Mending Broken Links


Foraging Challenges

Herbivores on wildlands select diets from a smorgasbord of 50 to 100 species.

Plant species and paths vary greatly in time and space in concentrations of primary and secondary compounds.

The challenges people have created are different. We forage in fast-food outlets and the aisles of supermarkets with many potentially toxic items all attractively displayed.

These “foods” appear to be nutritious, but they are as deadly as locoweed, warfarin, or sweet clover.

Nobody has to tell a bacteria, or a wild insect, fish, bird, or mammal how to eat, develop, and replicate.
Given a chance, rats can rectify sodium, calcium - magnesium (tetany), and amino acid deficiencies by selecting an appropriate diet.

Rats rendered diabetic voluntarily select diets devoid of carbohydrates, consuming only protein and fat.

But what about humans? Do people lack the ability to identify and choose nourishing diets? Or has that ability been hijacked?

Stop to consider the irony: people nowadays have to be told by authority figures of one sort or another what and what not to eat.

Flavor-feedback interactions involve phytochemicals interacting with cells and organ systems in a dynamic network of communication that unites cells and organ systems with environments.

These relationships, mediated by nerves, neurotransmitters, peptides, and hormones, are the basis for the nutritional wisdom of the body manifest through the ability to meet needs for energy, protein, amino acids, various minerals, and to self-medicate.
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Flavor-nutrient learning outside the laboratory
- Craving for fruits with scurvy
- Pica with mineral deficiencies
- Craving for salt with salt deprivation
- Craving for fat with rickets
- Cravings for fat on lean-meat diets

Elusiveness of flavor-nutrient learning in studies in humans: can’t control what people eat.

Basal Diet
- History
- Individuality

Link familiar flavors with high-fructose corn syrup to do two things...
- Lure kids to the novel food by dressing it in a known and liked flavor.
- Reinforce the flavor with a blast of energy.

A 284 g (90-kcal) portion of strawberries (cost $1.50 U.S.) has 5 g of fiber, large amounts of minerals and vitamins and hundreds of phytochemicals.

A 28 g (90-kcal) portion of Fruit Gushers (cost $0.46 U.S.) has 9 g of sugar and 1 g of fat, but virtually no beneficial nutritional constituents of strawberries because a Strawberry Fruit Gusher has no strawberries.

Rather, it consists of pears (from concentrate), sugar, dried corn syrup, corn syrup, modified corn starch, fructose, and grape juice (from concentrate).

Target kids to change dietary habits of a culture

Inability to Learn based on Consequences
- Immediate positive consequences – energy, nutrients, less cost...
- ...are followed by aversive consequences – obesity, diabetes, CVD, cancer – that occur weeks, months, or years later with much greater costs to individuals and society...
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Two Categories of Cravings

Cravings for foods and drinks high in refined carbohydrates are established and maintained by chronically high levels of insulin (hyperinsulinemia), which signal the body to use glucose rather than fatty acids for energy.

We extract and purify primary and secondary compounds to amplify their effects, which can lead to addiction. Dose and rate of release make the poison: chewing a coca leaf is different from sniffing cocaine.

An Apple a Day

Sugar Eaten Annually
18 g in 1830s
45 g in 1920s
98 g in 2000s

Palates Link Animals with Landscapes

Sugar
Metabolism
Phytochemicals
Satiety

Cola
Rapid
Few
Low

Apple
Slow
153
High

Flavor Feedback
Wisdom Body
Social Cultural

Explanations for why animals eat a variety of foods.
Eating any food to satiety causes a transient food aversion based on interactions among flavor, primary, and secondary compounds.

Nothing is more important for health through nutrition than:

Landslapes with diverse arrays of plants are nutrition centers and pharmacies with vast arrays of primary and secondary compounds.
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- Total Mixed Ration: ground and mixed corn, barley, alfalfa, corn silage
- Free Choice: corn, barley, alfalfa, corn silage

How did food intake, animal performance and costs differ?

- Total Mixed Ration: ground and mixed corn, barley, alfalfa, corn silage
- Free Choice: corn, barley, alfalfa, corn silage

- Choice ate less than mixed
- Gained weight at same rate
- Choice cost less to feed than mixed ($1.49/kg gain vs. $1.84/kg gain)

Do people who eat phytochemically impoverished diets overingest foods in a futile quest for protein, minerals, and other phytochemicals in low concentrations?

