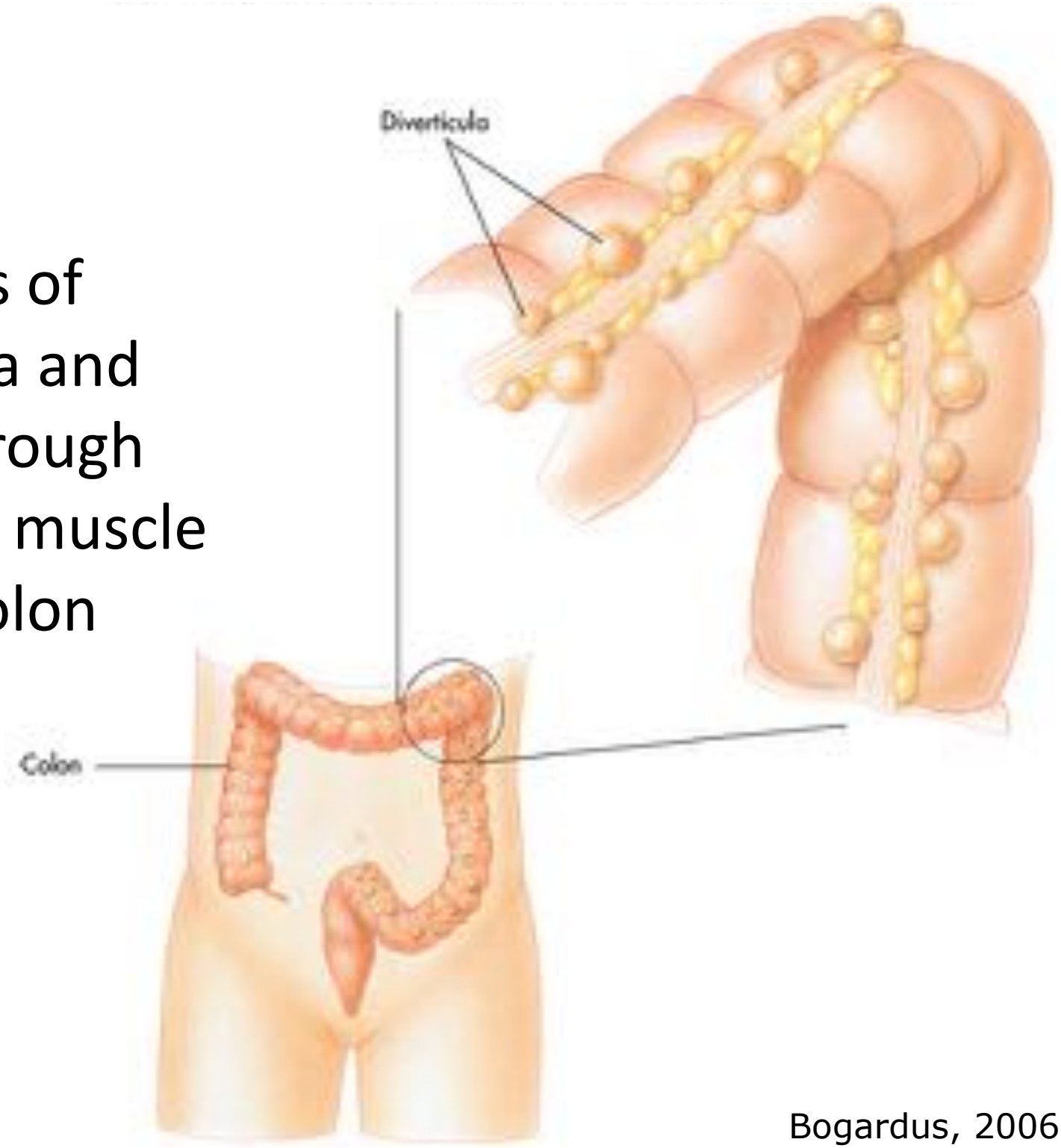
Fibre

- Reduces the risk of:
  - *Colon cancer*
  - *Heart disease (CAD)*
  - *Type II diabetes*
- Improved risk of all-cause *mortality*
- Enhances *weight loss* (greatest single change)
- Helps prevent *hemorrhoids, constipation,* & *diverticulosis*

