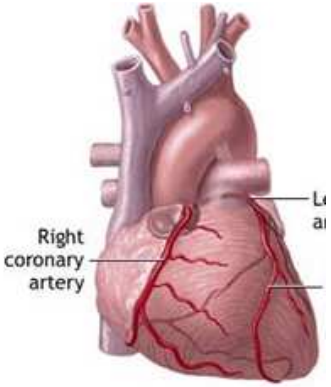


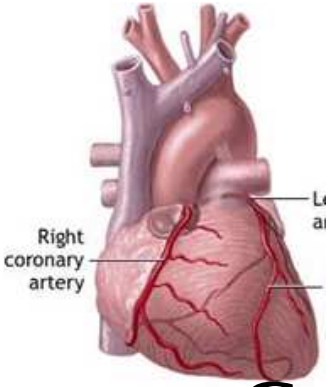
Food, Diet & Nutritional Prevention of
Cardio-Vascular Diseases

Prof. Denis E. Corpet

National Veterinary School of Toulouse

UMR ENVT-INRA Xénobiotiques: Aliments & Cancer

Lesson : http://Corpet.net/Denis



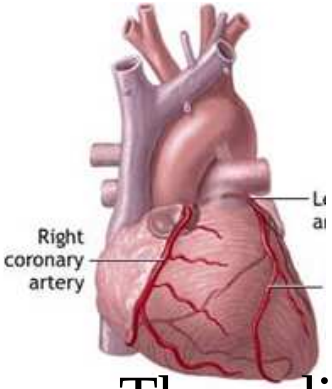
Better Diet Reduces Risks

Which Diseases?

- **Cardio-Vascular Diseases**
- **Cancers**
- Diabetes mellitus (type II)
- Obesity & Hypertension
- Osteoporosis & Dental caries
- Constipation & Bile gallstones
- Brain diseases (age demetia, Alzheimer)
- Cataract & Macular degeneration Conclusion

Nutrition-Diseases Link
How do we Know?

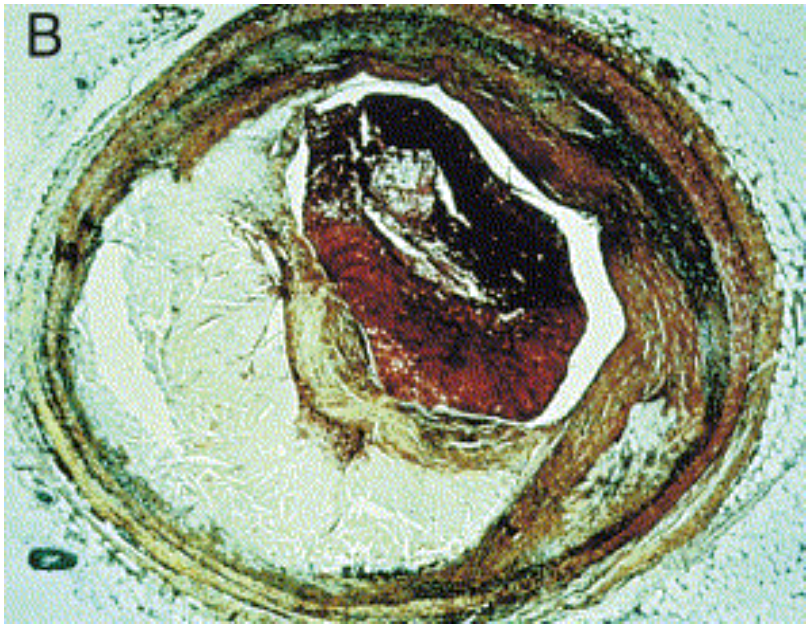
- Mortality causes are changing
  From infectious diseases to chronic diseases
- Hard to prove cause/effect link
  population level, lag time, many factors
- Methodological Difficulties
  hard to measure food intake, to recall, to get good controls, to get good animal models
- Recommendations ethics: first no harm!
  Need strong evidence, no health risk, no psychological or economical risk
- **Evidence criteria**: strength (RR), consistence, sequence, specificity, biological mechanism Conclusion

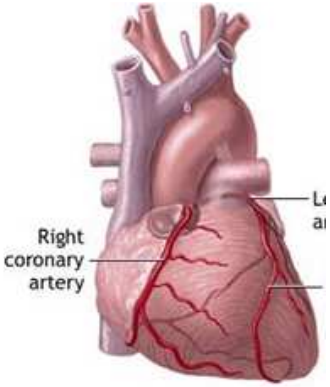


Cardio-Vascular Diseases

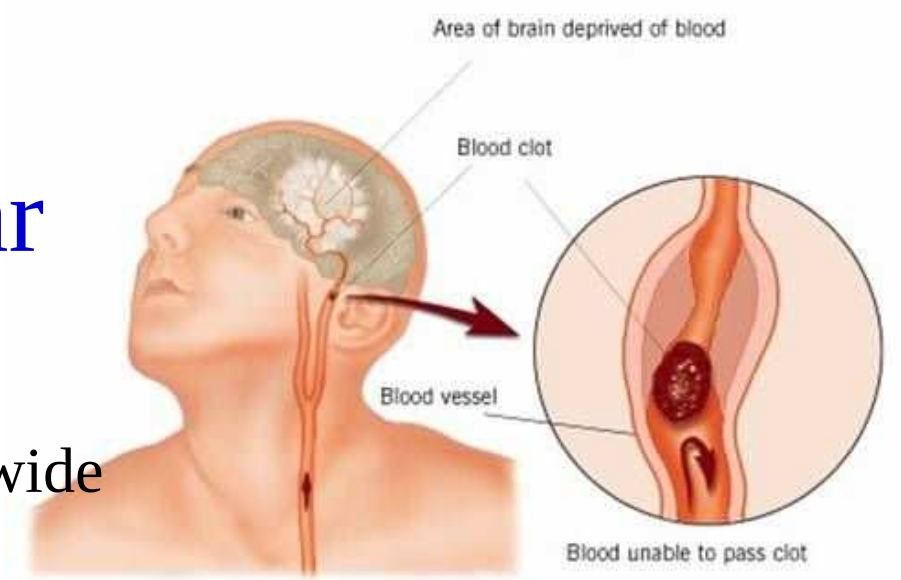
Three different diseases:

- Cerebrovascular Accident = Stroke
- Coronary artery disease, Atherosclerosis = Heart attack
- Peripheral Vascular Disease: poor blood flow in legs, arms. Due to cigarette smoking => Gangrene, foot amputation





Stroke
Cerebrovascular Accident



Strokes cause 6 million deaths worldwide

(second to hearth attacks, in 2004)

30 million people are stroke survivors

Incidence of stroke has doubled in low-and middle-income countries (past 40 years), but has fallen in rich countries: most strokes now in Africa and Asia

Loss of brain function due to lack of blood supply

Due to ischemia caused by blockage or a hemorrhage

The affected area of the brain cannot function

→ inability to move one side of the body

→ inability to understand or to speak

→ inability to see one side of the visual field

Proportion attributable:

50% High blood pressure

30% Low physical activity

20% Current smoking

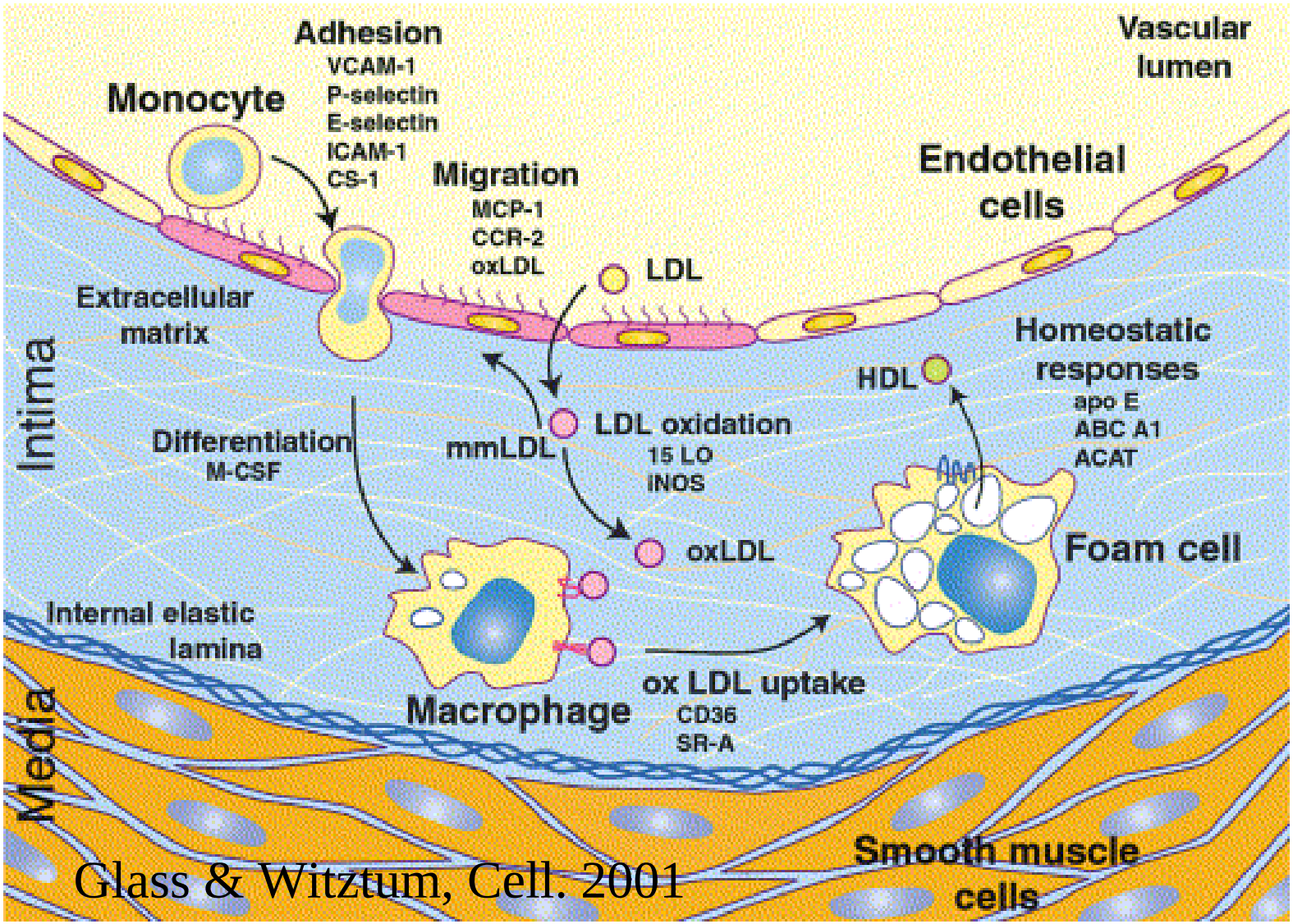
20% Unhealthy diet

INTERSTROKE study

Lancet 2010; **376:** 112–123

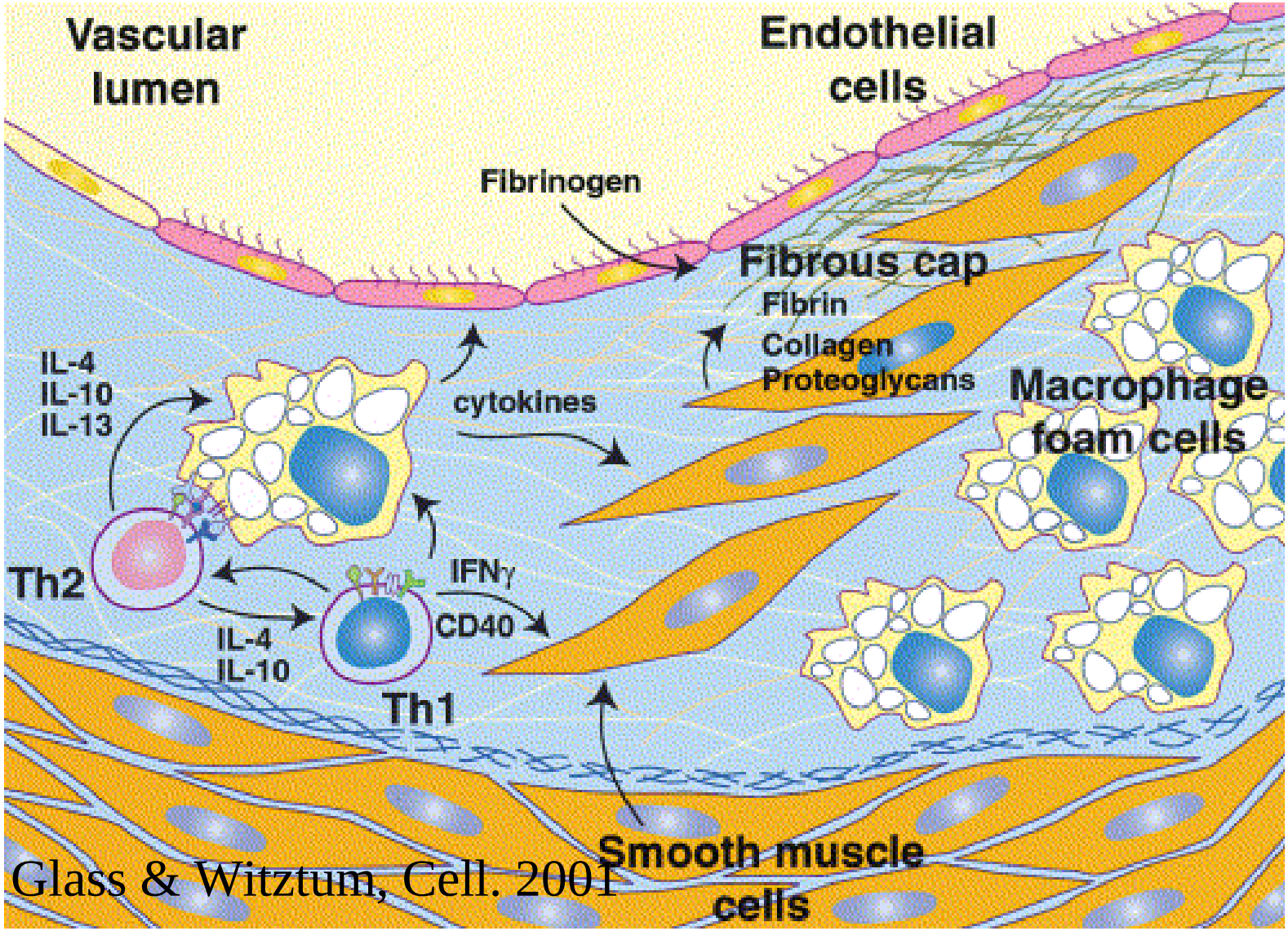
Coronary artery disease: plaque evolution- 1

Oxydation des LDL, attachement des monocytes et migration sous l'endothélium, transformation en macrophage et accumulation de LDL pour former cellule spumeuse (*foam cell*),