Grazing Circuits

- Stimulate appetite/intake
- Enables individuals to regulate intake of primary and secondary compounds
- Target grazing to enhance/maintain biodiversity

Grazing Circuits for Human Beings

- Legumes and whole grains high in fiber
- Fresh fruits and vegetables high in phytochemical richness, antioxidants and capsaicin
- Dairy products, meat and poultry high in protein

Which combinations of foods make meals satiating?
Glycemic index (GI) and glycemic load (GL) characterize the rate of carbohydrate absorption after a meal.

Foods high in refined carbohydrates are quickly converted to glucose. That stimulates production of insulin, which boosts storage of energy in fat cells. (Glycemic Index Pyramid, Ludwig, 2000).

Some fruits and spices can reduce hyperglycemia and insulin resistance.

Foods order can reduce glucose-insulin responses

- Drinking wine prior to a meal reduces the GI of the meal by 15 percent.
- Adding organic acids like vinegar or their salts to foods lowers the GI.
- Eating a high GI dessert at the end of the meal is a good practice.
- Eating food high in protein or fat before eating foods high in refined carbohydrates lowers the GI.

Meal courses can reduce glucose-insulin responses

- Glucose and insulin are much lower when food order is vegetables (lettuce and tomato salad with Italian vinaigrette and steamed broccoli with butter) and protein (chicken breast) followed by carbohydrate (ciabatta bread and orange juice) than when food order is reversed.

Meal patterns during the day affect glucose-insulin responses

A high-energy breakfast combined with low-energy dinner decreases hyperglycemia throughout the day. That combination also increases GLP-1, a hormone that promotes insulin sensitivity, increases satiety, and thus reduces food intake.

Value of Fasting for Humans

Intermittent Fasting
Limit eating to a specific, narrow window – 6 to 8 hours – of time each day.

- Normalizes insulin and appetite hormones.
- Normalizes growth-hormone hormone levels.
- Boosts mitochondrial energy efficiency.
- Lower triglycerides and improve other biomarkers of disease.
- Reduce oxidative stress.
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Always Hungry?
Foods high in refined carbohydrates stimulate production of insulin, which boosts storage of energy in fat cells. Thus, other cells and organ systems lack energy, which causes metabolism to slow in an effort to save energy.

Variety

The foods we eat have changed in two fundamental ways.

The flavor of plants and animals has gotten blander. We add synthetic flavors to improve the taste of bland foods.

We have thus dis-incentivized ‘real’ foods, because they don’t taste good, and we’ve made junk food all the more desirable.

We’re all connected...

The health and well-being of people is linked to the health of soil.

Phytochemical richness declined from 10% to 50% in 43 fruits, vegetables, and grains from 1950 to 1999.

Fruits and vegetables picked green, prior to ripening, decreases phytochemical richness.

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It’s hard to get kids and adults to “eat your vegetables.”

Hide vegetables in dishes.

Flavor-flavor conditioning

Intensive breeding has reduced flavor, but people can select for phytochemical richness and flavor.

Over 5,000 volatile compounds in strawberries.

Flavor-enhancing volatile compounds enhance flavor of fruits without increasing energy content.

Neither the food industry nor scientists who study food intake and preferences... have made the link between obesity and phytochemistry.

Indeed, there’s no need to do so if the objective is to increase food intake!

We further reduce phytochemical richness by extracting and purifying compounds and by processing foods.

We’re all connected...

Plant Diversity and Chemistry → Biochemical Richness Diet → Quality Milk, Cheese, Meat

Meat flavor reflects soil and diet, influenced by the phytochemical richness of the landscape.

Yet, no studies have assessed how that affects human health.
Unfortunately, most studies don’t emphasize the origins (diets) of red meat.

**Six Arguments for a Greener Diet**

Postprandial Inflammatory Responses: low-grade systemic inflammation, characterized by an increase in plasma levels of pro-inflammatory markers such as TNF-α, IL-6, and C-reactive protein, is linked with heart disease and cancer.

In humans, postprandial inflammatory responses are much greater for meat from cattle (wagyu) fed high-grain diets than for meat from a wild herbivore (kangaroo) eating a phytochemically rich diet.

**Roles of Phytochemicals in Meat and Fat**
- Energy, Protein
- Fat-soluble vitamins
- Benefits of other phytochemicals that accumulate in fat?

Phytochemicals in the diet a source of health, especially for meat eaters like the Inuit who lacked access to fresh fruits and vegetables.