Dahl & Stewart, 2015

Diverticulosis

- outpocketings of colonic mucosa and submucosa through weaknesses of muscle layers in the colon



Bogardus, 2006

Fibre

Total fibre **= dietary fibre + functional fibre**

Dietary fibre

- Nondigestible carbohydrates and lignin that are *intrinsic* & *intact* in plants.
- Grains, rice, seeds, legumes, fruits

Functional fibre

- *Isolated* nondigestible carbohydrates that have beneficial physiological effects in humans.
- Cellulose, guar gum, psyllium, **pectin**

Dahl & Stewart, 2015

Fibre

- Constituent sugars are *not absorbed* in the small intestine
- Fibre entering the large intestine may be *fermented* by gut microbiota or
- Some may be resistant to *fermentation*, passing through the digestive tract relatively *unchanged*

Dahl & Stewart, 2015

Dietary Reference Intakes (DRI) for total fibre by life-stage group

g per 1000 kcal/day

and

g/day for median energy intake

Life stage group	Adequate Intake[c]			
	Men	g/day	Women	g/day
0 to 6 mo	ND[d]	ND	ND	ND
7 to 12 mo	ND	ND	ND	ND
1 to 3 y	14	19	14	19
4 to 8 y	14	25	14	25
9 to 13 y	14	31	14	26
14 to 18 y	14	38	14	26
19 to 30 y	14	38	14	25
31 to 50 y	14	38	14	25
51 to 70 y	14	30	14	21
>70 y	14	30	14	21
Pregnancy				
<18 y	NA[e]	NA	14	29
19 to 50 y	NA	NA	14	28
Lactation				
<18 y	NA	NA	14	29
19 to 50 y	NA	NA	14	29

Table 2.
Dietary fiber content of selected foods[a]

Food	Serving size	Total dietary fiber (g/serving)	Energy (kcal/serving)
Fruits			
Prunes, dried	5 prunes	3.4	114
Orange	1 fruit (2 ⅞-in diameter)	3.1	75
Apple with skin	1 large (3 ¼-in diameter)	5.4	116
Banana	1 large (8-in long)	3.5	121
Raisins	1 small box (1 oz)	1.0	84
Figs, dried	2 figs	1.6	42
Pear	1 medium pear	5.5	101
Raspberries	½ c	4.0	32
Strawberries, raw	1 c, sliced	3.3	53
Vegetables			
Beans, kidney, canned	½ c	5.5	108
Peas, split, cooked	½ c	8.1	116
Lentils, cooked	½ c	7.8	115
Lettuce, iceberg	1 c, shredded	0.9	10
Kale, raw	1 c, loosely packed	0.6	8
Spinach, cooked	½ c	2.2	21
Peas, green, canned	½ c	3.5	59
Carrots, raw	8 baby carrots	2.5	30
Potatoes, boiled	½ c	1.4	68

Dahl & Stewart, 2015

Potatoes, boiled	½ c	1.4	68
Potato, baked, skin-on	1 medium (2 ¾-in diameter)	3.3	138
Sweet potato, no skin	½ c mashed	4.1	125
Broccoli, raw	½ c	1.1	15
Celery, raw	½ c chopped	0.8	8
Beets, cooked	½ c sliced	1.7	37
Grains			
Raisin bran	1 c	7.4	190
Shredded wheat	2 biscuits	5.5	155
Rice, brown, cooked	1 c	3.5	218
Bread, white (refined wheat)	1 slice	0.8	77
Bread, whole wheat	1 slice	1.9	81
Oatmeal, cooked	¾ c	3.0	124
Rye crispbread	1 wafer	1.6	37
Crackers, graham	2 squares	0.5	60
Nuts			
Almonds	¼ cup	4.5	207
Walnuts	¼ cup, pieces	2.0	196

a Data from US Department of Agriculture, Agricultural Research Service.[8]

Dahl & Stewart, 2015

Questions?

