

Vitamin K₂, And the End of Osteoporosis

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Dr. John's Brief Bio

- Missionary child in India till age 18 – British Boarding School
- Johns Hopkins Undergraduate
- Yale University School of Medicine
- 25 years in traditional internal medicine/emergency medicine
- Medical Director of St Luke's and Sinai's ER
- Aurora's Wellness teacher: 2005-2011
- Board Certified in Anti-Aging Medicine 2009
- Board Certified in Holistic and Integrative Medicine 2010
- Advanced Fellow in Regenerative Medicine 2011
- Masters Degree in Metabolic and Nutritional Medicine 2012 from the University of South Florida
- Advanced Fellowship in Integrative Cancer Care: USF
- Started writing email 2007.....#1 on Google in 2013

Objective

- History of how K1 and K2 were discovered
- Answer the Question: Why do American Women Break Their Hips so much more than other Cultures
- What K2 does
- The Calcium Conundrum
- What went wrong?
- Collaboration with A and D
- Healing Bones
- Reversing Heart Disease
- Lots more if we have time

How Often Do American Women Break Their Hips

- 50% of Caucasian women will fracture a hip/wrist/back over age 65
- 260,000 women a year break a hip
- Greater risk for premature death from hip fracture at age 65 than heart disease or cancer
- 1 in 3 women who fracture a hip never leave the nursing home
- 1 in 5 die from it
- African American women: less than half the rate of Caucasian
- African American compared to East African: 80 to 1
- American Caucasian to New Guinea: 1,100 to 1
- I grew up in Village India: my doctor friend Ajit, at Khariar Hospital (2 million population) has never seen a broken hip
- Why?

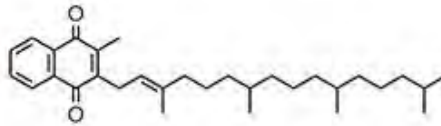
History (How it got lost)

- Danish Biochemist Henrik Dam working on a very high fat diet in chickens in the 1930s
- Noticed that some chickens bled to death
- They got better if fed greens or liver
- Required for clotting: called Vitamin K because Koagulation is how you spelt with a K in German
- Early 1940s: American Edward Doisy isolated and identified the nutrient
- 1943 Dam and Doisy got the Nobel Prize for it
- Vitamin K was called the coagulation nutrient
- Humans made it in their gut – so had plenty of it (blocked by coumadin)

Three Mistakes

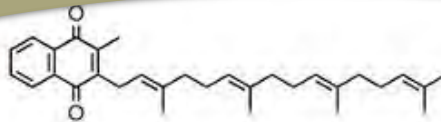
- 1. Thought K1 and K2 were variants of the same
- 2. Thought it was all about coagulation only
- 3. Decided that deficiency was very rare

K1

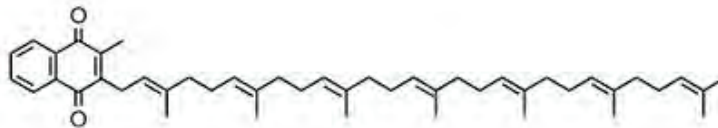


Two forms of Vitamin K2

MK-4

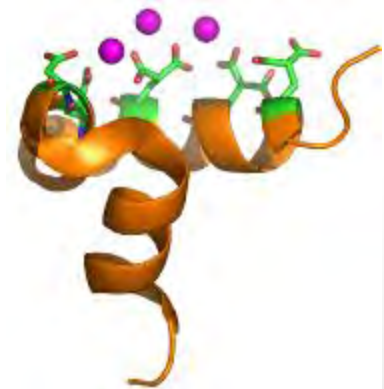
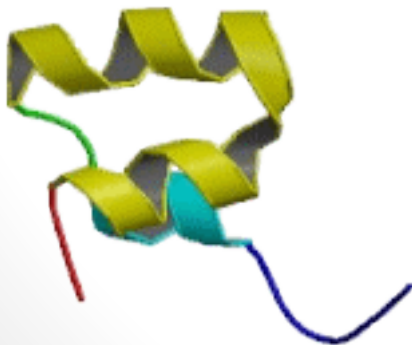


MK-7



Two Major Discoveries

- Harvard 1975
- 1. Osteocalcin
 - The critical bone protein that binds calcium **into** bone
- 2. Matrix GLA Protein in the 1990s
 - The critical calcium protein that pulls it **out** of arteries
 - Booth et al Nutr Rev 1997 282-84
- K2 has a Key role in CALCIUM Metabolism.
- K2 defines where Calcium should and shouldn't go



2007: K2 Deficiency is Common

- Cranenberg et al, Vitamin K: the coagulation vitamin that became omnipotent. Thromb Haemost 2007, 98(1):120-125
- Suddenly the light turned on. Recognized that K2 activated osteocalcin by carbonylating it, and everyone had high levels of UNCARBOXYLATED K2
- This vitamin, discovered 70 years ago was identified as being central to the major diseases of our day:
- Osteoporosis and heart disease
- And its deficiency was COMMON
- But that's not the whole story.
- It had been described 70 years before, and we missed it!

Pop Quiz

- 1. Vit K1 deficiency is common, almost universal. T or F
- FALSE. It's K2 deficiency that's common. K1 is present in everyone and is hard to suppress.
- 2. We discovered that K2 deficiency was common in 2007 when we learned how to measure for the presence of “un-carboxylated” osteocalcin.
- TRUE. The lights just turned on. Everyone was low.
- 3. Osteocalcin is the protein that binds calcium in your bone. Vitamin K2 activates that protein.
- Bingo!

Activator X

- Four years before the Nobel Prize for Vitamin K was given
- A researcher who didn't know what he was investigating called it Activator X
- And he was just a dentist in private practice
- Weston Price
- (No wonder, he was from Cleveland)



Weston Price

- The Charles Darwin of Nutrition
- Born in Canada, but practiced around Cleveland, Ohio for 50 years
- In 1925 embarked on a world wide tour of remote places
- To understand why modern humans got cavities and bad, misaligned teeth
- Swiss valleys, Peruvian Amazon, New Zealand Maori, Outer Hebrides, Andean Sierra, Alaskan Inuit, Australian aborigines,
- They all had square faces, healthy arches, no cavities
- Common to be healthy until exposed to western food
- First could come tooth decay, dental arch defects, then gum disease, then heart disease and diabetes

Weston Price. Dentist



Compared Teeth to Food

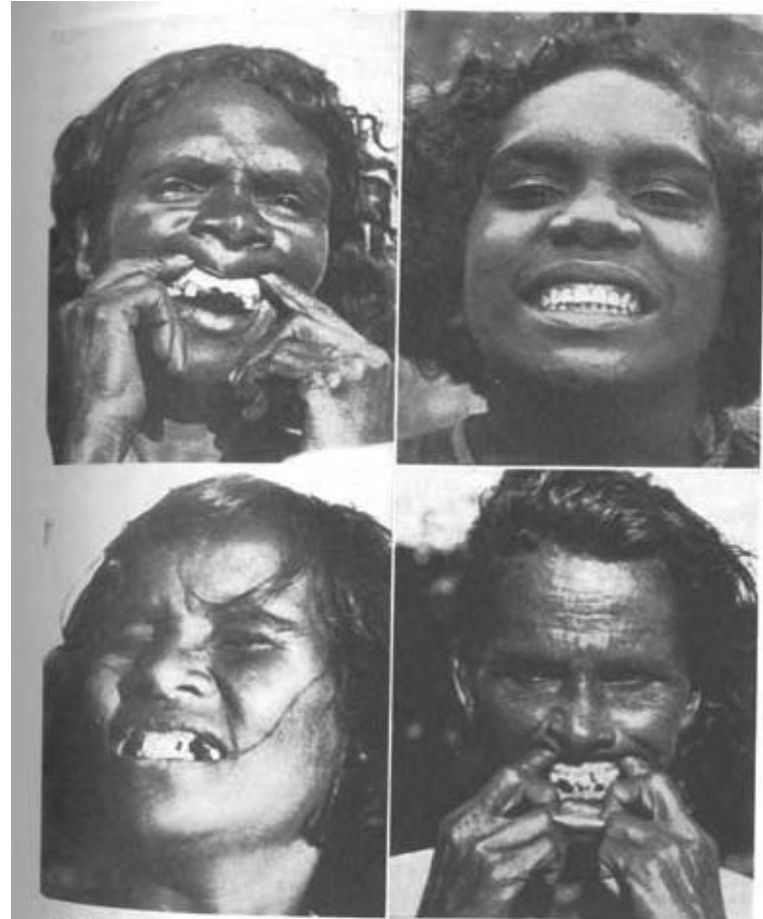
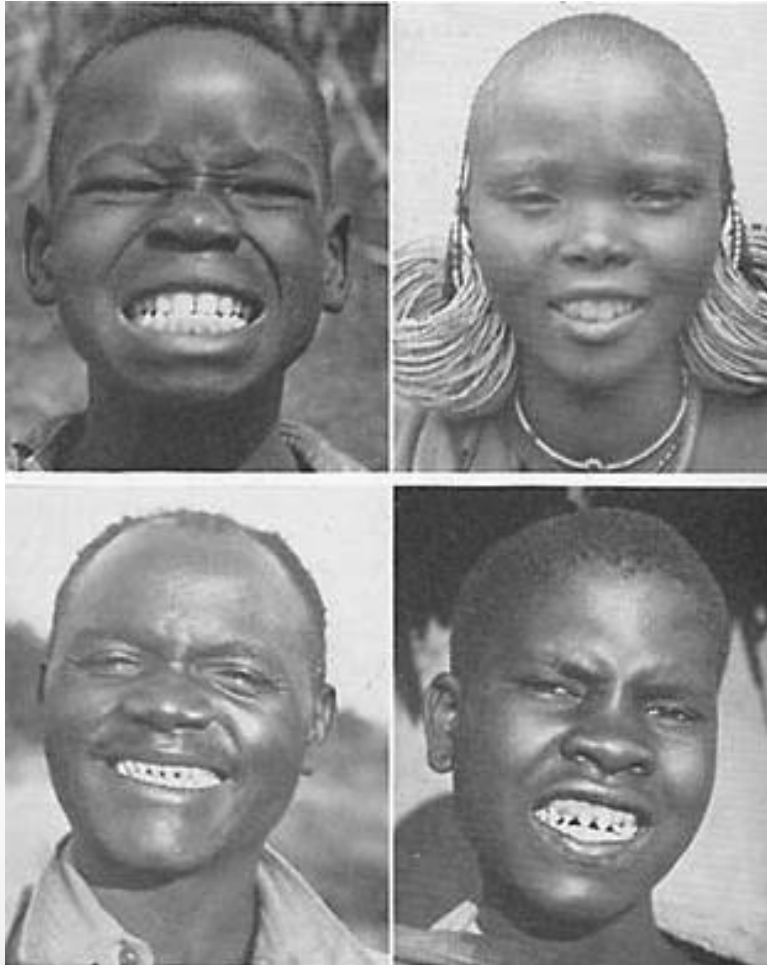


FIG. 54. Wherever the primitive Aborigines have been placed in reservations and fed on the white man's food of common dental caries has been introduced.

Why are these People so Healthy?



Native people eating traditional foods had physical excellence, splendid facial and dental arch forms, and no cavities.

He found common threads

- Foods that can be transported long distances, stored without spoiling: rice, white flour, sugar, vegetable fat, canned goods
- Caused lousy teeth, crowded dental arches, cavities....TB...
- He decided it was the absence of some essential factor
- Findings
- Healthy Traditional diets contained
 - Four times the mineral and water soluble vitamins
 - 10 times the fat soluble vitamins (KADE)
- He focused on the fat soluble vitamins (Price. WA Nutrition and Physical Degeneration, 8th edition ed (La Mesa, CA: Price Pottenger Nutrition Foundation, 2008, 241)
- Aside from A and D, which were known in the 1930s, he identified another fat-soluble “activator”

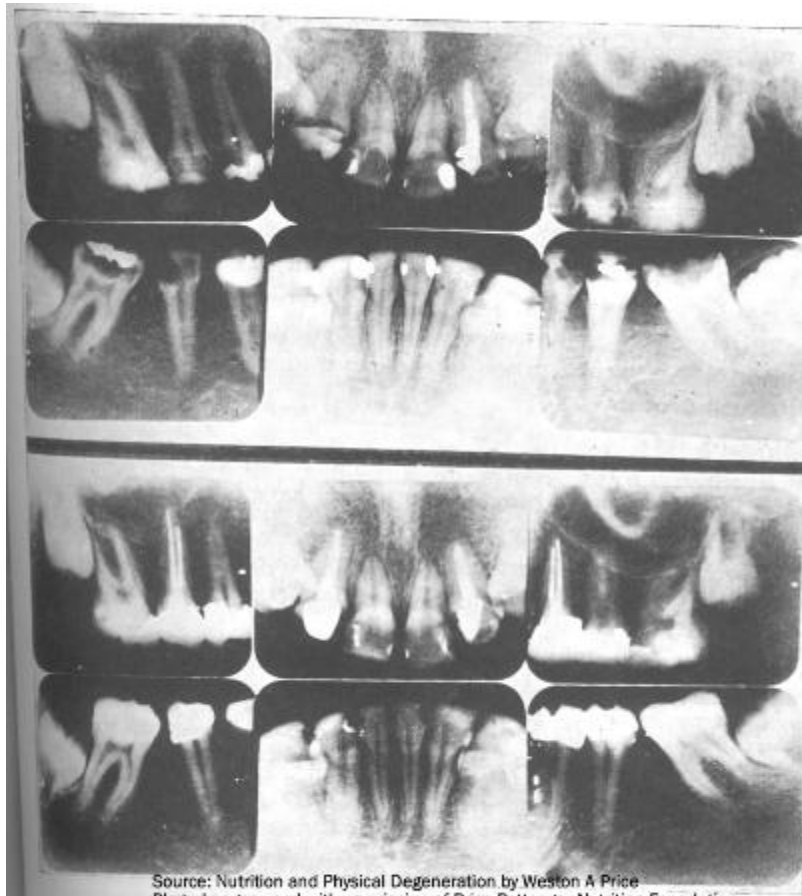
Activator X



- Was present in fish eggs, egg yolks
- Organ meats
- Butterfat of cows eating rapidly growing green grass
- Price created "Activator X" by combining butter oil from cows eating green grass in spring with cod liver oil
- He stopped filling cavities.
- Teeth cured! Cavities filled in on their own
- Published X-rays of teeth before and after being treated with Activator X
- Remarkable findings on x-rays
- It wasn't until 2007 that the connection was made between Ohio Dentist with a home remedy, and Vitamin K2



Famous case of 20 cavities



Source: Nutrition and Physical Degeneration by Weston A Price
Photo Images used with permission of Price-Pottenger Nutrition Foundation
<http://www.price-pottenger.org/>

Fig. 117.—Case of girl who had forty-two cavities in twenty-four teeth. With the diet restated with activator X, the pulp chambers built in secondary dentin and all the teeth were saved. Full dentures had been recommended.