People of the Deer

Palates Link Animals with Landscapes

What does it mean for creatures to be locally evolving with landscapes?
Cultural Inflection
Expressed behaviors occur within the context of ongoing adaptation in environments where creatures are conceived, born, and live over many generations.

Environments influence gene expression, which influences form, function, behavior, which influences gene expression.

Origins of Our Food Preferences
Mother’s diet influences children’s food preferences in utero (amniotic fluid) early in life (milk, foods)

Humans who get organ transplants experience changes in preferences that reflect those of the organ donor.

Clara Davis’ Self-selection of Diets by Young Children

- Water
- Sweet milk
- Sour milk
- Sea salt
- Apples
- Bananas
- Orange juice
- Fresh pineapple
- Peaches
- Tomatoes
- Beets
- Carrots
- Peas
- Turnips
- Cauliflower
- Cabbage
- Spinach
- Water
- Potatoes
- Sweet milk
- Oatmeal
- Sea salt
- Apples
- Barley
- Orange juice
- Fresh pineapple
- Peaches
- Tomatoes
- Beets
- Carrots
- Peas
- Turnips
- Cauliflower
- Cabbage
- Spinach

No child selected the same foods meal-to-meal and no two children selected the same combinations of foods, but they all ate foods that enabled fine health.
Clara concludes:
By this time you have all doubtless perceived that the “trick” in the experiment (if “trick” you wish to call it) was in the food list. Confined to natural, unprocessed and unpurified foods as it was, and without made dishes of any sort, it reproduced to a large extent the conditions under which primitive peoples in many parts of the world have been shown to have had scientifically sound diets and excellent nutrition.

Native peoples provided special foods to prospective parents, to the father and the mother before conception and to the mother during pregnancy, as well as to the children. They carefully imparted their nutritional wisdom to the young, ensuring the health of future generations.

But that has not been so, especially during the past half century. Now, foods available in the isles of supermarkets, and choices people learn to make are influenced by corporate, political, and academic elders.

Transgenerational Metabolic Syndrome
Mothers who gain excessive weight during pregnancy, mothers who are obese, and mothers who become diabetic during pregnancy are more likely to have fatter babies with higher incidence of diabetes, cardiovascular disease, cancer...

Pancreas develops more insulin-secreting cells. Baby over-secretes insulin and with age becomes insulin-resistant.

Epigenetic gene expression affects form, function, and behavior
Fat mothers make fat babies make fat mothers...
People have learned in utero and early in life to preferentially select energy-dense diets.

- We spend well over $1.5 billion each day for the health care system.
- Medicare spending is projected to increase from $550 billion in 2010 to just over $1 trillion by 2022.

Humans study and attempt to understand consequences of eating specific foods or compounds; herbivores, hunter-gatherers, and peoples in some cultures learn to eat combinations of foods that are healthful.

Due to our penchant for analysis...

- "...many North Americans believe food is as much a toxin as it is a nutrient and that eating is nearly as dangerous as not eating."
- This contrasts with a more relaxed, pleasure-oriented attitude toward food among the French, which is accompanied by relatively high intake of fat-rich foods.

Which food would you take if you were going to be stranded on a desert island for one year?

- Bananas, Peaches: 42%
- Corn, Alfalfa Sprouts: 27%
- Hot Dogs, Chocolate Milk: 12%
- 7%
- 5%
- 4%
- 3%
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How Fat Became Toxic

Issues with gluten: autoimmune (celiac disease, dermatitis herpetiformis), gluten ataxia, allergic (wheat allergy), and possibly immune-mediated (gluten sensitivity).

As with the 'toxic' effect of salt and fat, many people who think they have adverse reactions to wheat do not.

People in all treatments (high-gluten, low-gluten, no-gluten) had pain, bloating, nausea, and gas to a similar degree, indicating strong nocebo effects.

Omega-3s were thought to be anti-inflammatory, and heart-protective.

Preliminary findings were encouraging...

...but more recent double-blind placebo-controlled studies find no effects.

I wouldn’t have seen it if I hadn’t believed it:
Placebo and Nocebo Effects

Searching for Magic Bullets

Cardiovascular Disease

Memory Loss

Macular Degeneration
As Martijn Katan, renowned expert on diet and cardiovascular disease, points out...

“It’s embarrassing, since we’ve been telling people to eat omega-3 fatty acids because they are wonderful for the heart...”

Martijn Katan concludes...

“I am not ready to give up on omega-3s yet, but you’re better off getting them from fish, not fish oil capsules.”