We have 10 minutes for questions.

We will start the second half of this session at 3:00 pm if you want to step out for a short break.

Photo of the "fermentation wall" at Agrius Restaurant by Andrew Hendrickson

Omega-6 & Omega-3 Fats

Omega-6

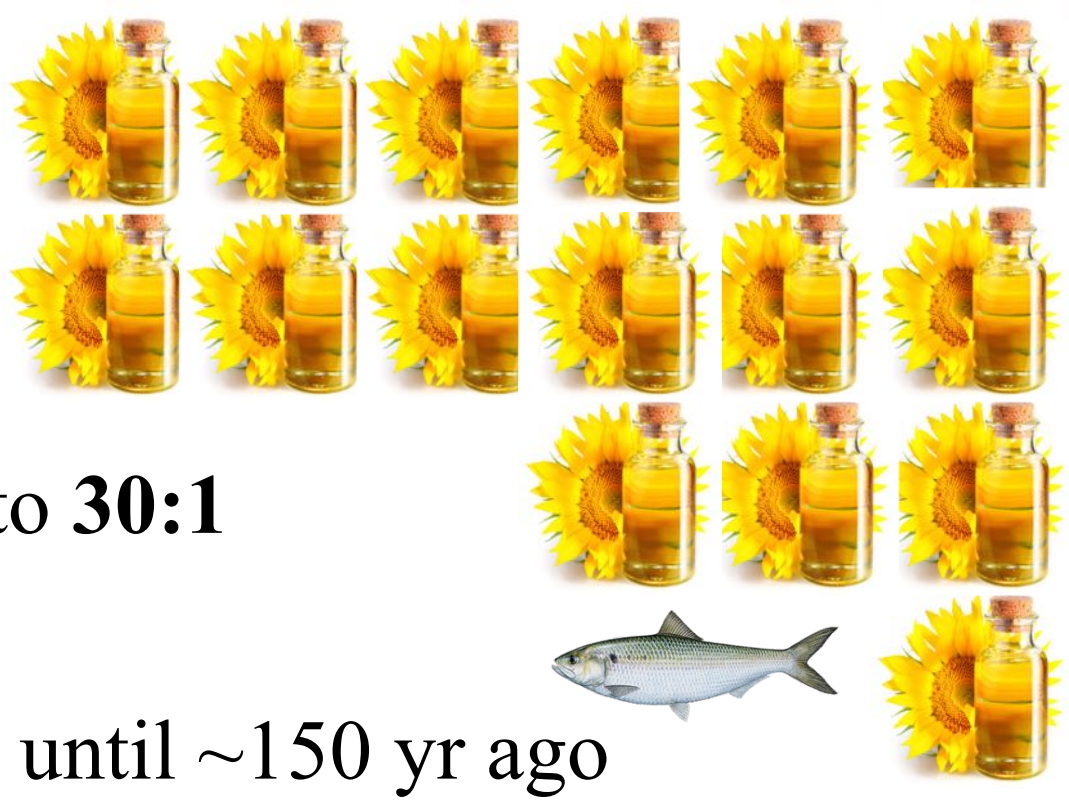
- Safflower oil
- Sunflower oil
- Corn oil
- Soybean oil
- Walnut oil
- Cottonseed oil
- Canola oil
- Peanut oil

Omega-3

- Fish
- Flaxseed

Thompson 2014

Omega Fats



Current "*western*" diet

-Ratio of N-6:N-3 is **15:1** to **30:1**

Throughout human history until ~150 yr ago

-Ratio of N-6:N-3 was ~**1:1**

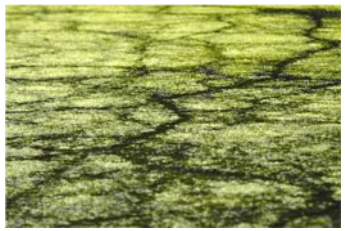
Ratio of N-6 to N-3 has implications for health;

-cardiovascular disease, cancers, osteoporosis, and inflammatory & autoimmune diseases