Watch the Cavity Get Better

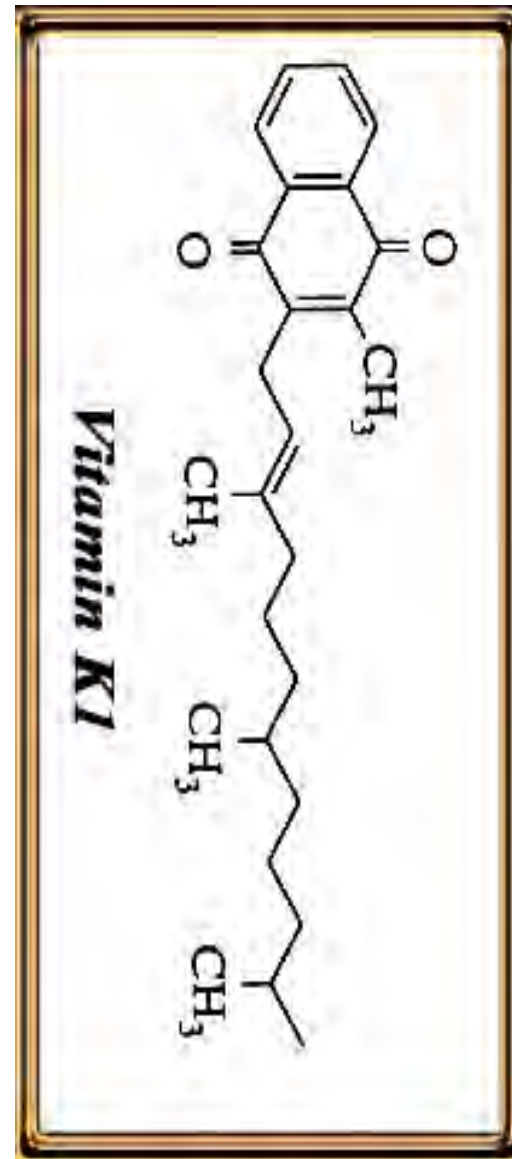


Pop Quiz on History

- 4. Vitamin K was discovered in 1995? 1978? 1937? 1929
- Answer: ALL the above. Weston Price found Activator X in 1929 or so but it wasn't till the 1937 that Dam described it and got credit for it, and 1940 that Doisy isolated it. In 1995 we finally realized that K2 had calcium activity.
- 5. Weston Price made his Activator potion from what?
- The butter of grass raised cows: eating rapidly growing spring grass added to Cod Liver Oil
- 6. We missed Vit K2's action because we thought all of K's actions were about white blood counts going awry? T or F
- False. It was blood clotting we focused on
- 7. We missed K2's actions also because we thought that K deficiency was very rare. T or F
- True

Vitamin K1

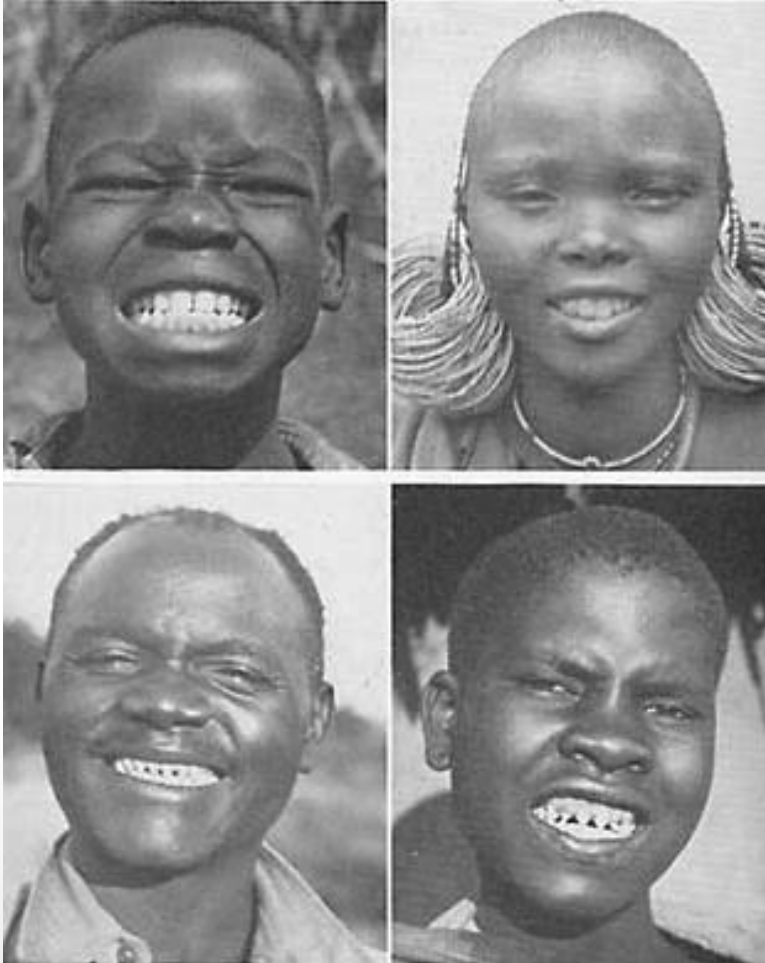
- Is a blood clotting agent
- Warfarin blocks it
- Made by gut bacteria and recycled
- Rare to be deficient in it
- Your gut makes all you need
- Taking too many antibiotics can rarely make you deficient



What Does K2 Do?

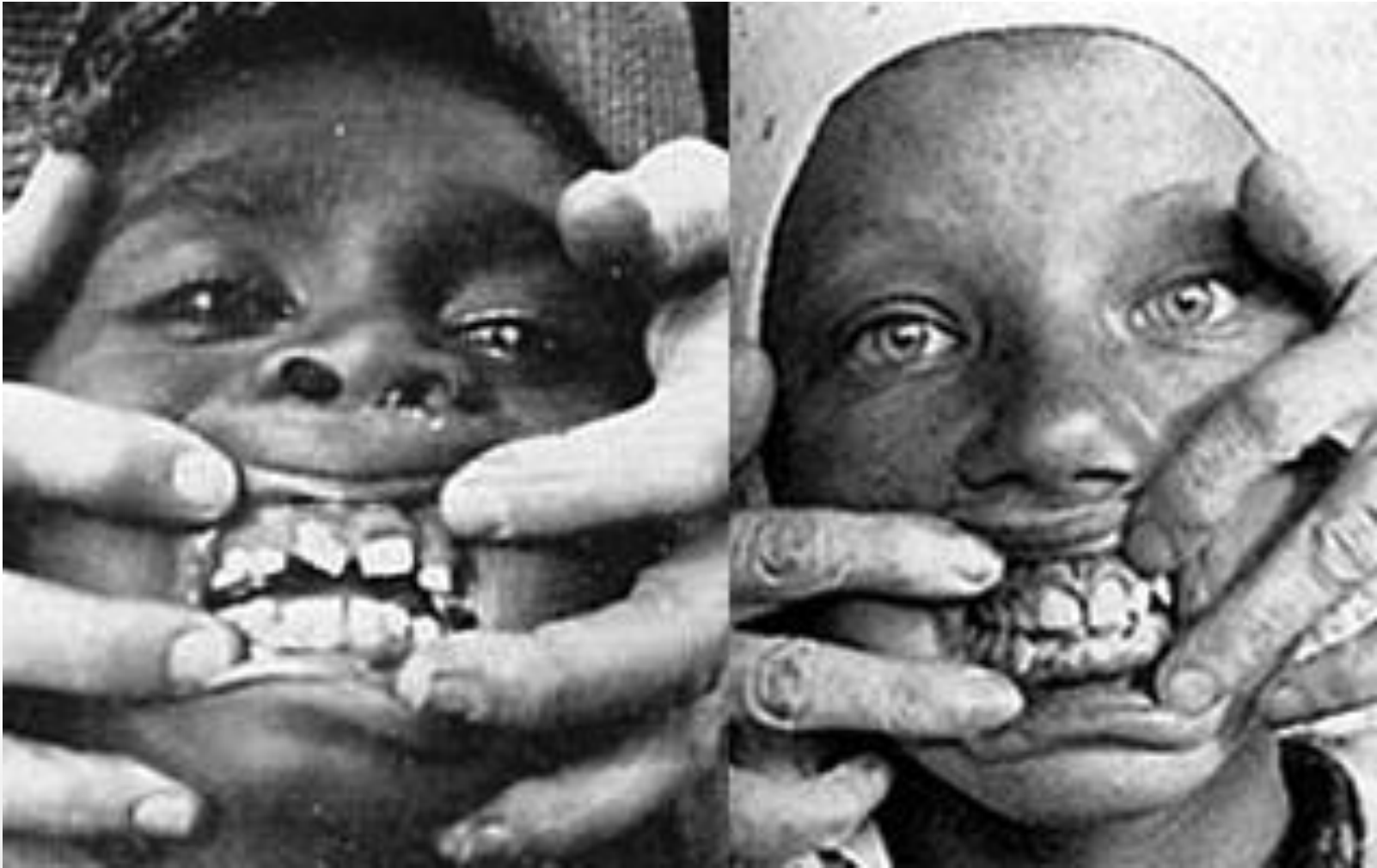
- 1. Activates proteins responsible for calcium and phosphorous deposition in bones and teeth
- 2. Directs childhood and infant growth by preventing premature calcification of cartilage and bones
- 3. Plays an important role in reproduction. Sperm has high levels of osteocalcin, dependent on K2
- 4. Activates proteins that cells are signaled to produce by Vitamins A and D (This is where osteocalcin and bone growth comes in)
- 5. Protects mouth, teeth and gums in saliva
- 6. Protects against calcification and inflammation of blood vessels and the accumulation of plaque
- 7. Helps make myelin sheath of nerve cells, improving learning
- 8. Essential for proper facial development with full arch and less crowded teeth.
- 9. Dramatic insulin effect through osteocalcin activation

Look at these broad, beautiful faces – strong jaws and teeth



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Nutrition Foundation
www.ppnf.org