Studies that compare the effects on health of specific compounds with combinations of compounds with individual foods with combinations of foods create synergies as complexity increases.

We’ve come to rely on nutrition supplements ‘preventatively’ to maintain health...

...but they often have no benefits, and at high doses, they can adversely affect health.

Moving beyond silver bullets...

Phytochemically rich combinations of foods -- not compounds or individual foods -- are etiologic in health.
Nature fills vacuums with individuals and no two are alike.

A group of people is like a collection of marbles of all sizes and compositions. Try to “average” these marbles, and you come out with nonsense. You can “average” their color by mounting them on a circular disk and rotating it rapidly. The color comes back a dirty gray. But there isn’t a dirty-gray marble in the lot!

Weight Loss Study (A to Z) assigned 311 overweight or obese premenopausal women to one of four diets. Within each group, some women lost 40 to 50 pounds while other women gained 5 to 10 pounds over 12 months, a range of 60 pounds.

- Zone Atkins
- Low Carbohydrate, High Fat
- Low Fat, High Carbohydrate

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Exercise Study assigned 35 overweight or obese men and women to one of four exercise regimes.

- Exercise – on a stationary bike, treadmill, or stepping or rowing machine—strenuously enough to burn 500 calories per session, five time a week.

After 12 weeks, the ‘average’ person lost 8 pounds, but some people lost 32 pounds, while others gained 4 pounds.

- Roughly 25% of people have a greatly blunted response to glucose: they do not produce much insulin following a glucose challenge.
- Conversely, another 25% of people respond to a glucose challenge by producing far too much insulin: they are hyperinsulinemic.
- The other 50% of people are on a continuum between these two extremes.
- This suggests 25% of the population is adapted to a diet of refined carbohydrates, while 25% is at high risk of obesity and diabetes.
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Reconnecting

Two-thirds of the Earth’s land mass is rangeland, and home to two billion people who depend on livestock at least partially for their livelihood. Managing land for CO₂ sequestration, even on a small scale, could have a big impact on people and the planet. Ranching and farming are key ecologically and economically.

Ecological Doctors

In the hands of ‘ecological doctors,’ the Axe, the Cow, and the Plow become means for rejuvenating landscapes and communities.

We’re all connected...

Animal Impacts ↔ Plant Diversity and Chemistry ↔ Carbon Sequestration

Carbon Sequestration Options

No-Till Farming Pasture Cropping Managed Grazing

There are two spiritual dangers in not owning a farm.” Aldo Leopold wrote nearly 70 years ago in A Sand County Almanac.

“One is the danger of supposing that breakfast comes from the grocery, and the other that heat comes from the furnace.”
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“To avoid the first danger, one should plant a garden, preferably where there is no grocer to confuse the issue.”

“To avoid the second, he should lay a split of good oak on the andirons, preferable where there is no furnace, and let it warm his shins while a February blizzard tosses the trees outside.”

Reduce lawns grow herbal, vegetable, medicinal, and flower gardens. Nothing can as simply re-create linkages as this humble act.

Resources Used to Grow Lawns Annually

- Over 30 thousand tons of synthetic pesticides at a cost of well over $2 billion.
- Over 800 million gallons of gasoline. The gas spilled refilling lawn mowers is 17 million gallons — 1.57 times the amount spilled by the Exxon Valdez off the shores of Alaska.
- Residential water use outside the home is 30% to 60% of total water use. Depending on the estimate, 7 billion to 9 billion gallons of water are used each day for suburban irrigation.

Shop and create meals mindfully

- Buy wholesome foods (healthful varieties vegetables, fruits)
- Pasture-reared meat, cheese

Expose your body to a variety of whole foods and trust the wisdom of your body to select what it needs.
In some ways, the ever incomplete and conflicting understanding of foods and compounds in health, and the presumed adverse or beneficial consequences of eating them, is worse than no knowledge at all.

But the quest to understand is now vital given the many ways people have adversely modified foods during the past century.

As scientists delve deeper into genomics, molecular biology, anatomy, physiology, biochemistry, pharmacology, and so forth, we reflect less on the ‘wisdom of the body’ as the originator, integrator, and manifestation of all these processes.

In so doing, we fail to consider the most important point, one the body of every wild insect, bird, and mammal including hunter-gatherers who ever roamed the planet ‘knows’ from experience.

The body was the first geneticist, molecular biologist, physiologist, nutritionist, pharmacist, and physician. A body knows what to do regarding diet and health, given appropriate choices.