Simopoulos 2006

Omega-3 Fats

- 3 types of omega-3
  - ALA is present in plant oils, such as:
    - flaxseed, soybean, canola oils, chia seeds, walnuts
  - DHA and EPA are present in:
    - fish, fish oils, and krill oils
    - The fats are originally synthesized by microalgae, not by the fish.
    - When fish consume phytoplankton that consumed microalgae, they accumulate the omega-3 in their tissues



- How much is recommended?
  - 1.1 grams per day for women, 1.6 for men

NIH 2018

Omega-3 Fats

- The omega-3 content of fish varies widely
- Cold-water fatty fish, such as salmon, mackerel, tuna, herring, and sardines, contain high amounts
- Fish with a lower fat content such as bass, tilapia and cod, as well as shellfish contain lower levels

NIH 2018

Omega-3 Fats

- The omega-3 content of fish also depends on the composition of the food that the fish consumes
- Farmed fish usually have higher levels of EPA and DHA than wild-caught fish, but it depends on the food they are fed.
  - Farm-raised Atlantic salmon from Scotland showed that the omega-3 content decreased between 2006 and 2015 due to the replacement of traditional marine ingredients in fish feed with other ingredients

NIH 2018

Omega-3 Fats

- Beef is very low in omega-3s
  - but beef from grass-fed cows contains somewhat higher levels of omega-3 than that from grain-fed cows
- Some foods, such as certain brands of eggs, yogurt, juices, milk, and soy beverages, are fortified with DHA and other omega-3s.
- Since 2002, manufacturers have added DHA and arachidonic acid, the two most prevalent fats in the brain, to most infant formulas

NIH 2018

Omega-3 Fats

Table 2: Selected Food Sources of ALA, EPA, and DHA [29]

Food	Grams per serving		
	ALA	DHA	EPA
Flaxseed oil, 1 tbsp	7.26		
Chia seeds, 1 ounce	5.06		
English walnuts, 1 ounce	2.57		
Flaxseed, whole, 1 tbsp	2.35		
Salmon, Atlantic, farmed cooked, 3 ounces		1.24	0.59
Salmon, Atlantic, wild, cooked, 3 ounces		1.22	0.35
Herring, Atlantic, cooked, 3 ounces*		0.94	0.77
Canola oil, 1 tbsp	1.28		
Sardines, canned in tomato sauce, drained, 3 ounces*		0.74	0.45
Mackerel, Atlantic, cooked, 3 ounces*		0.59	0.43
Salmon, pink, canned, drained, 3 ounces*	0.04	0.63	0.28
Soybean oil, 1 tbsp	0.92		
Trout, rainbow, wild, cooked, 3 ounces		0.44	0.40
Black walnuts, 1 ounce	0.76		

NIH 2018

Algae As Human Food

Algae and sea vegetables are part of several diets

Three unknowns in the scientific research:

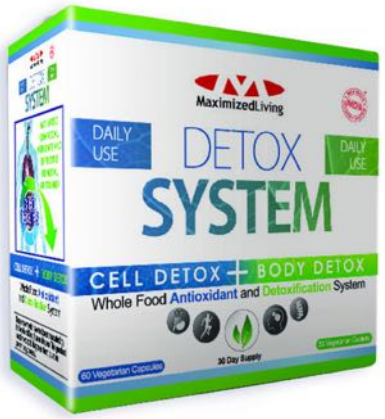
1. Variation of nutritional composition of algae across species, seasons, and different regions
   - nutrition & contamination
2. Unknown bioavailability
3. Unknown effects on metabolism

Pyropia being dried in squares in the intertidal zone by First Nations' people at Pearse Island, British Columbia (2009). Harvesters would traditionally lay the seaweed out to dry on warm rocks while waiting for those fishing to return with the canoes (photo credit, Amy Deveau).