Narrower faces, misaligned teeth



Swiss Grass Fed Cow in Spring



Calcium Conundrum

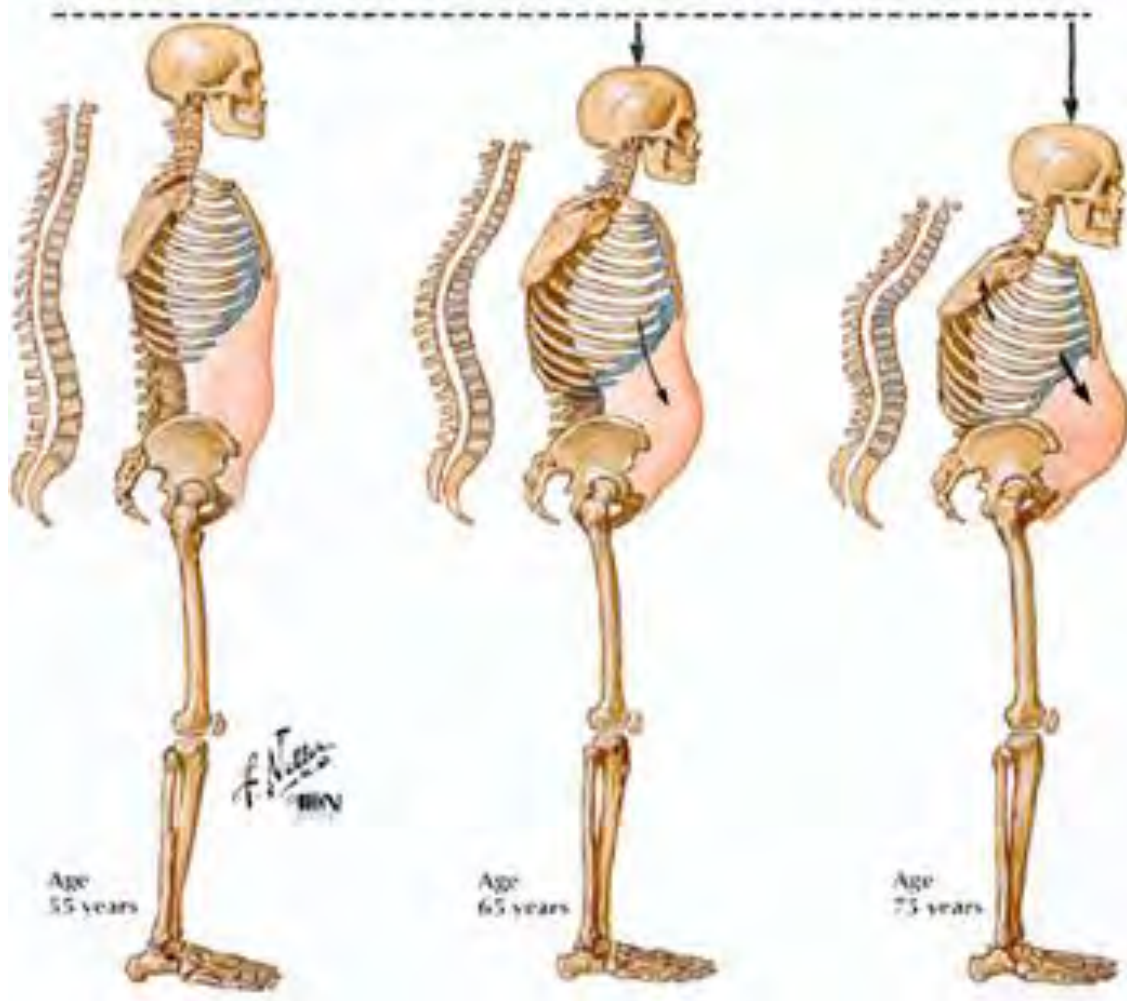
- 1. April 2011. British Medical Journal: Women who take extra calcium for osteoporosis are at greater risk of heart attack (3 fewer broken bones, 6 more heart attacks per 1000)
- 2. The Conundrum: Too much calcium in arteries but too little in bones. Arteries are worse!
- 3. BOTH processes are caused by inadequate K2
- 4. Repeat: Both processes are caused by K2 deficit
- 5. Too Little in Bone
- 6. Too Much in Arteries
- BOTH commonly caused by inadequate K2

Risk of Osteoporosis

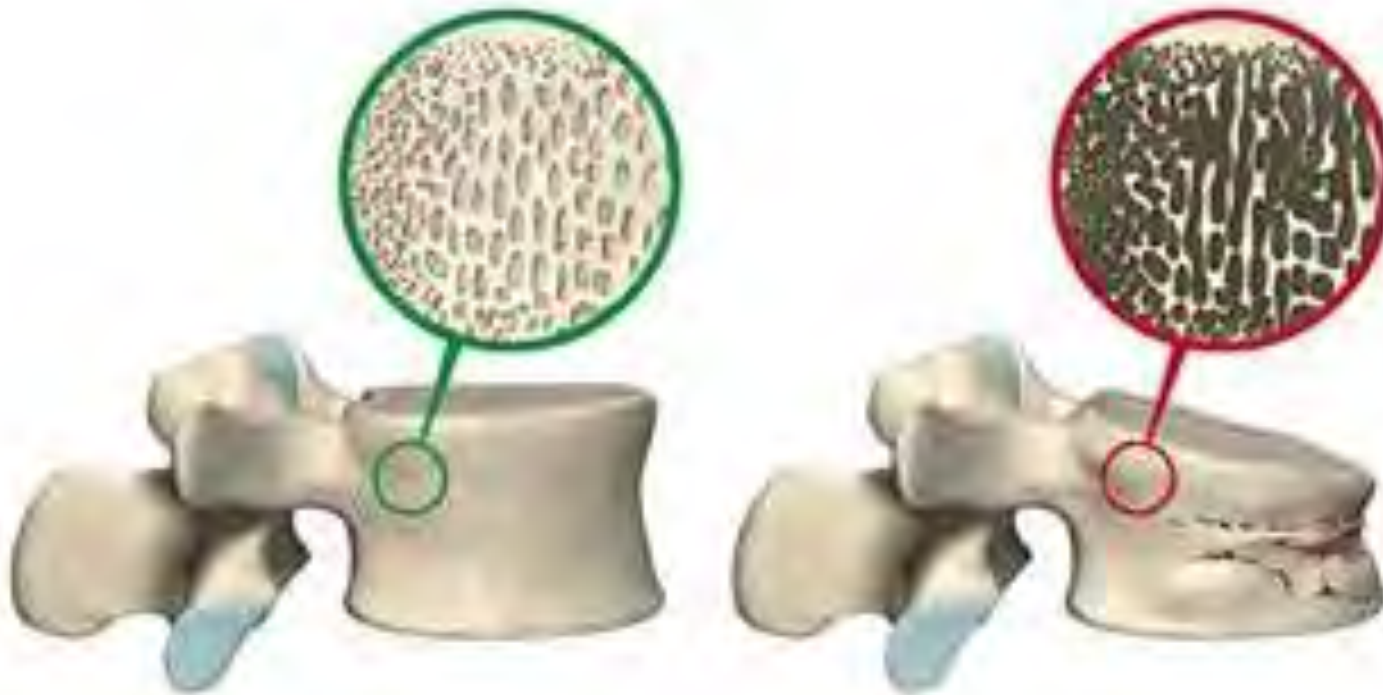
- Half of women over age 50 will have a fracture due to thin bones
- 12% of men will
- 75% of hip fractures never regain independence
- 33% die within 3 months
- American women: at least 80 fold increased risk of fractured hips compared to “less western societies”



We lose height



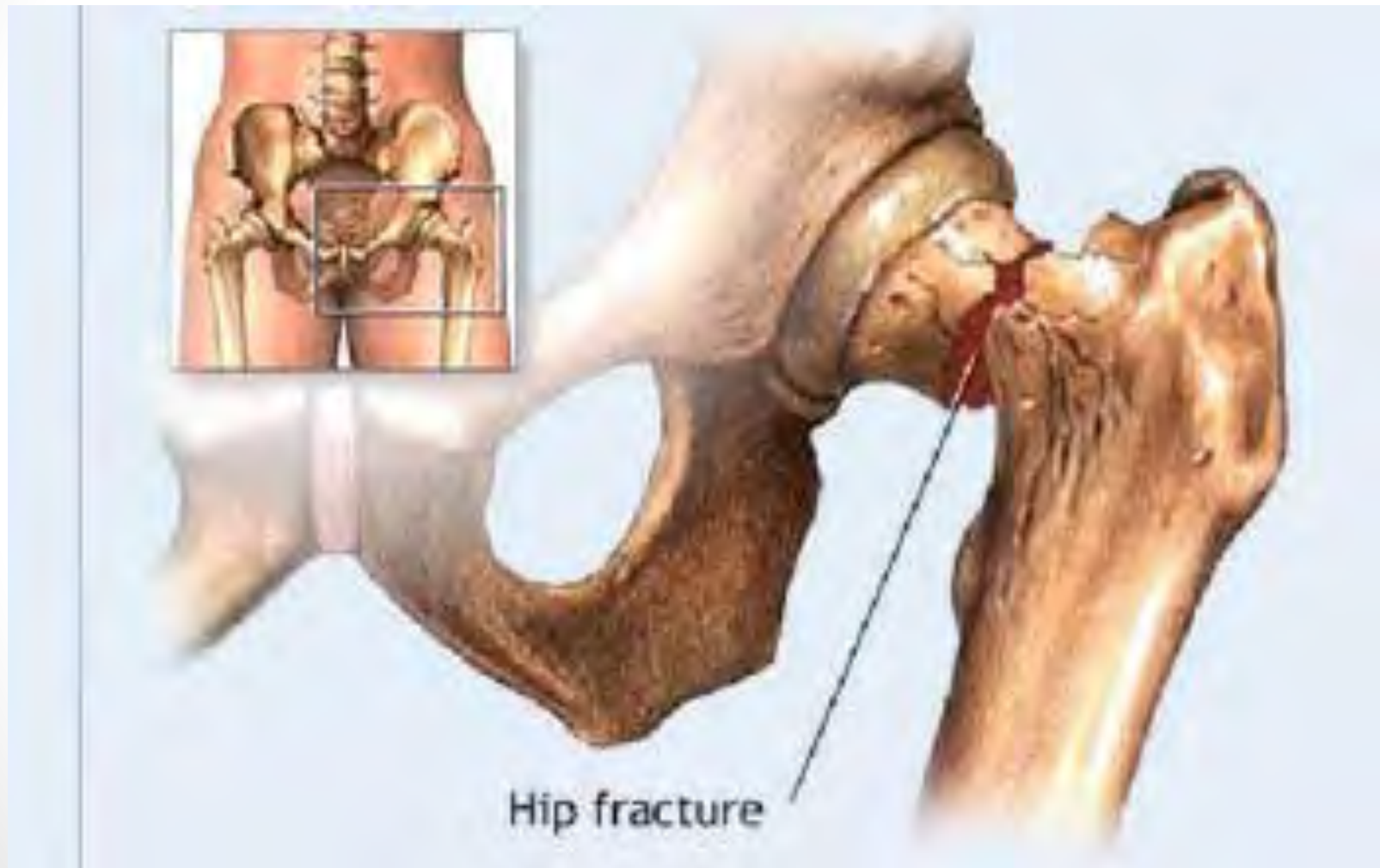
Our spines settle - compress



Get shorter and more bent over

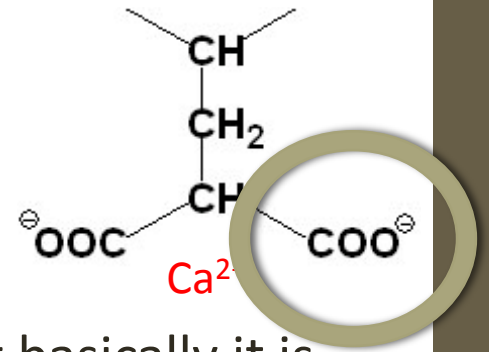


We break hips



What does Vitamin K2 do?

- It modifies two proteins that are otherwise inert
- They become activated
- One is called osteocalcin
 - This one binds calcium into bone
- The other is called MGP (matrix gla protein)
 - This one fishes calcium out of arteries
- The technical term is “gamma carboxylation” but basically it is adding an extra carbon dioxide to the end of a glutamate amino acid: and that makes for two negative bonds that bind a calcium 2^+ atom
- Voila – the protein binds multiple calcium atoms firmly, and they then become embedded in bone

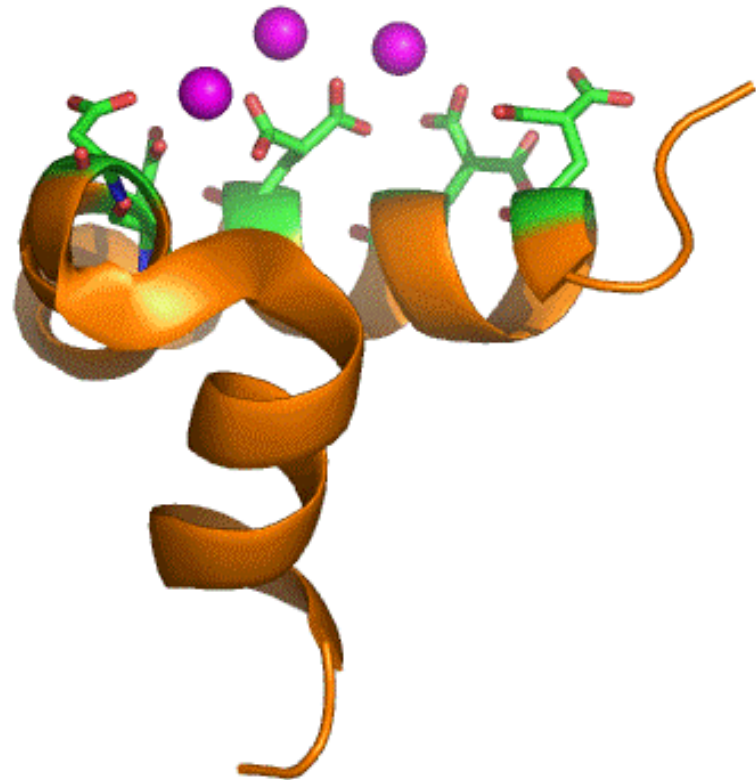


Pop Quiz

- 8. The Calcium Conundrum is that we get calcium in our bones and not in our arteries. T or F
- FALSE. You've obviously been texting and not listening. Exactly backwards: we get calcified arteries and thin bones.
- 9. Two major proteins that K2 activates are called _____ and _____.
- Osteocalcin and Matrix GLA Protein or MGP
- 10. American women break their hips at about 50 times the rate of women in less industrialized societies. T or F
- FALSE. 80 times or more.
- 11. American's get shorter as they grow older because they are lacking K1.
- No, they get shorter because their bones "settle" – possibly caused by lack of K2 and resultant osteoporosis.