Glass & Witztum, Cell. 2001

Coronary artery disease: plaque evolution- 2

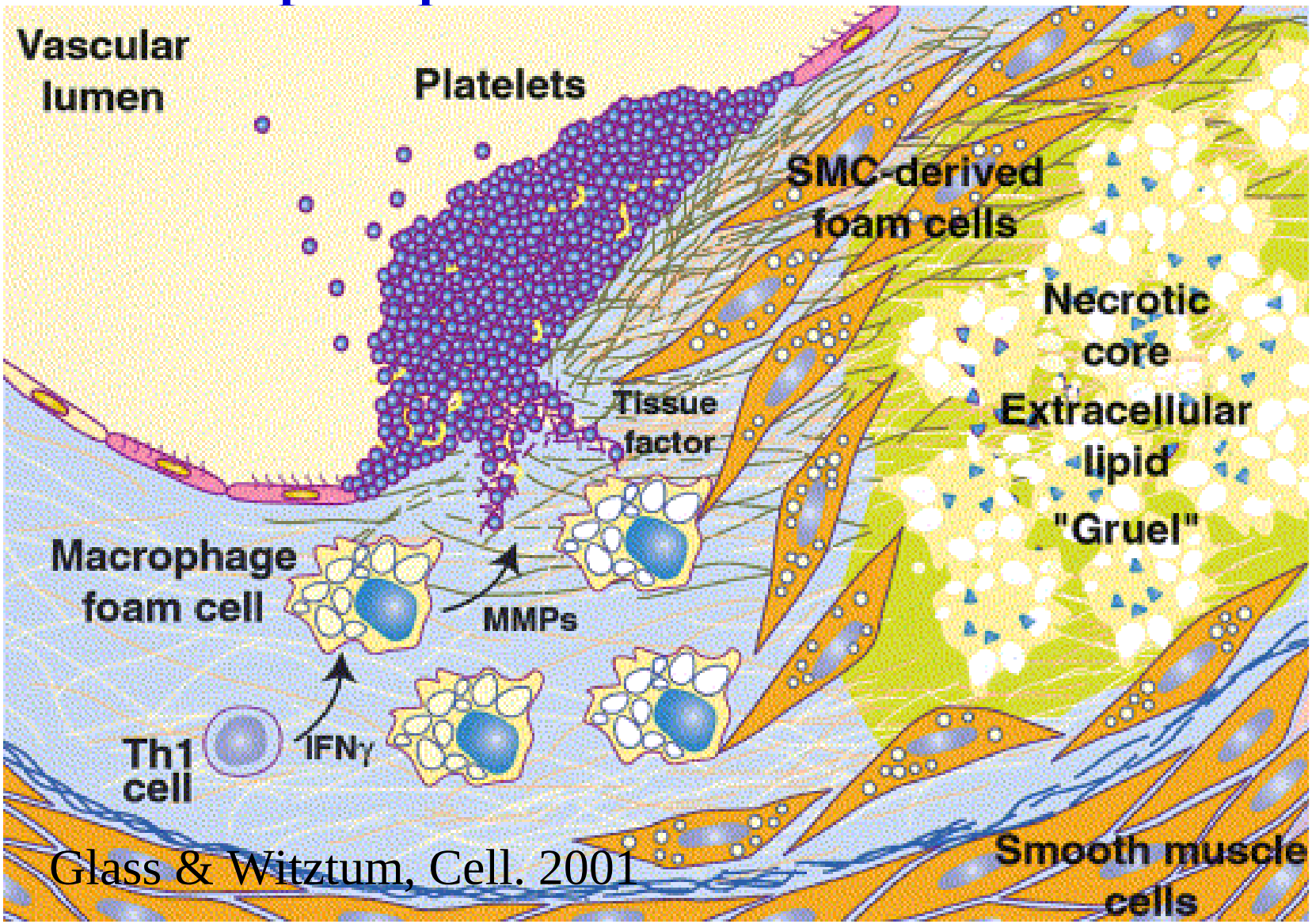


Glass & Witztum, Cell. 2001

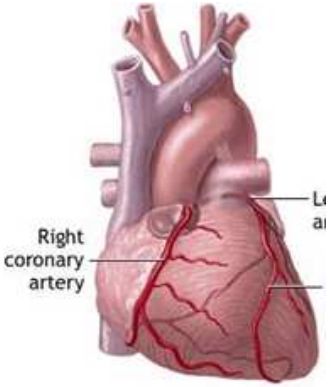
Inflammation induite /macrophages spumeux+ cell. Th1 & Th2 et synthèses de cytokines. Migration de cellules musculaires et établissement d'une chape fibreuse autour des cell spumeuses

La nécrose des cellules spumeuses => noyau nécrosé & cholestéro
Lors d'une hypertention, rupture de la plaque: contact sang-'intima
coagulation "explosive" et formation d'un thrombus.

Coronary artery disease: plaque evolution- 3



Glass & Witztum, Cell. 2001



Causal and preventive risk factors for cardiovascular disease

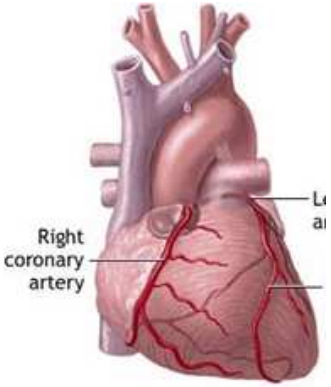
Causal

- Cigarette smoking
- Elevated cholesterol
- Hypertension
- Obesity
- Physical inactivity
- Diabetes

Preventive

- Low-dose aspirin
- Estrogen replacement therapy in women?
- Antioxidant vitamins?