Wells 2018

Why ‘detoxes’ don’t work

- The natural mechanisms for ‘detoxifying’ your body include:
  - Your liver
  - You kidneys
  - Your immune system
- When you do a ‘detox’ or a ‘cleanse’ you are:
  - Losing gut microbiota (1 kg)
  - Muscle and liver glucose (1-2 kg)
  - Body water (3-6 kg)



Why ‘detoxes’ don’t work

- You are much better off to:
  - Stop eating foods that promote toxins
  - Eat more plants
  - Exercise

Brassicas (Cruciferous) Vegetables

- The 2015-2020 Dietary Guidelines for Americans recommend that adults consume 1.5-2.5 cups of dark green vegetables a week
- Including cruciferous vegetables such as
  - Broccoli
  - Cabbage
  - Brussel sprouts
  - Cauliflower
  - Arugula
  - Bok choy
  - Radishes
  - Kale

Webb 2018

Cruciferous Vegetables

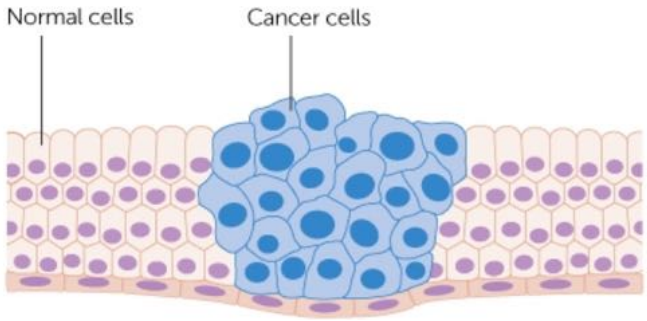
- Excellent source of disease-preventing nutrients, including;
  - Vitamins C, E, K
  - Folate
  - Minerals
  - Carotenoids
    - e.g., beta-carotene, lutein, and zeaxanthin.

- Cruciferous vegetables are also a unique source of glucosinolates
  - a large group of sulfur containing compounds, which have been shown to trigger the death of tumor cells

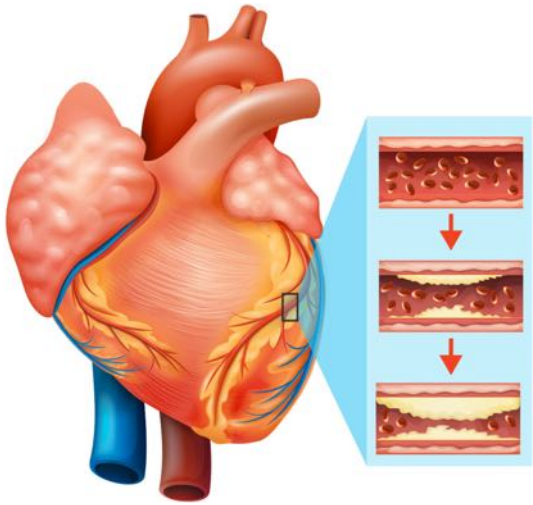
Webb 2018

Cruciferous Vegetables

- A diet high in cruciferous vegetables has been associated with:
  - lower risk of developing cancers of the bladder, breast, colon, endometrium, stomach, lungs, ovaries, pancreas, prostate, and kidneys.



- Inverse association between cruciferous vegetable consumption and heart disease
  - eating at least *one serving* of cruciferous vegetable per week could reduce the risk of heart disease risk by 16-48%.



Buil-Cosiales 2017

Phytochemicals (*phyto* = plant)

Naturally occurring chemicals in ***plants***

Biologically ***active*** in the body

Generally ***better functionality*** in whole foods

Most people consuming a western diet do not consume enough ***plants***

People that eat more ***plants*** *live longer* & have *less disease* (heart disease & cancer)

Phytochemicals give foods their ***unique flavours***

Thompson et al., 2014; Conner et al., 2017

Phytochemicals (*phyto* = plant)