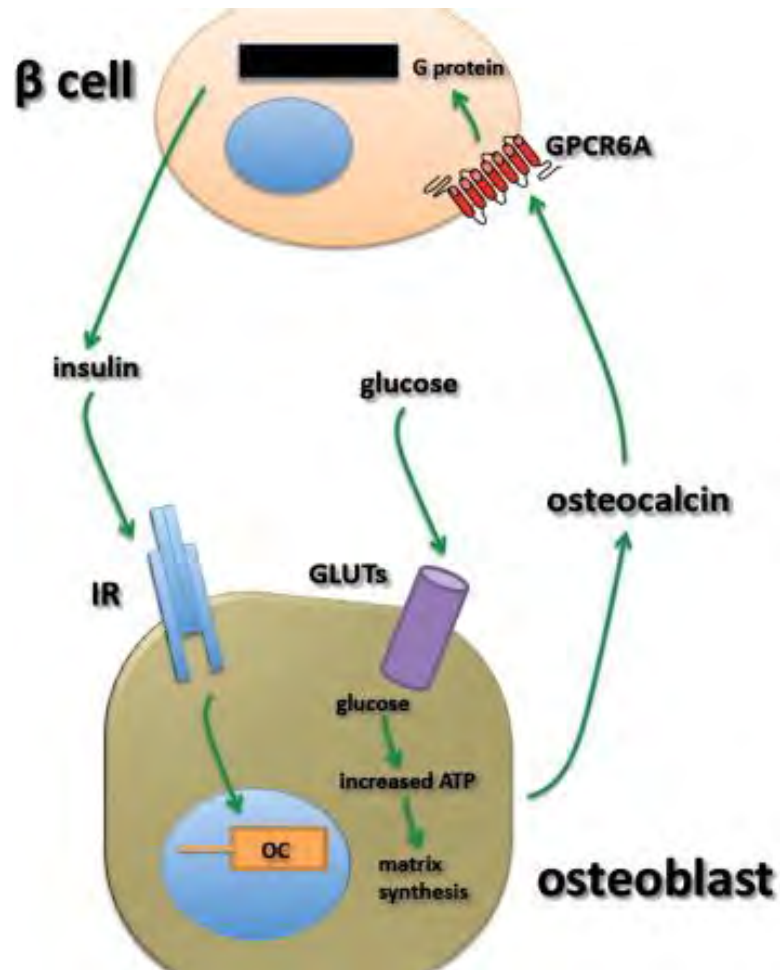
Osteocalcin

- After collagen, the most abundant protein in our bones
- Vitamin A and D cause osteoblasts to secrete and make osteocalcin
- But it is not activated until the K2 shows up
- The best way to measure adequacy of K2 is a blood test of “un-carboxylated osteocalcin”



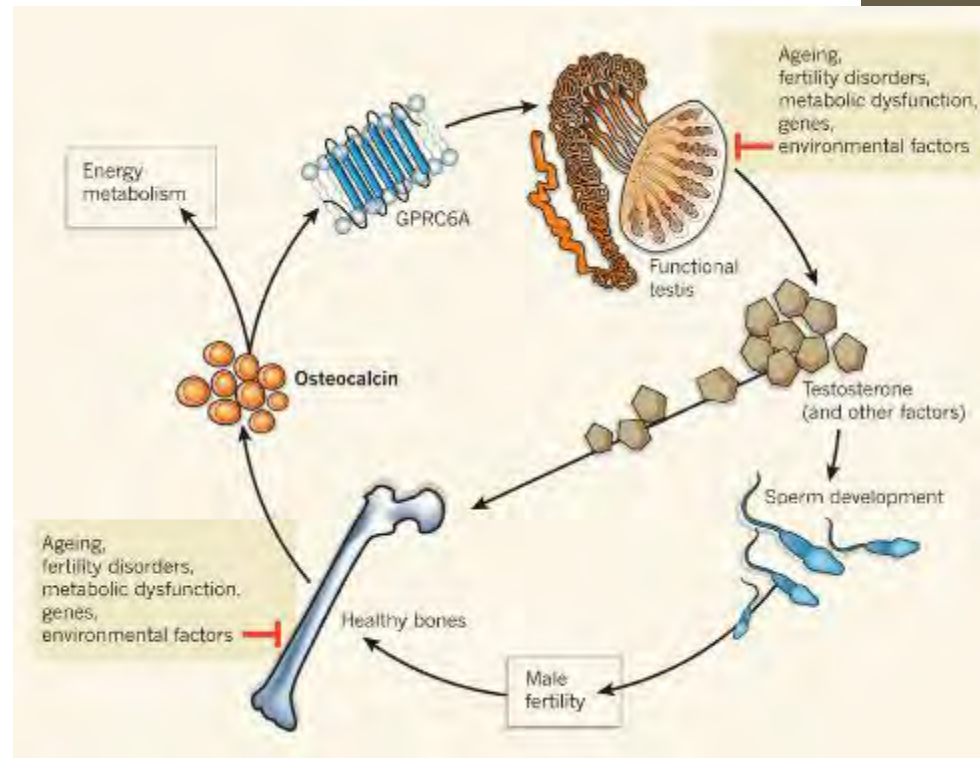
That's not all Osteocalcin does

- It causes the pancreas to make more insulin
- Exercise induces its production – and has a 24-36% lowering effect on glucose
- Hence, K2 plays a role in preventing and treating Type 2 diabetes



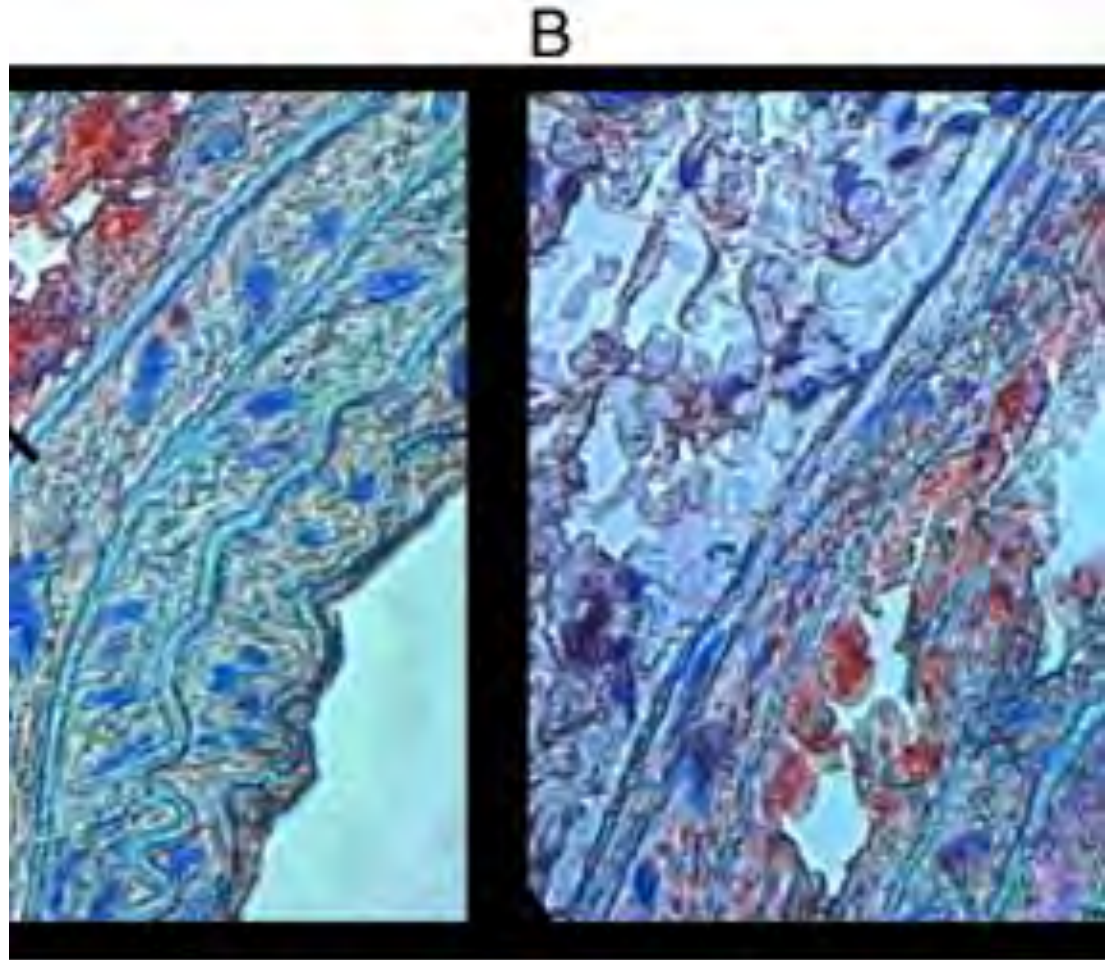
Osteocalcin and Male Fertility

- Osteocalcin helps regulate testosterone production
- Helps sperm survival and production
- Traditional cultures: men preparing to become parents eat more K2 rich foods – liver, etc



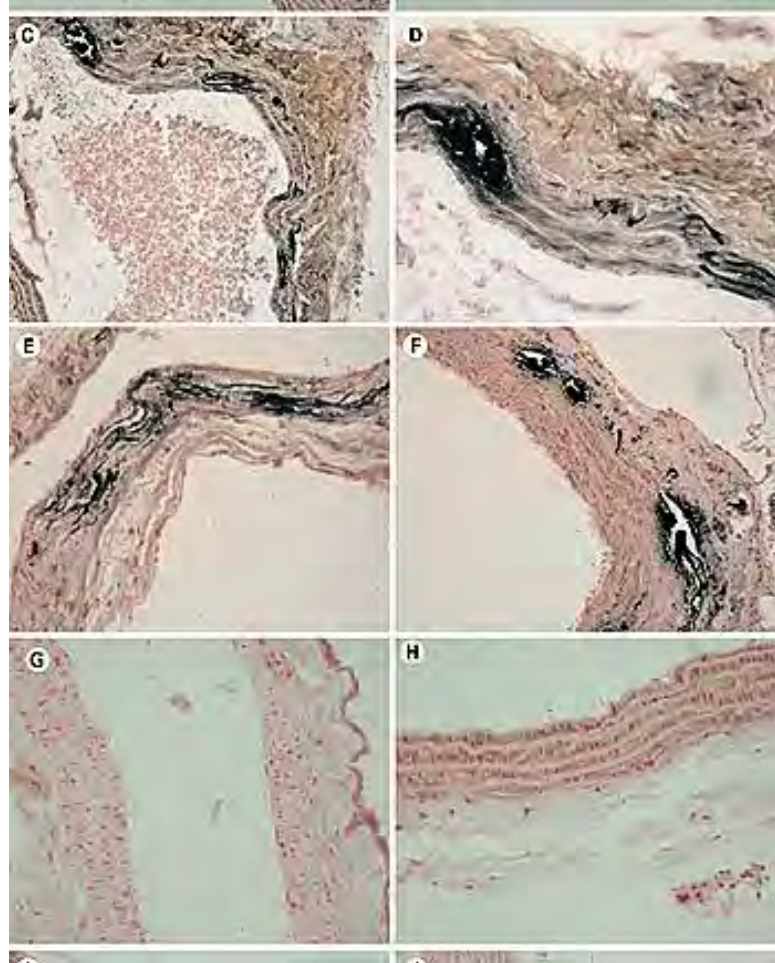
MGP

- Matrix Gla Protein
- Escorts Calcium OUT of blood vessels
- Lack of Vitamin K: builds up blood vessel calcium
- Not a passive event
- (Schurgers et al Thromb Haemost 2008 593)



Arteries get Bone in Their Wall

- 20% of plaque is calcium
- When on warfarin, with NO Vit K, arteries turn to bone
- MGP Protein, activated by K_2 does it – reverses the Ca^{2+}
- Can be reversed in animal models (Shurgers et al, Blood 2007 p 2823)



What went wrong?

- How did we become deficient?
- This is what Weston Price observed with healthy populations
- They ate “high value” animal food
- He made his Activator X from first spring grass raised butter



How is this different?