Hennekens. Circulation 1998 ; 97 : 1095

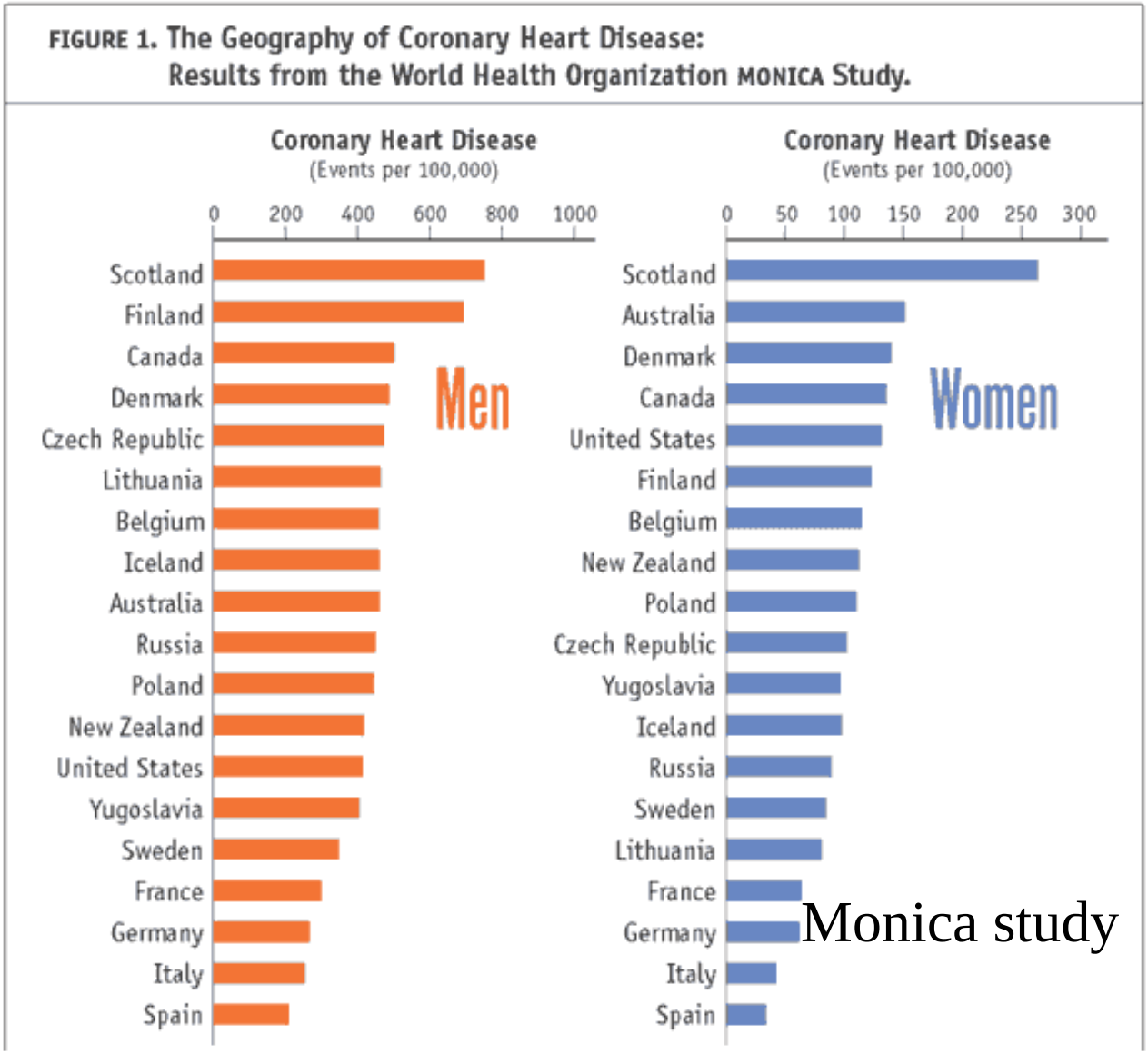


Cardiovascular Mortality International Comparisons

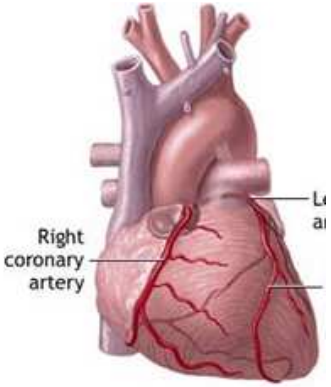
Mortality
Differences
Between countries:

Worst =
Scotland
Eastern Europe

Best =
Greece, Spain,
Japan, France

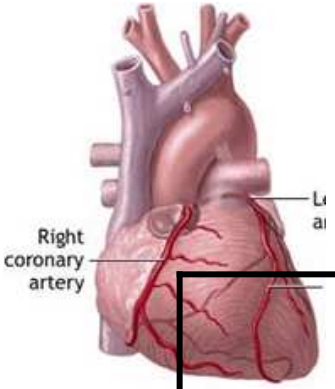


Monica study



International Study *Monica* Cardiovascular Data

☐	Belfast	Toulouse	RR
Death /100 000	**223**	**47**	**3,9**
Incidence 1st myocardial infarction	**482**	**138**	**3,5**



International Study *Monica*
Food Data

	Belfast	**Toulouse**	
Fruits	1.6	7.6	Vitamin C Phytochemicals
Potatoes	8.4	2.6	Vit.C
Vegetables	2.1	3.3	Fibres
Meat	14	19	Saturated!
Cheese	2	8	Saturated!
Milk	+++	-	Saturated
Alcohol	Beer	Red wine	