Phytochemicals give foods their ***unique flavours***

e.g. the bitter-tasting phytochemical *furanocoumarin*

Table 2-1 Some Phytochemical Compounds Under Study

Phytochemical	Food Sources
Allyl sulfides/organosulfurs	Garlic, onions, leeks
Saponins	Garlic, onions, licorice, legumes
Carotenoids (e.g. lycopene)	Orange, red, yellow fruits and vegetables (egg yolks are a source as well)
Monoterpenes	Oranges, lemons, grapefruit
Capsaicin	Chili peppers
Lignans	Flaxseed, berries, whole grains
Indoles	Cruciferous vegetables (broccoli, cabbage, kale)
Isothiocyanates	Cruciferous vegetables, especially broccoli
Phytosterols	Soybeans, other legumes, cucumbers, other fruits and vegetables
Flavonoids	Citrus fruit, onions, apples, grapes, red wine, tea, chocolate, tomatoes
Isoflavones	Soybeans, other legumes
Catechins	Tea
Ellagic acid	Strawberries, raspberries, grapes, apples, bananas, nuts
Anthocyanosides	Red, blue, and purple plants (eggplant, blueberries)
Fructooligosaccharides	Onions, bananas, oranges (small amounts)
Resveratrol	Grapes, peanuts, red wine

Some related compounds under study are found in animal products, such as sphingolipids (meat and dairy products) and conjugated linoleic acid (meat and cheese). These are not phytochemicals per se because they are not from plant sources, but they have been shown to have health benefits.

Table 2-2 Tips for Boosting the Phytochemical Content of a Diet

- Include vegetables in main and side dishes. Add these to rice, omelets, potato salad, and pastas. Try broccoli or cauliflower florets, mushrooms, peas, carrots, corn, or peppers.
- Look for quick-fixing grain side dishes in the supermarket. Pilafs, couscous, rice mixes, and tabbouleh are just a few that you'll find.
- Choose fruit-filled cookies, such as fig bars, instead of sugar-rich cookies. Use fresh or canned fruit as a topping for puddings, hot or cold cereal, pancakes, and frozen desserts.
- Put raisins, grapes, apple chunks, pineapples, grated carrots, zucchini, or cucumber into coleslaw, chicken salad, or tuna salad.
- Be creative at the salad bar: Try fresh spinach, leaf lettuce, red cabbage, zucchini, yellow squash, cauliflower, peas, mushrooms, or red or yellow peppers.
- Pack fresh or dried fruit for snacks away from home instead of grabbing a candy bar or going hungry.
- Add slices of cucumber, zucchini, spinach, or carrot slivers to the lettuce and tomato on your sandwiches.
- Try one or two vegetarian meals per week, such as beans and rice or pasta; Chinese vegetable stir fry; or spaghetti and tomato sauce.
- When daily protein intake more than meets recommended amounts, reduce the meat, fish, or poultry in casseroles, stews, and soups by one-third to one-half and add more vegetables and legumes.
- Keep a bowl of fresh vegetables in the refrigerator for snacks.
- Choose fruit or vegetable juices instead of soft drinks, and preferably 100% juice varieties.
- Substitute tea for coffee or soft drinks on a regular basis.
- Have a bowl of fruit on hand.
- Switch from crisphead lettuce to leaf lettuce, such as romaine.
- Use salsa as a dip for chips in place of creamy dips.
- Choose whole-grain breakfast cereals, breads, and crackers.
- Add flavor to your plate with ginger, rosemary, basil, thyme, garlic, onions, parsley, and chives in place of salt.
- Incorporate soy products, such as tofu, soy milk, soy protein isolate, and roasted soybeans into your meals (see Chapter 6).

Phytochemicals – *Important Note!*

No peer-reviewed scientific studies show benefits of individual antioxidant nutrients (i.e. supplements)

→ *may even be pro-oxidants (bad) due to contaminants*

Eating *whole foods* that are high in these nutrients (plants & fibrous fruits) have consistently been shown to be associated with *improved longevity*.

Contamination of Nutritional Supplements

- 30/44 of *products available in Canada* tested had substituted ingredients
- 22/44 *did not contain the main ingredient* claimed on the label
- 15/44 herbal products contained *contaminants* and or *fillers* not listed on the label

Herbal products available to consumers in the marketplace may be *contaminated* or *substituted* with alternative plant species and fillers that are not listed on the labels

- WHO lists this as a "*global concern*"

World Health Organization

Newmaster et al 2013

Your body evolved to eat food.

Your body is what you ate.