Chickens



Pigs



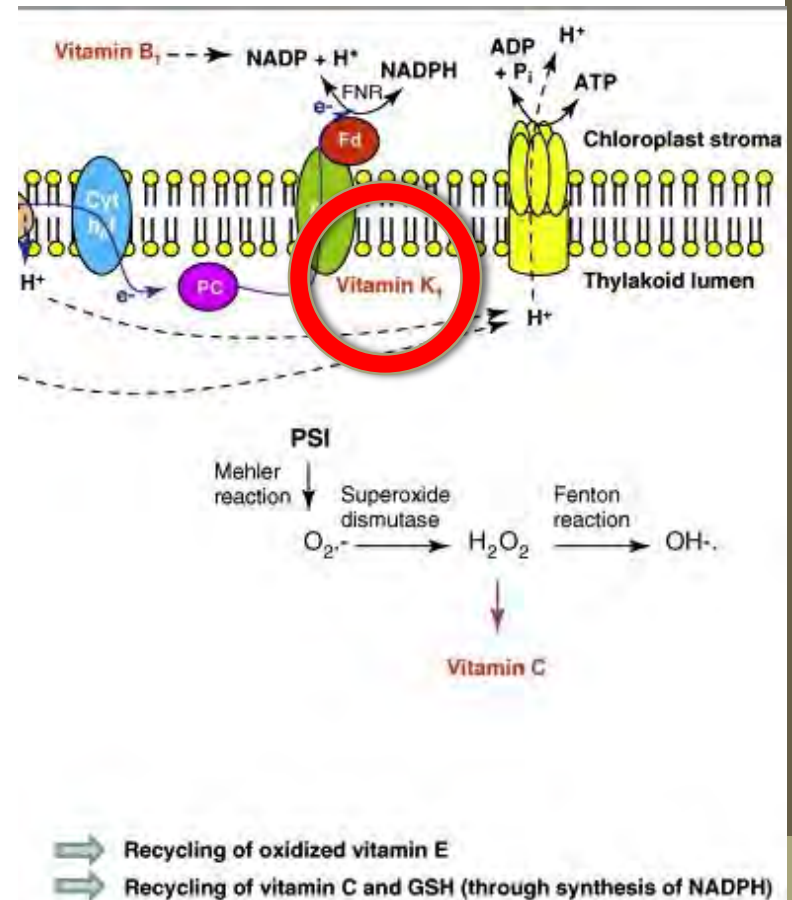
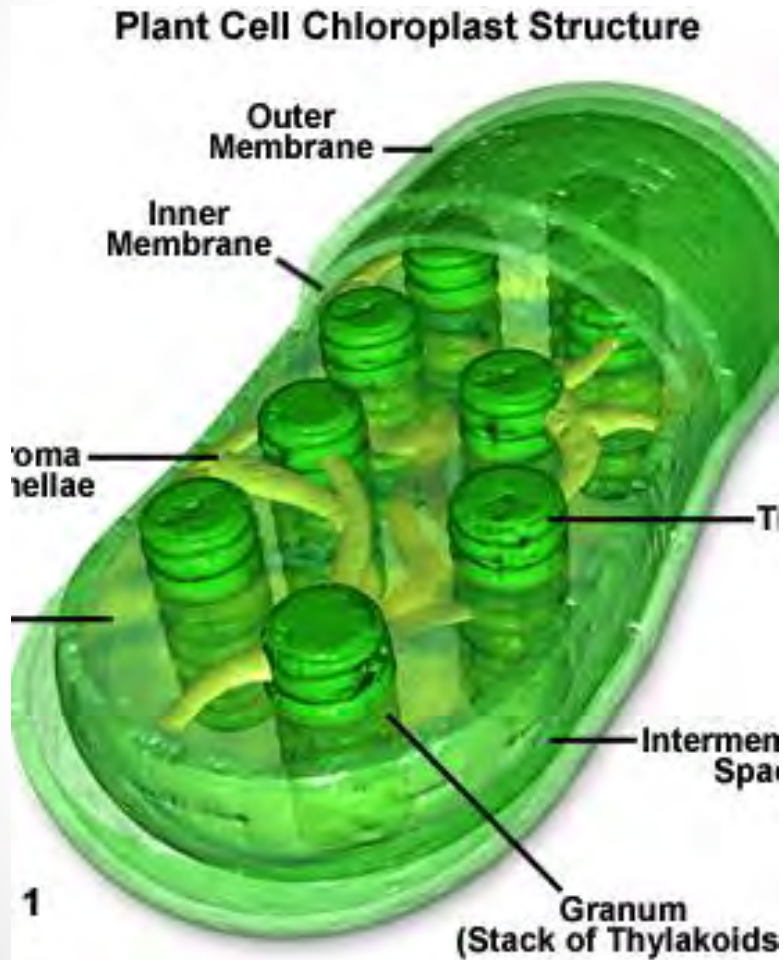
What Difference Did you See?

- No grass
- No sunlight
- No dirt
- Artificial feed
- We thought it was the omega-3 fats
- Along with omega fats were also the Vitamin K family
- Our food supply has changed
- So, we all missed this phenomenon assuming if the animal was alive, it had made all it needed of whatever was inside it

Indigenous Populations Ate

- Food freshly prepared and served
- Whole grains ground and eaten the day they were made
- No sugar
- Animal products found by hunting or raised on grass
- Special attention paid to high value fat
- Children fed organ meat and butter before adults
- Living outdoors with much more sunshine
- No artificial oils or trans fats
- Much less salt
- Abundant vegetables
- Which was the most important?

Green Grass Has Chlorophyll



Animals eat green plants

- They get Vitamin K_1 (so do you)
- It is then converted in the animal to K_2
- Grazing animals accumulate K_2 in their tissue in direct proportion to the amount of K_1 in their diet.
- (Masterjohn C, On the trail of the elusive X-factor. Wise Traditions 2007, 8(1):14-32)



You Are What You Eat

- But you also are what your animals eat!



What Foods Have K_2 In Them

- Yellow
- Beta-carotene, the precursor for Vitamin A is often in the same foods as K_2 .
- Butter from cows eating grass is very yellow
- Eggs for free range chickens is yellow
- Conclusion: Eggs, cheese and butter, if from grass raised animals, are very good for you because of their K_2
- This explains the French Paradox: they eat eggs cheese and butter and have lower rates of heart disease



Research Findings: Eggs

- Grass raised chicken eggs have:
 - 25% less saturated fat
 - 2/3s more Vit A
 - Double Omega-3 fats
 - Three time Vit E
 - 50% more folate
 - 70% more B12
 - 4-6 times the Vitamin D
 - 30% less cholesterol
 - More K2
- Woginrich J Backyard chicken basics. Mother Earth News 2011 April/May, 245:44-48

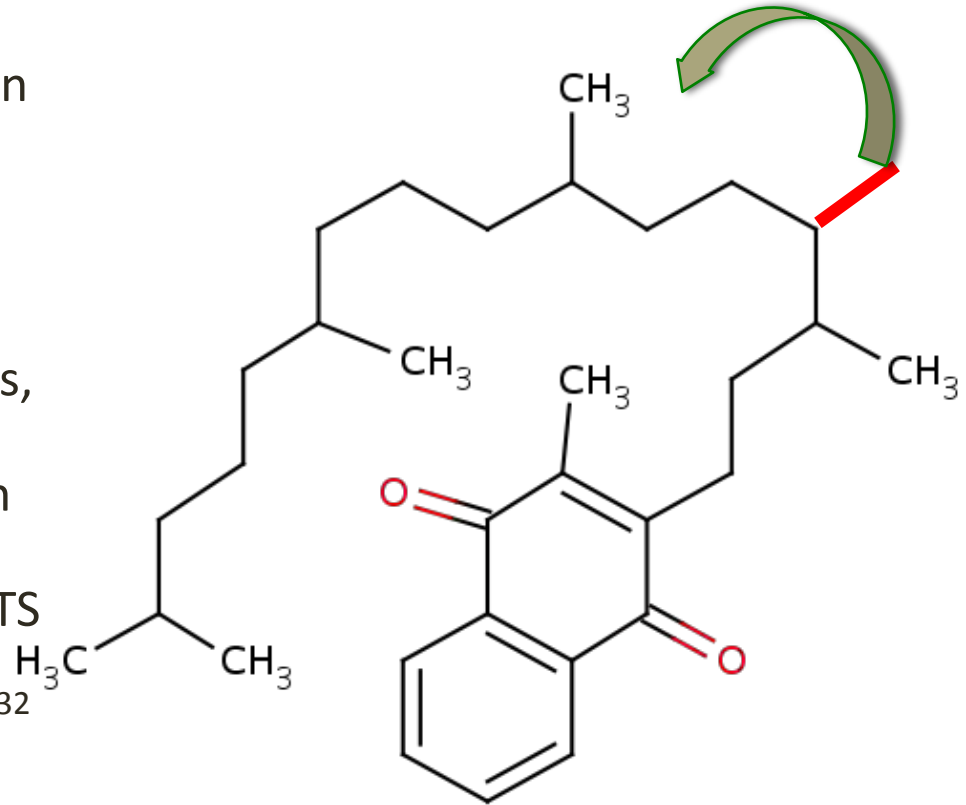


Pop Quiz

- 12. K1 is found naturally in green grass, right next to the chloroplast. T or F
 - True
- 13. It is changed into K2 in animal guts and mammary glands. T or F
 - True
- 14. Grass raised chickens have more Vitamin A, more omega fats, more folate, more B12, mor D, less cholestereol, more K2.
 - Yes, yes, yes, yes, yes and yes
- 15. Indigenous societies in Price's research always fed their children and pregnant mothers high value animal organ food.
 - True

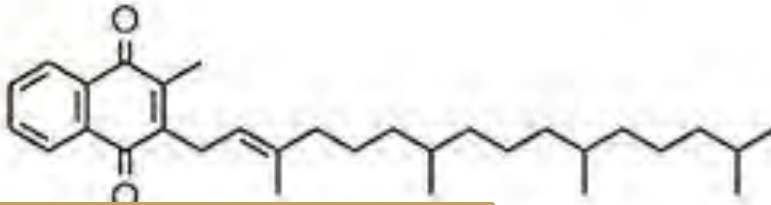
Trans Fats and Vitamin K2

- DHP is formed (dihydrophyloquinone) when K2 is heated with trans fats
- A mutant form of K2 from hydrogenating oil
- Bent over double!
- Trans fats, even tiny amounts, increase calcium in plaque
- Used as a marker in research studies of low quality foods
- Conclusion: Avoid TRANS FATS
- Booth et al, Jr of Nutrition 2008 p 492
- Kummerow et al Am J Clin Nutr 1999 Nov 832



Structure of the K family

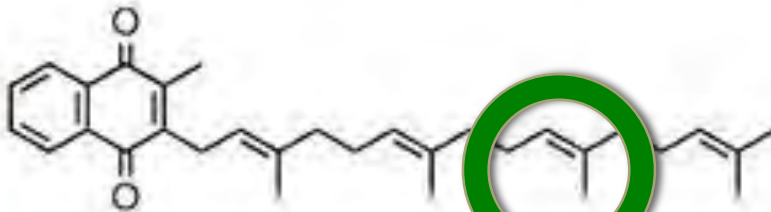
K1



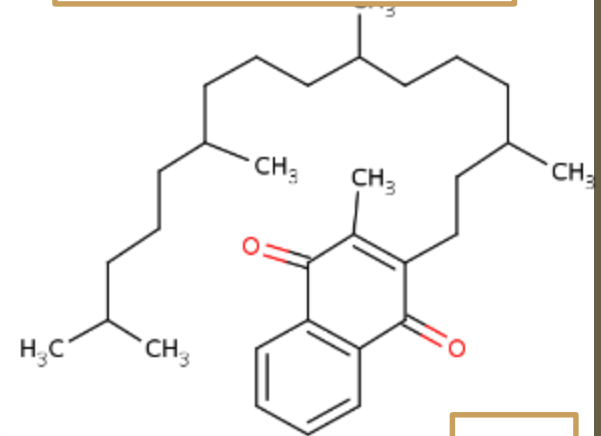
Blood clotting: made in gut

Made with trans fats,
Mucks everything up

MK-4

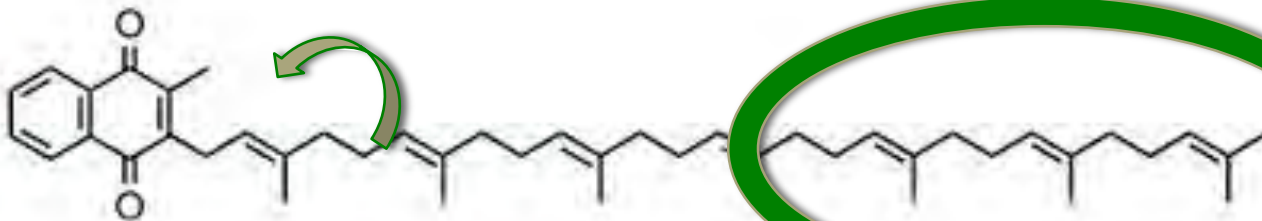


Most common in many dairy foods: animals. Balances calcium



DHP

MK-7



Most potent MK, made in Natto. Balances calcium in bones/arteries

Vitamin K₂ Content of Foods

Food Source (100 grams)	Micrograms of K2	Proportion of K Types
Natto	1103	90% MK-7
Goose Liver Pate	369	100% MK-4
Hard Cheeses (Gouda)	76	6% MK 4, 94% other
Soft Cheeses (Brie)	56	6% MK 4
Egg Yolk (Dutch)	32	98% MK4
Goose leg	31	100% MK-4
Egg Yolk (US)	15	100% MK-4
Chicken Liver	14	100% MK-4
Cheddar Cheese (USA)	10	6% MK-4
Chicken Leg	8.5	100% MK-4

Hayowitz DB Vitamin K content of meat, dairy and fast food in the US Diet,
J Argric Food Chem 2006, 54:463-67

Natto



History of Natto

- Discovered in Japan around 1080
- Soldiers were attacked while boiling soybeans to feed their horses. Threw the beans in a sack of straw
- Three days later returned and found a gelatinous substance
- Straw used until recently: now *Bacillus subtilis natto* is the bacteria used in industrial vats
- They love it Tokyo, but not in Hiroshima or western Japan
- Watch YouTube: eating Natto for the first time
- Kaneki et al Japanese nata as determinant of hip fractures Nutrition 2001, 17(4)
- Yaegashe et al Eur J Epidemiol 2008, 23(3):219
- Shurtleff w History of natto and its relatives from soybeans. 1100 BC to 1980
www.soyinfo.org

How Much K do we Need?