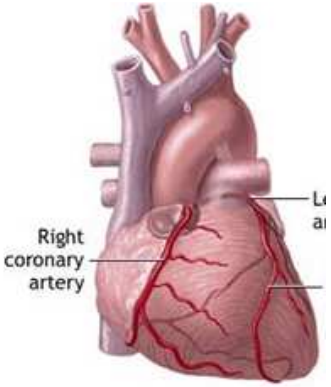
Observation: hypotheses, no evidence

Nurses'Health Study
Harvard, Boston, USA

Stampfer … Willett, New Engl. J. Med, 2000

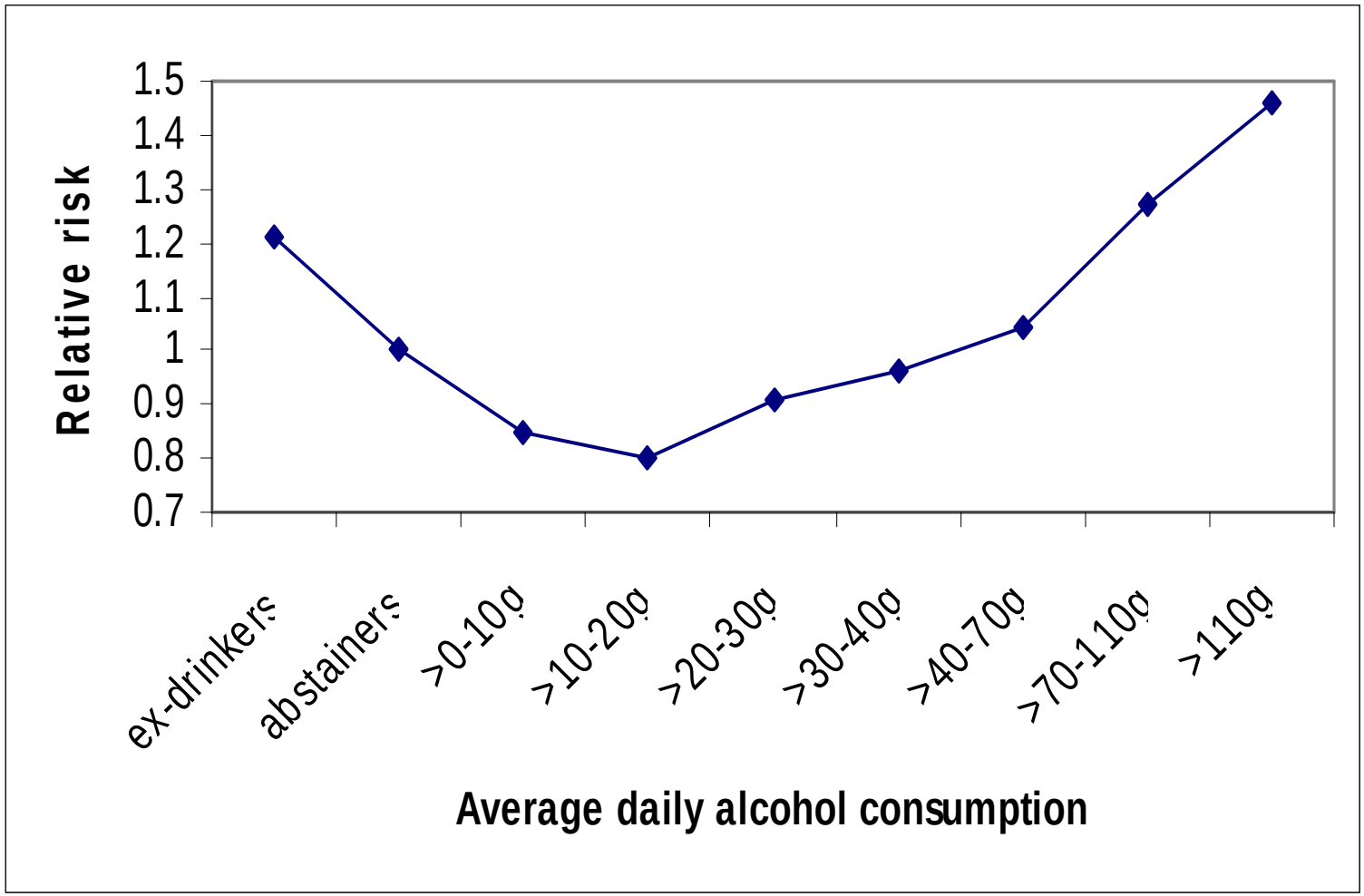
- Cohort 122 000 nurses followed since 1976
- Total of **1 128 "Heart Attacks"** observed within 14 years