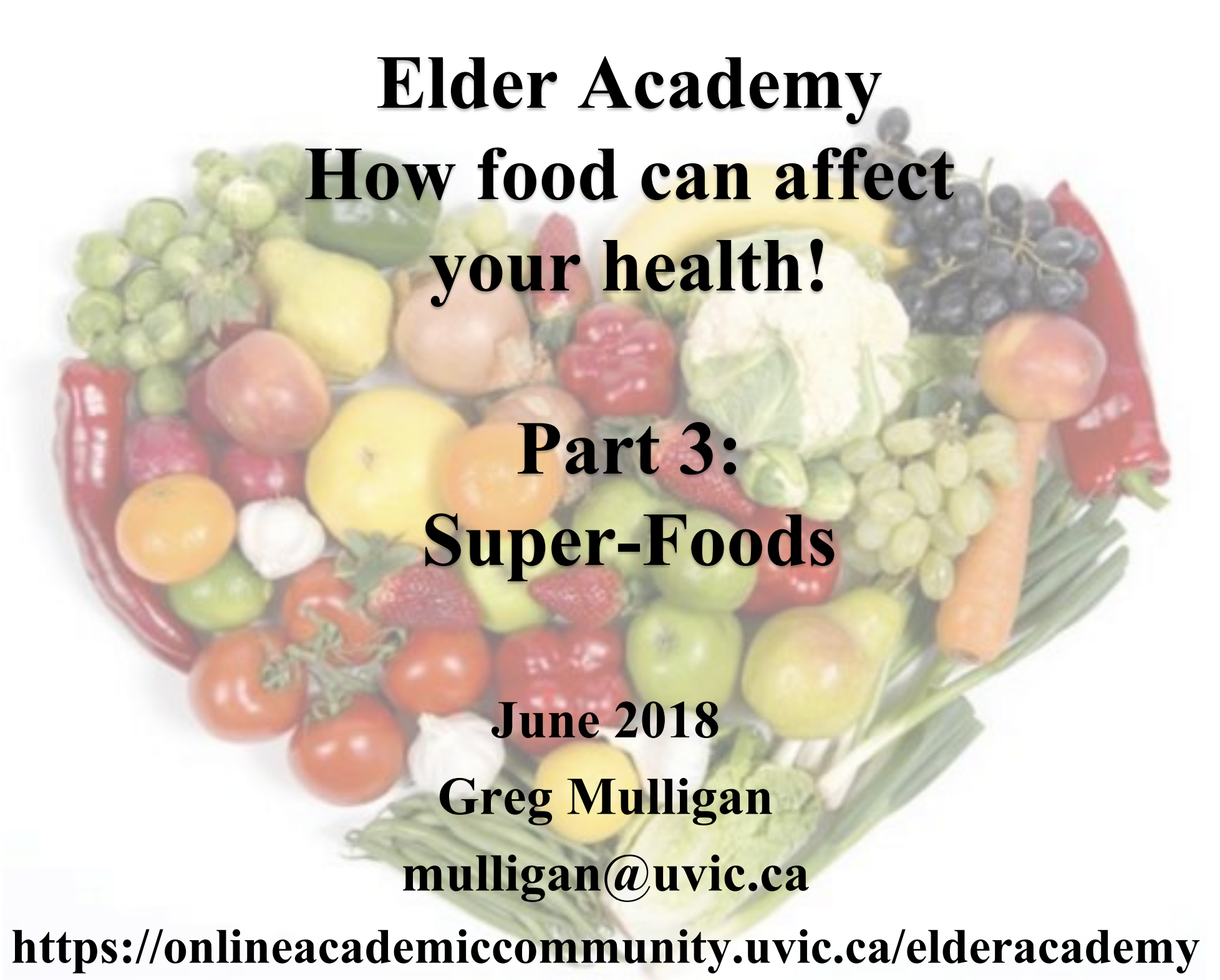
Eat where & when you live.

Questions?

We have some time for questions and will return next week for:

Part 4: Food & Human Health: Eating for cognitive and muscle health, effects of cooking, and more!

Photo of the "fermentation wall" at Agrius Restaurant by Andrew Hendrickson



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