- Current American dietary advice doesn't distinguish between K_1 and K_2 — which makes the advice incomplete.
- Most folks have K_1 function fully and completely activated, with dramatic shortfalls in K_2
- European Consensus Meeting 2004: We need new guidelines for K_2 (Europ Jr Nutr 2004 p 325)
- Rotterdam Study: J Nutrition. 2004 p 1171: 57% risk reduction for death from heart attack with top third of MK4 and 25% all cause mortality reduction: top to bottom third comparisons

Dose?

- MK-4 is what animals naturally make
- You would need about 45 mg a day
- Problem: it only lasts a few hours
- We don't know if that matters
- You may have to take it three times a day
- Alternative: MK-7 from Natto
- Once a day dosing does a great job
- MK-7 for post menopausal women: 240 micrograms a day is sufficient



Pop Quiz

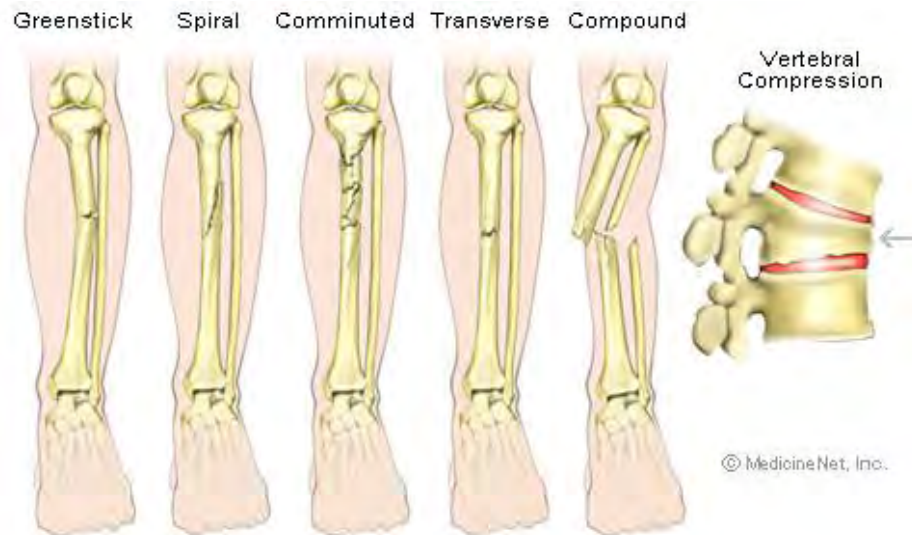
- 16. The highest source of K2 is the food called natto, a delicious preparation of soybeans from Japan. T or F
 - True on the concentration, maybe not on the flavor
- 17. Trans fats reinforce and multiply the effect of K2. T or F
 - Utterly false. Virtually annihilate it
- 18. There are clear guidelines for K supplementation. T or F
 - False. It's in flux, but clear that we need more. And there needs to be special caution with folks on coumadin who need the blood thinning effect of the K1 blocking effect
- 19. A reasonable dose might be 45 mcg of K2 (MK-4) or 240 mcg of K2 as MK-7. T or F
 - True

Other Effects of K₂

- Inhibits Osteoclasts
- Stops bone breakdown so osteoblastic (building up) activity can catch up
 - (Kameda et al Vit K2 inhibits osteoclastic bone resorption by inducing osteoclast apoptosis. Biochem Biophys Res Commun 1996 March 27, 220(3):515-19)
- MENOPAUSE: Estrogen levels drop
 - Osteoclast activity rises
 - IL-6 rises – which stimulates MORE osteoclasts
 - Chew up more bone
 - K₂ reverses the IL-6 increase and the osteoclast increase
- MK-7 reverses menopausal bone density changes

Transplant Patients

- Have 34 times the fracture rate of regular folks
 - 2010: Norwegian Study: 180 mcg of MK-7 for one year and bone density went up in the treatment group
 - And down in the placebo group, as usual
- (Forli et al Transplantation 2010, 89(4):458-64)



Typical Bone Fractures

K_1 vs K_2 s' Effect on Osteocalcin

- K_1 : needs 1000 mcg a day to activate osteocalcin
- Humans can't absorb that much from food
- K_2 is highly absorbed.
- K_2 is 3 times more active at raising osteocalcin levels
- Dutch Study: K_1 vs K_2 over 40 days
 - K_1 peaked out at 3 days
 - K_2 showing increasing osteocalcin daily for all 40 days
 - (Shurgers et al Vit K comparison of K1 and MK7, Blood 2007, 109:3279-83)



Alzheimer's Disease

- Strong association between osteoporosis and Alzheimer's
 - (Loskutova et al J Alzheimer's Dis 2010, 20(1):313)
- Alzheimer's patients consume 50% LESS K₂ in their diets
- K₂ has a strong ability to reduce the formation of free radicals in the brain, blocking free radical accumulation and brain cell death in lab studies (Li et al, J Neurosci 2003 Jul 2, 23(13):5816) and
 - Li et al Vitamin K prevents oxidative cell death by inhibiting activation of 12-lipoxygenase in developing oligodendrocytes. J Neurosci Res 2009, Jul, 87(9):1997-2005),
 - Li et al Novel role of Vit K in preventing oxidative injury to developing oligodendrocytes and neurons. Neurosci 2003 Jul 2 23(13):5816-26)
- **Hypothesis:** Vit K is central to the deficiency causing Alzheimer's (Allison AC The possible role of Vit K deficiency in the pathogenesis of Alzheimer's disease and augmenting the brain damage associated with CV disease. Med Hypothesis 2001 Aug, 57(2);151-55)

Skin Wrinkles



- Known fact: the severity of wrinkles correlates with osteoporosis risk (Pal L Kidwai et al Skin wrinkling and rigidity are predictive of bone mineral density in early postmenopausal women Endocr Rev 2011, 32(03 Meeting Abstracts):3-126)
- Decreased kidney function is associated with facial wrinkling, and that's associated with inactivated MGP.
 - (Park Association of kidney....Neph Dial Trans 2009, 24(7):2095-101,doi:10.1093/ndt/gfp024)
 - Logan et al Your Skin, Younger (Naperville, IL: Cumberland House, 2010)
- Japanese women who eat Natto have less wrinkles than age matched women in Shanghai and Bangkok
 - Tsukamoto, et al Intake of fermented soybean (natto) and increased K2 and osteocalcin in normals J Bone Miner Metab 2000; 22



Pseudoxanthoma elasticum

- Wrinkles from hell
- Mechanism found in 2007
- MGP is never activated and is abundant in the elastic fibers of PXE tissue samples
- It is the high un-activated MGP that causes the wrinkles?
- Is that what causes wrinkles in all of us?
 - Gheduzzi D et al, Matrix gla protein is involved in elastic fiber calcification in the dermis of PXE Lab Invest 2007, 87(10):998-1008
- What does Vit D do? Increases production of MGP but then you don't activate it until you take K2



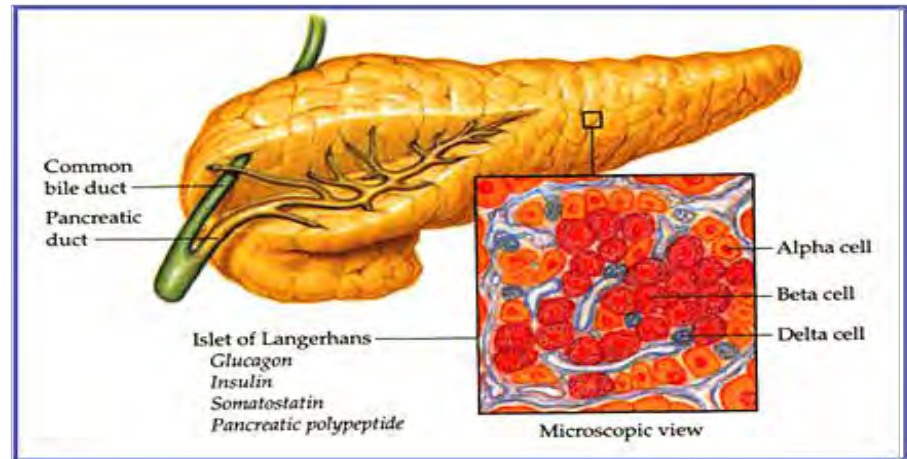
Varicose Veins

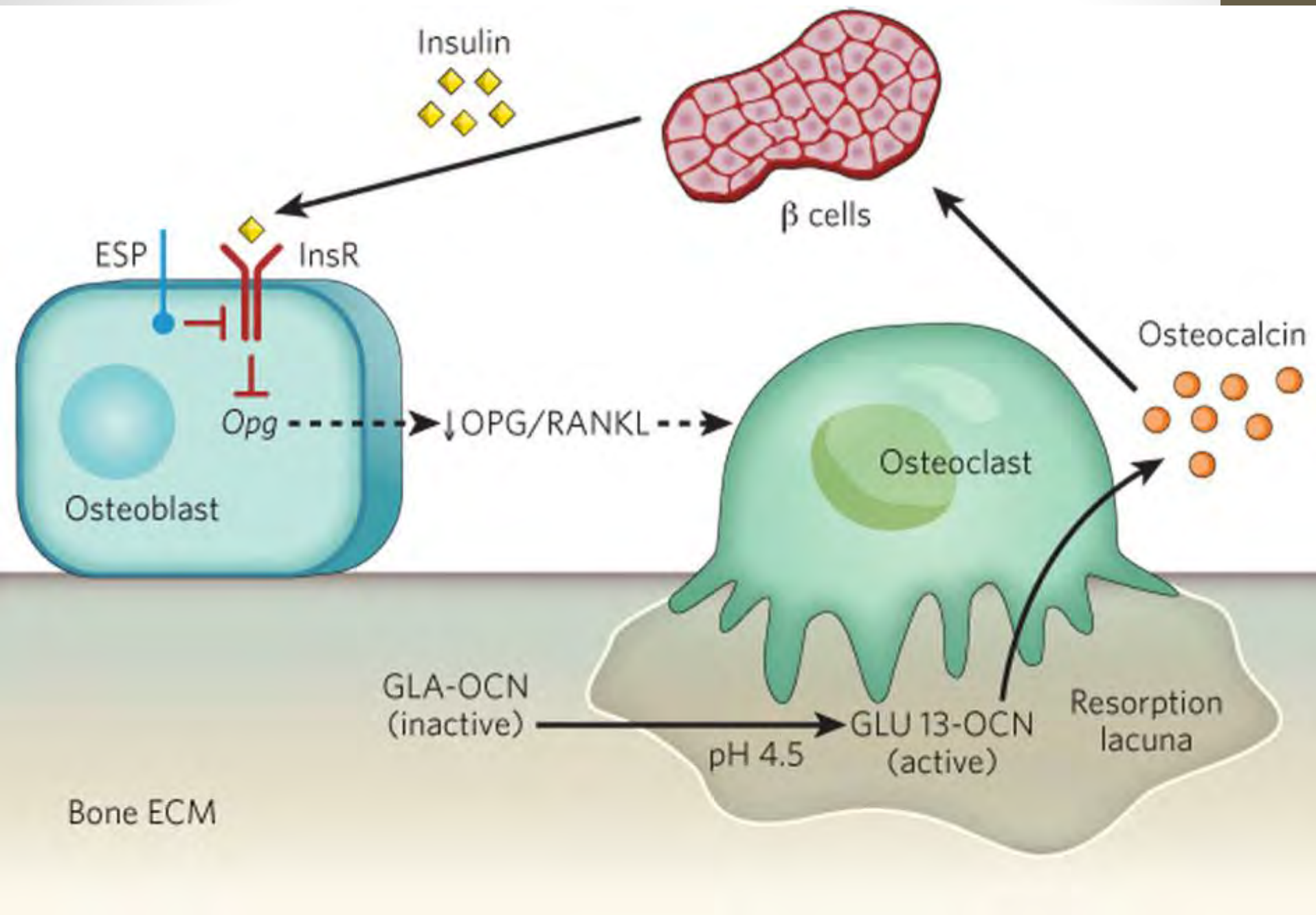
- MGP is prevalent in the walls of veins
- When MCP isn't activated, it contributes to the remodeling of the vein wall, causing bulging
 - Cario-Toumaniantz et al
J Vasc Res 2007,
44(6);444-59