- Only **62 HA** in [non-smokers + 30 min physical exercise/d + "correct" diet](= low *trans* FA, lot of *n-3* PUFA, fibers, folate, and low GI starchy foods
- Only **5 HA** in [*idem* + BMI <25 + more than 1 drink every 2 days]

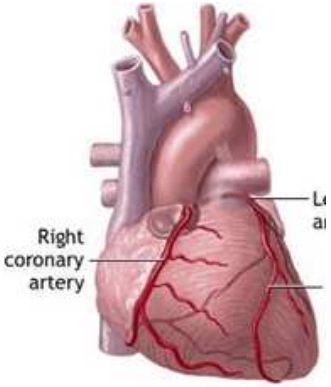
Observation: hypotheses, no evidence



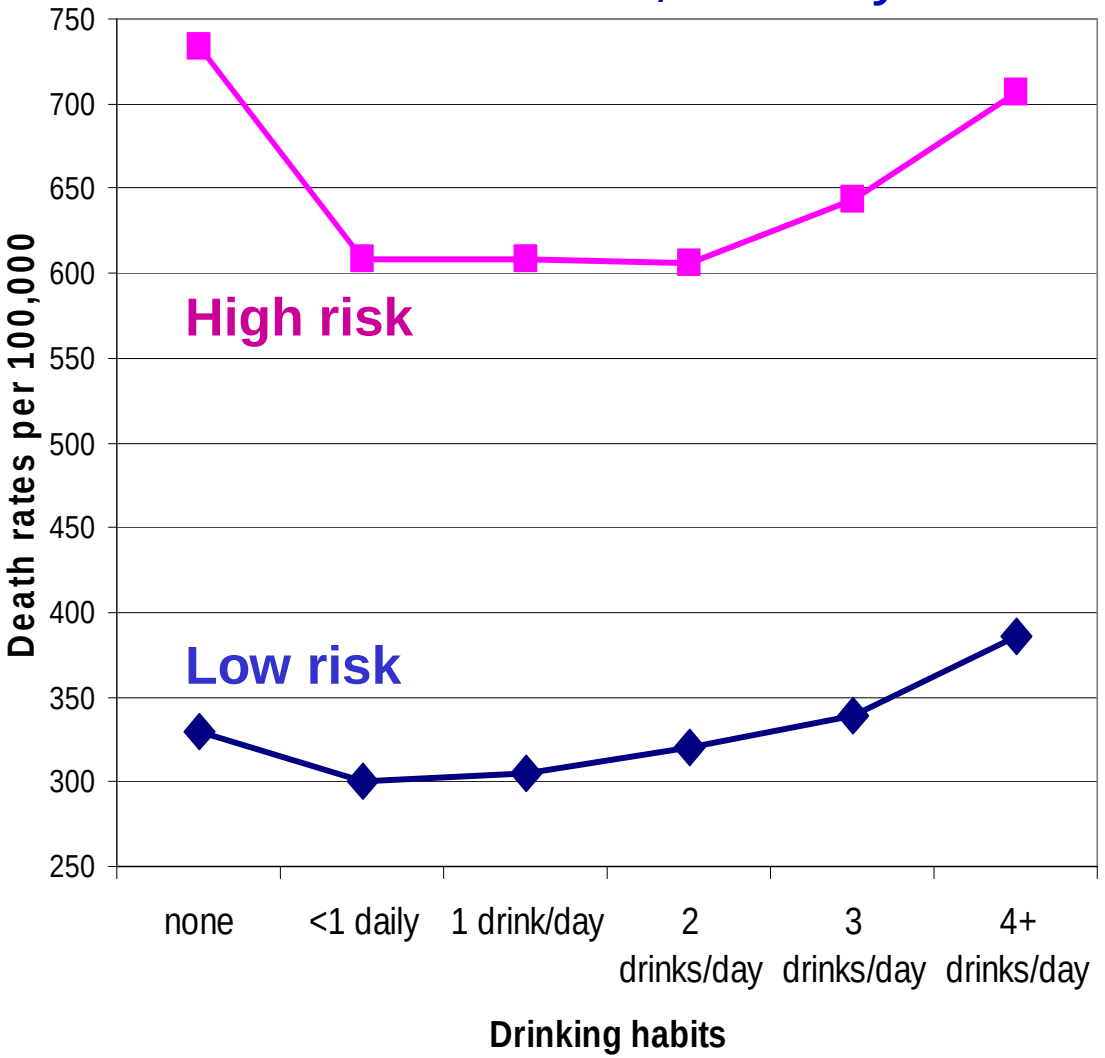
Alcohol et Relative Risk of **Death** (all causes)