Diabetes

- Pancreas has very high levels of K_2
- Animal studies: low K_2 slows insulin response
- Induce K_2 deficiency in animals: become insulin resistant and get Type II diabetes
 - Sakamoto Low vit K...Int J Vitamin Nut Res 1999 p 27-31



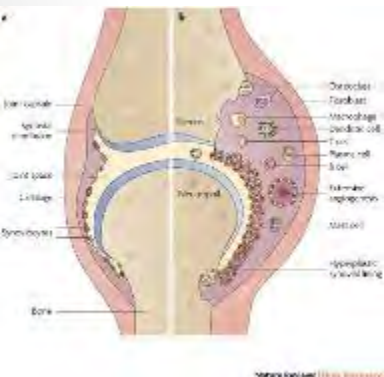


More On Diabetes

- One week on Vitamin K₂ in healthy, nondiabetic trial participant reduces post meal insulin production by 50%
- Dramatically lower insulin means your body is working much more efficiently to take up glucose and use calories
- Probably through osteocalcin which is known to impact insulin sensitivity and K₂ activated osteocalcin
- Stands to reason: K₂ supplementation will improve insulin sensitivity
 - Sakamotos et al Possible effects of one week MK-4 intake in young healthy male volunteers Clin Nutr 2000 19(4):259

Rheumatoid Arthritis

- RA is known to have both higher rates of coronary artery disease and osteoporosis
- RA is known to have higher osteoclast activity
- K_2 has been shown to control osteoclast activity in RA on its own, and in conjunction with classical RA drugs
- K_2 has also controlled other inflammatory cells that are known to proliferate in RA
 - Morishita et al Osteoclast inhibitory effects of K_2 J Rheumatol 2008 Mar, 35(3):407-13
 - Okamoto et al, Vit K_2 and RA, IUBMB Life 2008 Jun, 60(6):355-61



K₂ for Brain Health in MS

- Brain contains the highest concentration of K₂ after the pancreas gland, salivary glands and the sternum
- K₂ found to help lay down myelin, the shrink wrapping around nerve axons
- MS is a disease of missing myelin
- MS is strongly linked to lack of Vit D in early life
- Animal model of MS called EAE is significantly prevented if K₂ is taken before symptoms develop
 - Moriya et al Vitamin K2 ameliorated EAE in Lewis Rats. J Neuroimmunol 2005 Dec 30, 170(1-2): 11-20
- K₂ accumulates in the brain 6 fold over K₁. But it is the most missing in our diet. Conclusion: eat grass raised butter, natto
 - Thijssen et al Vit K status in human tissues Br J Nutr 1996, 75:121-27

Cancer

- EPIC study from Europe:
- 24,000 men and women from ages 35-64 followed for 10 years. 1,755 cases of cancer developed, 458 died from it
- Results: independent of all other variable
- Highest K_2 level had 30% less cancer risk
- Dietary intake of MK-4 was more strongly inversely associated with fatal cancer than cancer incidence
- Fruits and veges are also strongly protective, and they have lots of K_1 in them. But K_1 showed no benefit. Only K_2
- Source of K_2 in Europe?..... (Not natto)
- Cheese, grass raised cows
 - Nimptsch et al Vit K intake in relation to cancer Am J Clin Nutr 2010, 91(5):1348-58
- Prostate Cancer: same finding. Cheese had more MK-7 and lowered risk of aggressive cancer
 - Nimptsch et al Cancer Epidemiol Biomarkers Prev 2009, 18(1):49

Pop Quiz

- 20. The Epic Study from Europe showed at 30% reduction in cancer risk from folks with the highest K2 intake? T or F
 - T
- 21. Diabetes is helped by K2? T or F
 - Dramatically.
- 22. Wrinkles are associated with lower K2 levels. T or F
 - True
- 23. Bone density improves in the most resistant patients of all, dialysis patients, when they take K2. T or F
 - True

Kidney Disease

- K2 deficiency is common in chronic kidney disease
- Increases as kidney disease progresses
- Blood vessel calcification progresses as well
 - (Holden et al Vit K and D in chronic kidney disease Clin J AM Soc Nephrol 2010 Apr, 5(4):590-97)
- Renal “osteodystrophy” also progresses, a distinct form of osteoporosis that also has density loss



Fertility

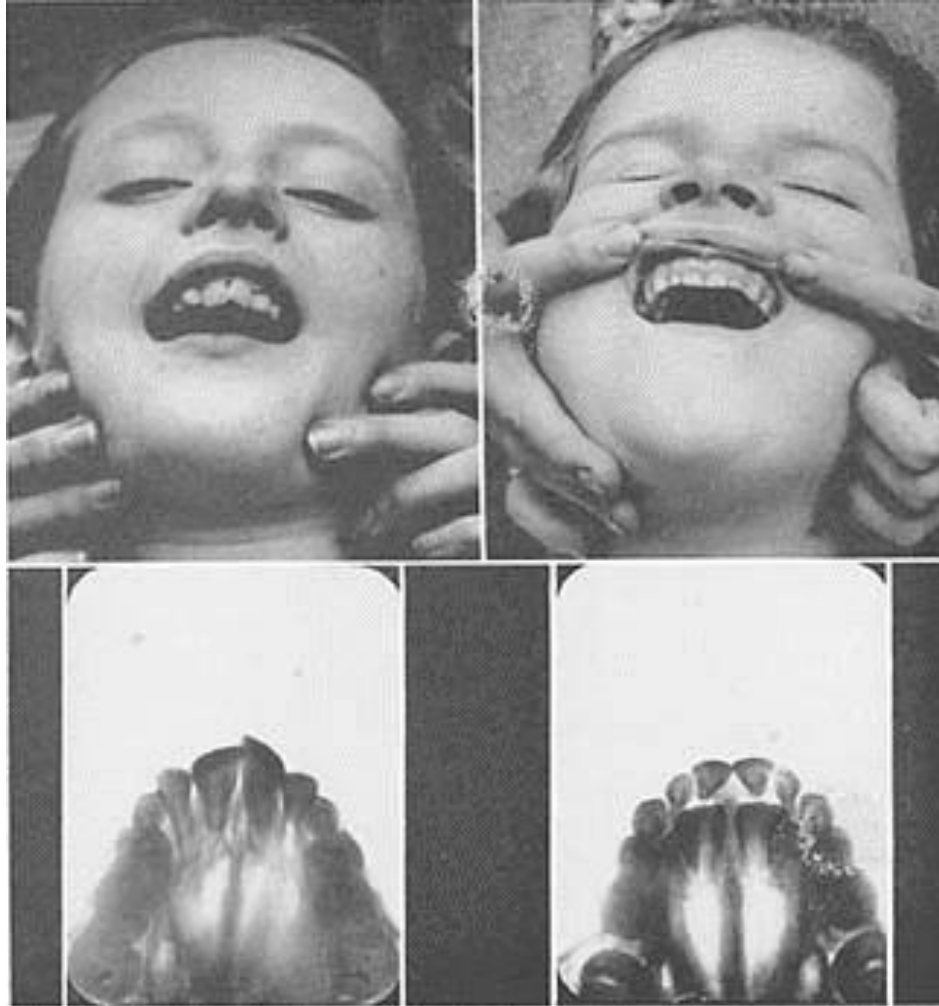
- Male sperm counts have been decreasing by 1% a year for decades in Western countries
- Male infertility is now common (Dindyal Int J Urol 2004, 2(1))
- In Men and Women: sex hormones play a critical role in bone density. They spike in puberty, as does bone density
- Women lose 25% of bone mass with menopause
- In Men, osteocalcin induces the production of testosterone
- Mice: osteocalcin deficient males have 60-80% lower T and have smaller litters and less frequent litters
- Osteocalcin binds to testicular Leydig cells, where T is made

Facial Shape

- Considered the most significant finding of Weston Price's work
- Price's findings showed that indigenous cultures with pre-western foods had broad faces, stronger jaws, never needed to have wisdom teeth extractions or braces
- Indigenous societies had special food for young couples planning on having babies: often eggs, fish eggs
- Price never got past "Activator X".
- All starts with nasal cartilage. It is rich in MGP protein in the fetus. With no K2, it is not activated and premature calcification stunts the growth of the face resulting in underdevelopment of middle and lower third of face
 - Howe et al Vit K-its essential role in craniofacial development: a review Austr Den J 1994, 39(2):88-92



Two Sisters: Second had K2 during pregnancy



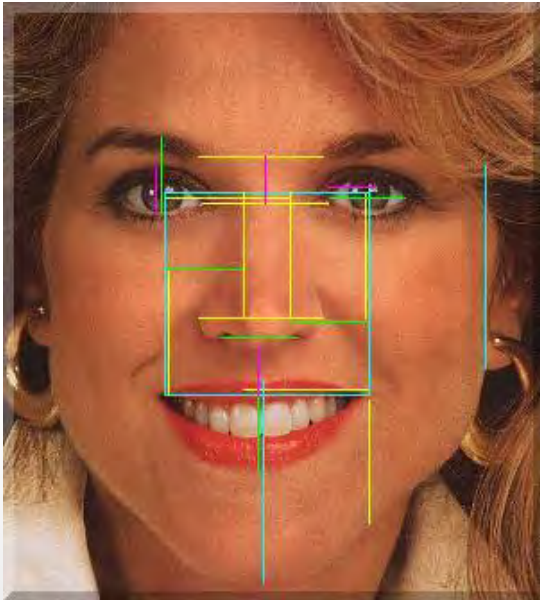
Price's Prenatal Food Formula

- Milk
- Green vegetables
- Sea food
- Organs of animals
- Cod liver oil
- Butter from grass raised cows
- Vitamins K, A and D in abundance in the form of Activator X (cod liver oil and spring, grass raised butter)!



Normally: later kids worse dental problems

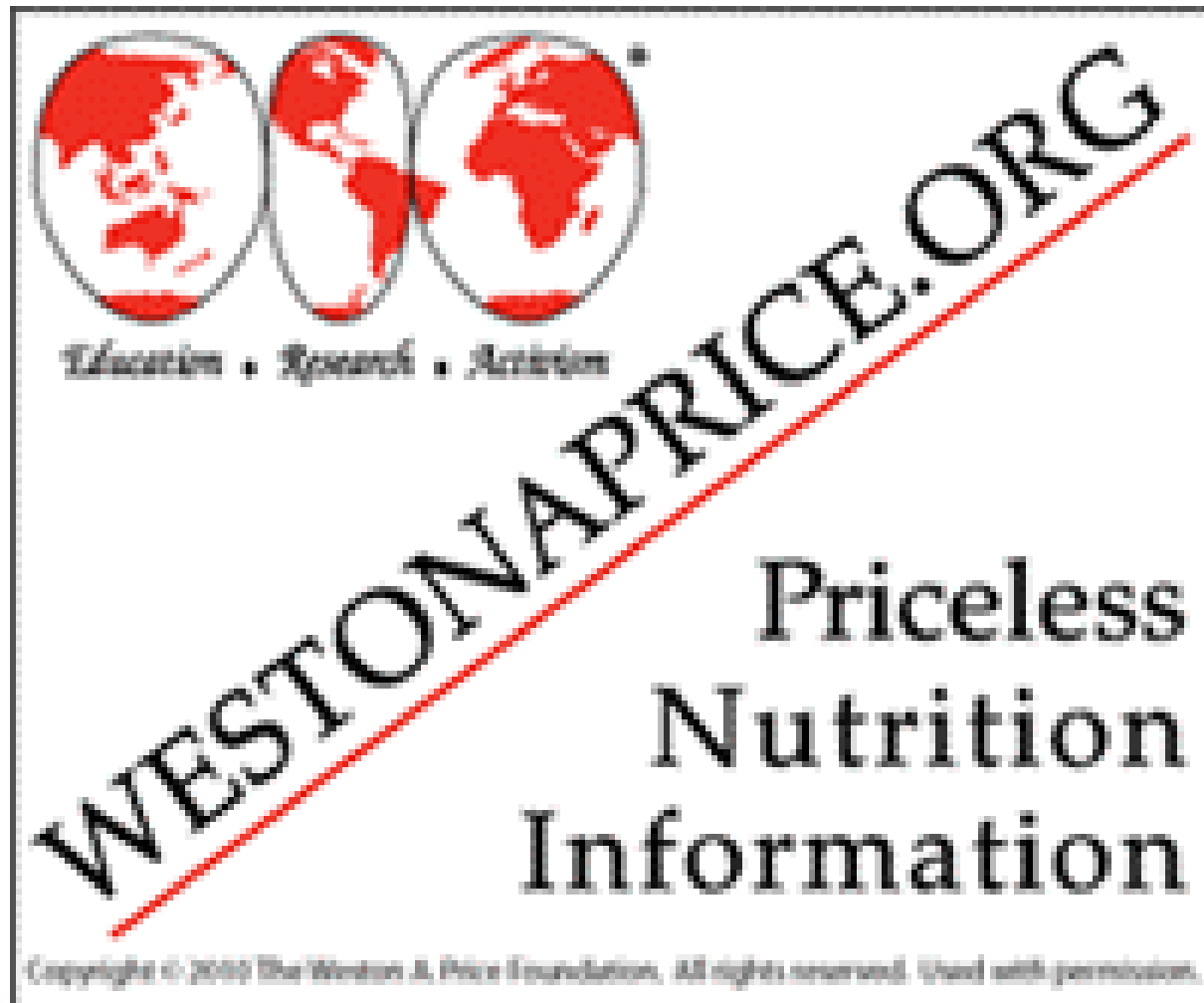
- Pattern of narrowing facial features in second and third children has been proven
- Viera AR et al: Birth Order and oral clefts: a meta-analysis. Teratology 2002 Nov, 66(5):209-16
- The Super models secret