Source: Rehm, 2001
Hommes 45 ans et +
Slide.:*Françoise Clavel*

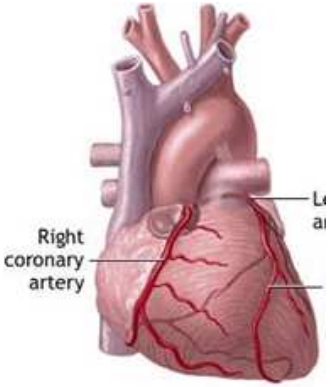




Death Rate, All Causes
High vs. Low Cardio-Vascular Risk
Men & Women, 30-59 years



Thun et al, 1997
Slide.: Françoise Clavel

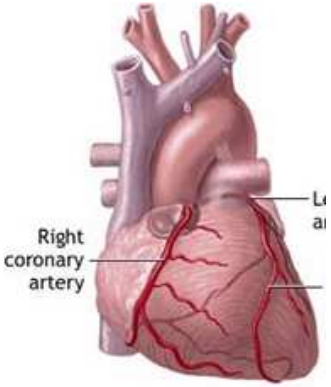


Lyon's Heart Study

de Lorgeril, Renaud, *Lancet* 1994

Intervention Study

- 600 patients surviving post heart attack
- Randomized to two groups of 300, G1 et G2
- *G1- control:* « Prudent diet » of the American Heart Association
- *G2- treated*: « Mediterranean diet »
  - No day without a fruit, increased vegetables
  - Bread, fish, poultry, red wine 2 glass/d : OK
  - Olive & colza oils, special Margarine 18:3 n-3
  - Reduced red meat, processed meat. No butter, no cream



Lyon's Heart Study

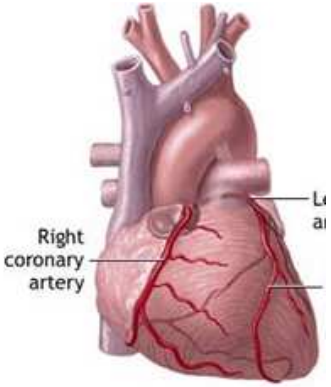
de Lorgeril, Renaud, *Lancet* 1994

Results

Stopped at 27 months	**G1 control**	**G2 mediter.**	***P value***
Heart attacks	33	8	0,001
CV deaths	**16**	**3**	0,02
Instant deaths	10	0	

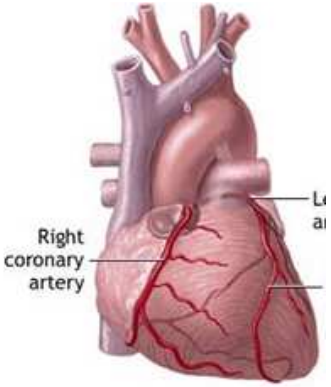
Intervention = only « true » evidence !

But complex intervention, hard to interpret!



Nutritional Prevention of **Cardio-Vascular Diseases**

- More n-3 PUFA (canola oil & salmon)
- More folate (fruits vegetabl) / homocysteine
- Some alcohol, polyphenols (red wine 2/d)
- More fibers (whole grain, vegetables)
- Less saturated fat (butter, beef), no *trans* fat
- No obesity, sedentarity /
  more physical exercise



Effective Prevention Program
Finland example

- 1970: Finland N°1 country for cardio-vascular mortality
- Combination of many well planned and well evaluated preventive community programs to change food habits
- **Change saturated fat to PUFA** (Butter was THE local product)
- **Big raise in vegetables intake**
- **Big reduction in salt intake**
- **Reduction in blood cholesterol of the whole population**
- **80 % reduction in cardio-vascular mortality**
- **Great increase in life expectancy**, and good health, and functional abilities of all the Finishs

Puska P. Ann Nutr Metab. 2009;54 Suppl 1:33-8.
Nat.Inst.Health Welfare, Helsinki, Finland.