Two Princes



Wide Faces on Narrow Face



Labor and Delivery

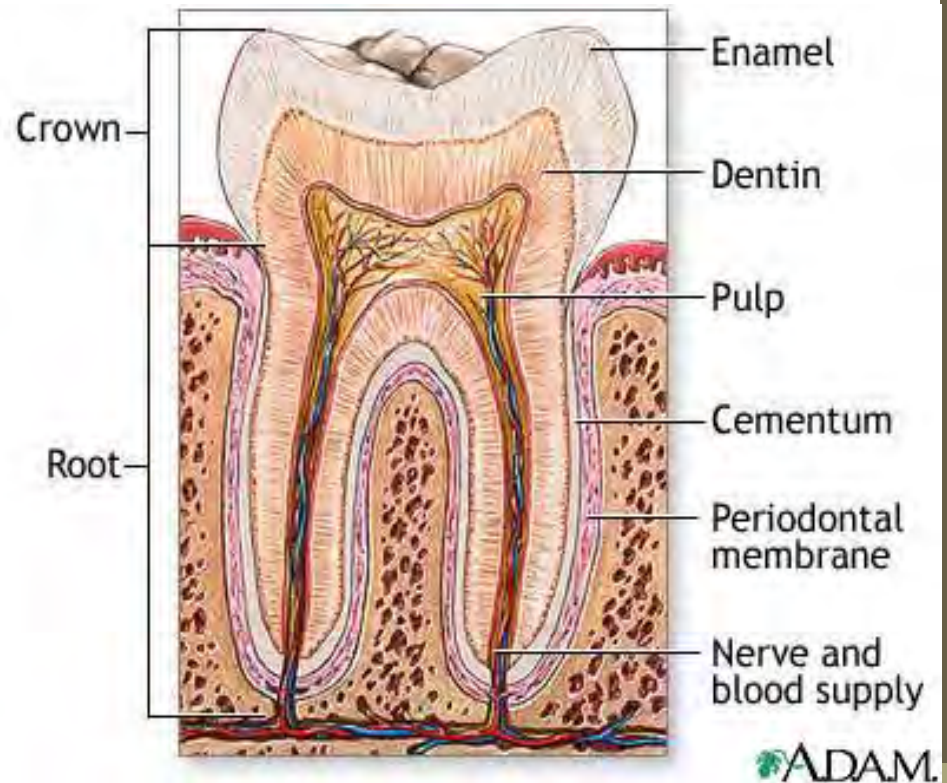
- Many reports in traditional societies: Grandma tells how she took a shawl and went into the bush, and then brought the baby back an hour later.
- Eskimo woman: 26 births - wouldn't wake up her husband (Price Nutrition and Physical Degeneration 2008, p 305)
- Dr Romig, Ob to the Inuit, "Never arrived in time to see a birth"
- Now, Inuit come to the hospital after being in labor for 3 days (Price ibid p 305)
- Price pinpoints the time when this change happened: narrow faces correlate with narrow pelvis – When Western food arrived in Alaska
- Lack of Vitamin D: 4 times the C-section rate (Merewood Jr Clin End Metab 2009, 94(3):940)
- If D is low, K is also playing a role as they work together
- Birth of the two girls from prior slide: #1 had 53 hour labor, #2 had a 3 hour labor with rapid recovery. Baby had better initial exam

Strong Bones

- Maximum density and strength by age 18-20
- Early 20s bone strength predicts future osteoporosis risk
 - Nishimure et al Measurement of uc-osteocalcin Clin Calc 2007 p 1702
 - Van Summeren et al Vit K status associated with childhood bone mineral content B J Nutr 2008, doi:10.1017/S0007114508921760
- Giving preteens K2 for just 6 weeks results in higher osteocalcin activation. 45 mcgs of MK-7 for 8 weeks decreases uc-osteocalcin
 - (Van Summeren Br J Nutr 2009 Oct, 102, (8):1171-78

Strong Teeth

- Dentin covers the pulp
- Dentin is formed throughout life
- Dentin makes osteocalcin and MGP
- Decay starts outside
- Bacteria travel down the dentin channels to the pulp



Price Observed

- Lots of carbs
- No effort at teeth cleaning
- No cavities and no brushing
- Eating carbs all the time!
- (Price WA Nutrition and Physical Degeneration. P 263)



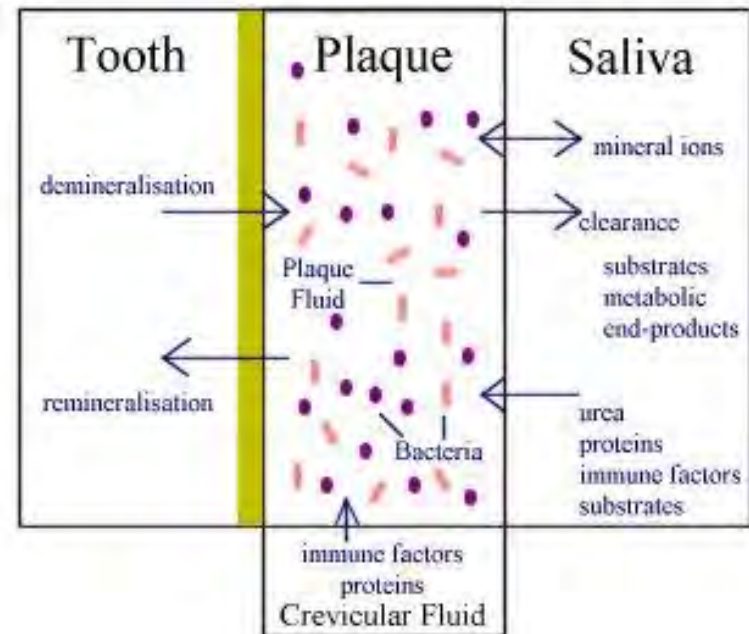
Price's Research

- Active tooth decay patients had 323,000 *Lactobacillus acidophilus* per ml in their saliva
- After eating Activator X. Count dropped to 15,000 per ml
- 95% decline
 - Price ibid p 398



Saliva Changes

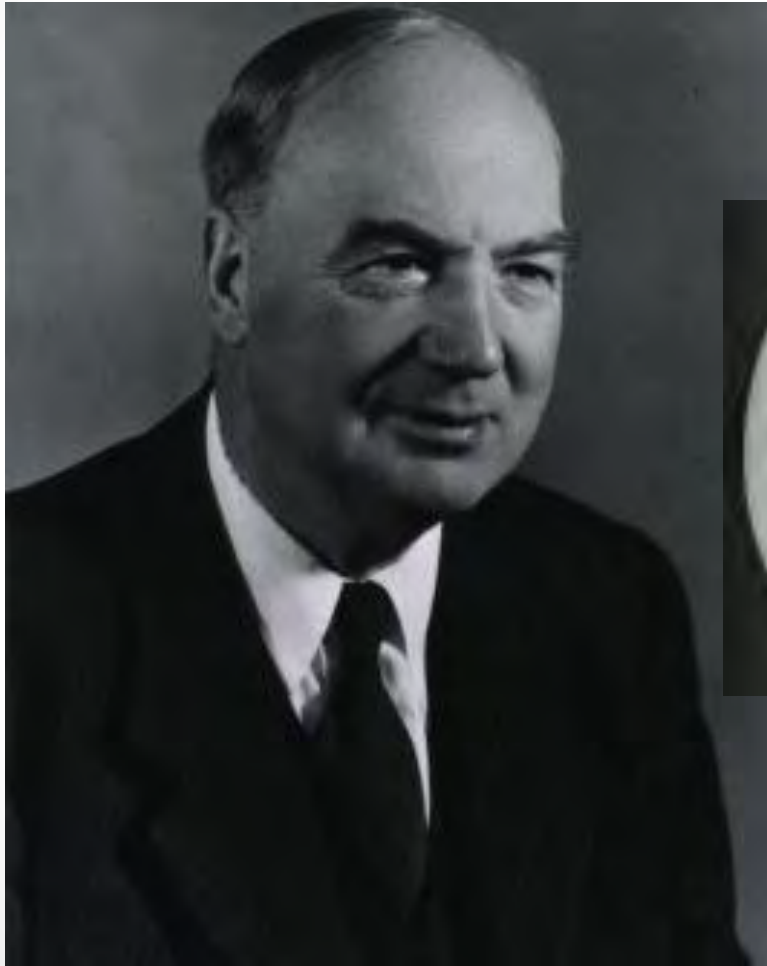
- Saliva in patients with cavities: minerals move from teeth into the saliva
- After K_2 : minerals move from saliva into bone
- Saliva has more K_2 than any other organ other than pancreas
 - Price ibid p 358



Price's Formula for Tooth Decay

- Cod liver oil (D and A)
- Grass fed butter (K2)
- Stopped drilling teeth
- Caused dentin to regrow and seal up the cavities
- Sr Edward Mellanby (Co-discoverer of Vit D) and his wife also advocated protocol to prevent cavities
- High in fat soluble KADE vitamins

Mellanby's: Cure Tooth Decay



Diet Main Cause of Tooth Decay

"I firmly believe faulty nutrition is one of the chief reasons for the prevalence of dental caries among the so-called civilized peoples today," Dr. Mellanby, noted English surgeon, said last night. Dr. Mellanby was giving a public lecture at the University.

It is not the whole story. There must be many other contributory factors, external and internal," she said.

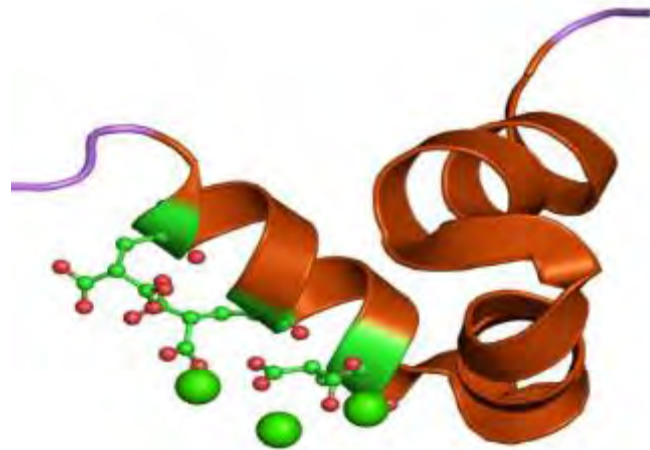
Dr. Mellanby recommended plenty of milk and regular doses of cod liver oil in children's diet, and very few cereal foods, to ensure against decay.

There seems to be definitely gum trouble in Australia and in Britain, but I am sorry to say the caries problem is very bad," she said, adding that she had examined about 1000 five-year-olds here.

The teeth of the children in institutions in Britain were better than those of children in private schools, because those in institutions had one or two pints of milk, some cod liver oil and a regular balanced diet every day.

How to Measure K2

- Can't -There is no test
- Have to measure the result of it's function
- Un-carboxylated Osteocalcin (uc-OC)
- Can measure "Ratio" of Osteocalcin to un-OC
- Average: 3.6 ng/ml
- Level below 1.6 ng/ml should be our goal
 - Koyama et al J Immunol Methods 1991 May 17, 139 (1):17-23



Don't be fooled by serum osteocalcin
Not a functional test.

DEXA and Cardiac Calcium



COMB Study

- Published late 2012 from Alberta Canada
- 77 women followed for one year
- Took K2 (100 mcg), Vit D 2000 IU, Mag 25 mg, Strontium 680 mg, dietary calcium and DHA (Fish oil 250 mg), Exercise
- DOUBLE the rate of bone density improvement (4%) compared to bisphosphonates (2%)
- No side effects, NO toxicity
- To make it even more potent: Alkalize with extra vegetables and alkaline salts (even bicarb)
- To really hit a home run: add estrogen, progesterone and testosterone in a balanced and moderate fashion

Conclusion

- 1. Vitamin K2 is a critical vitamin that has missed the radar
- 2. We lost it because it was confused with K1 that is about blood clotting
- 3. It involves calcium metabolism, pulling it out of arteries (where it shouldn't be) and into bones (where it should be)
- 4. But it helps myriad other functions as well: diabetes, cancer, heart disease, Alzheimer's, labor and delivery – all are “associated with deficiency”
- 5. The wellness model requires life time balance and support so “treatment” after a disease begins is likely less useful
- 6. Proof of effect may take decades
- 7. There is no toxicity
- 8. Prudent response: take the supplement

WWW. What Will Work for Me

- Take at least 100 mcg a day of MK-7
- MK-4 may activate osteocalcin better than MK-7
- Several combination products exist: MK-4 is shorter acting, MK – 7 is longer acting
- Be careful if you are on coumadin or have clotting risks (Leiden)
- Eat natto, pate, or grass raised butter