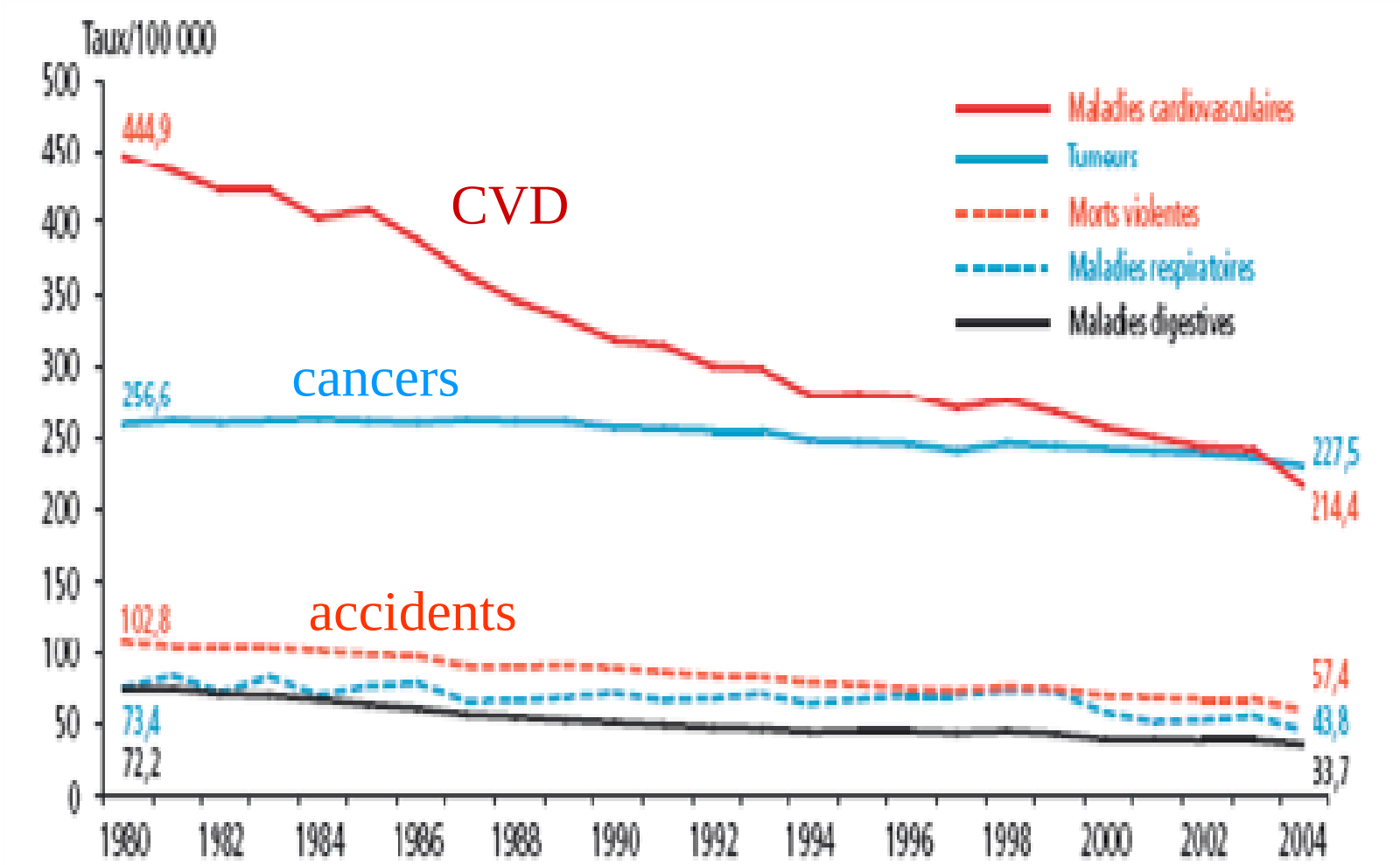
Fat and heart disease: yes we can make a change - the case of North Karelia

BACKGROUND/METHODS: The exceptionally high mortality from cardiovascular disease (CVD) in the Finnish population in the 1970s ensued the initiation of preventive health interventions, which were first started in the Province of North Karelia and later on extended to all other regions of Finland. Their aim was to change population diets, especially with respect to the quality of fat: to reduce saturated and increase unsaturated fat intake. In addition, emphasis was placed on increased vegetable intake and salt reduction. The aim of this paper was to illustrate the effect of combined efforts of several stakeholders on CVD. This comprehensive action in Finland has involved health education programs, preventive measures in health services, actions at schools, broad collaboration with non-governmental and private sector organizations, government policies, population-based monitoring and evaluation, and international collaboration.

•RESULTS: The combined efforts of all stakeholders have greatly helped people to reduce the intake of saturated fat and to replace this with unsaturated fat. This has been associated with an improved quality of the dietary fat (e.g. in 1972, over 90% of the population used butter on their bread compared to <5% at present) and a remarkable reduction in blood cholesterol levels. It has led to a 80% reduction in annual CVD mortality rates among the working aged population, to a major increase in life expectancy and to major improvements in functional capacity and health. Studies have shown that the reduction in blood cholesterol levels, explained by the target dietary changes, have had the greatest impact on these very favorable health changes. CONCLUSION: The Finnish experience shows both the feasibility and great potential of CVD prevention and heart health promotion through general dietary changes in the population.

http://www.pritikin.com/your-health/health-benefits/reverse-heart-disease/252-heart-disease-deaths-plunge-75.html

Death rates by major cause in France 1980-2004



* Standardized death rates /100 000