

CELL PHONES CANNOT CAUSE CANCER

Why do (some) epidemiologists say
that more research is needed?

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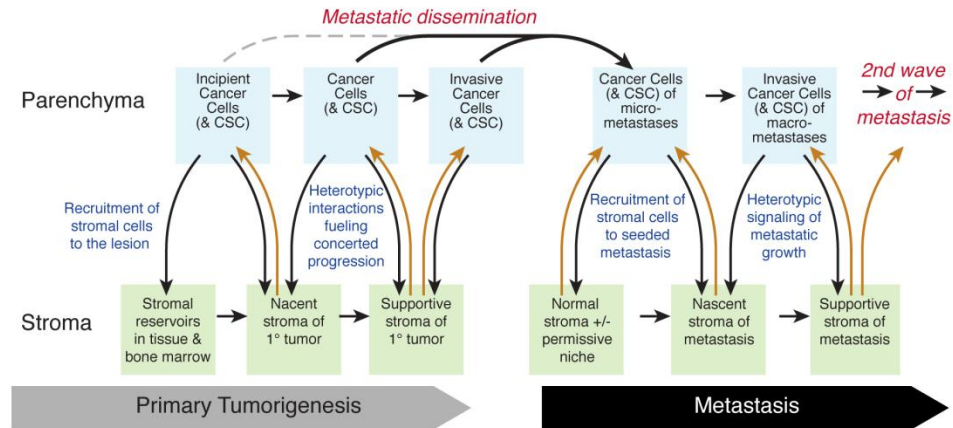
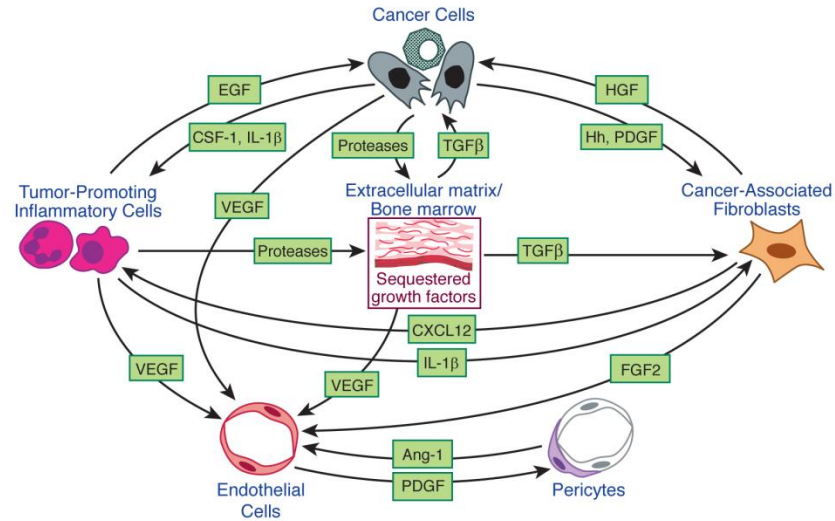
September 21, 2011

Proof that cell phones cannot cause cancer

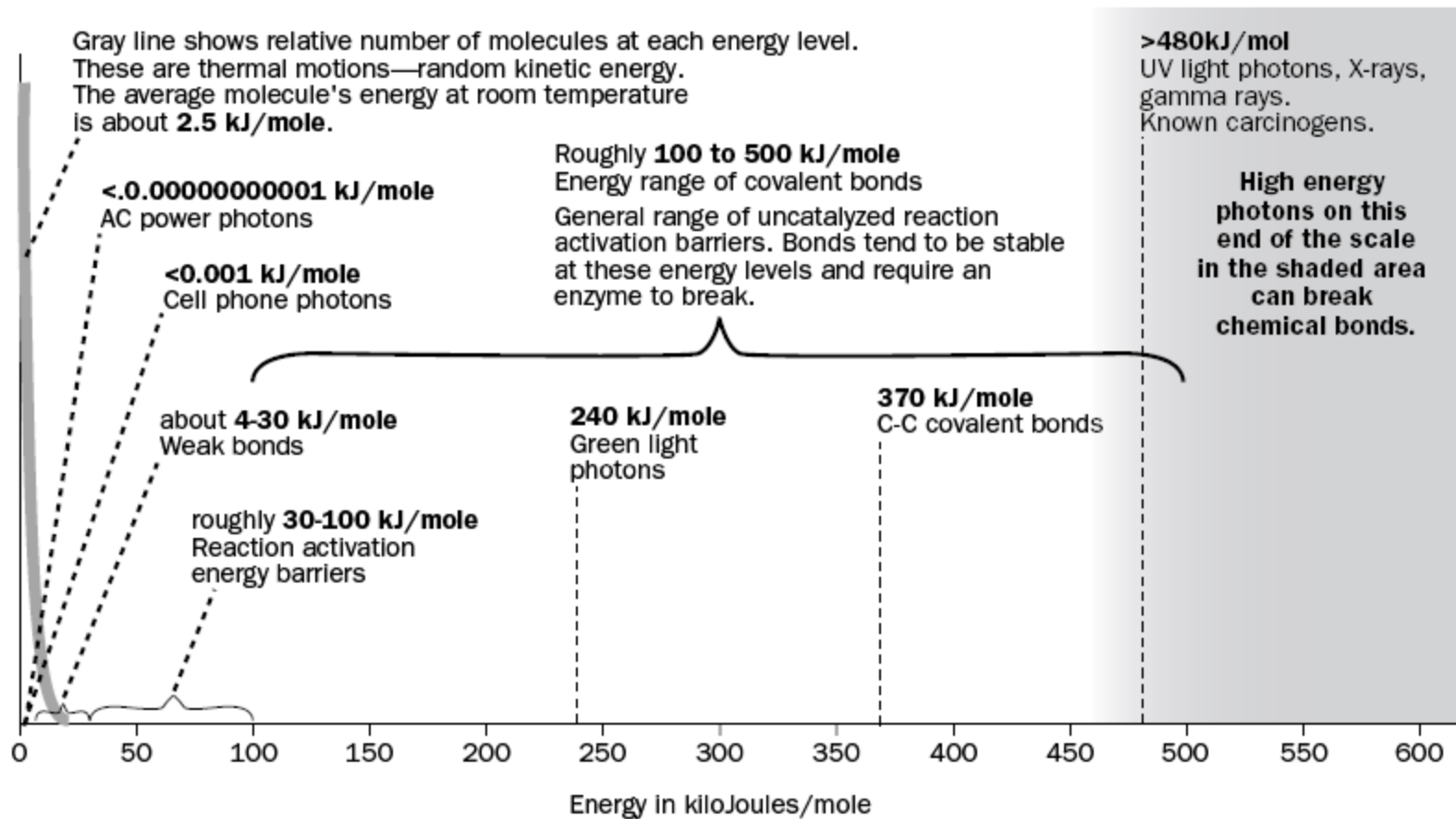
- Physicists know exactly what happens when any atom or molecule absorbs microwave radiation -- heating
 - Microwave frequency \ll collision frequency
- Everyone knows many other biological processes that do the same thing, but more so
 - Basal metabolism, exercise, ski cap, hot soup,...
- None of these other processes cause cancer

Usual physicist's argument

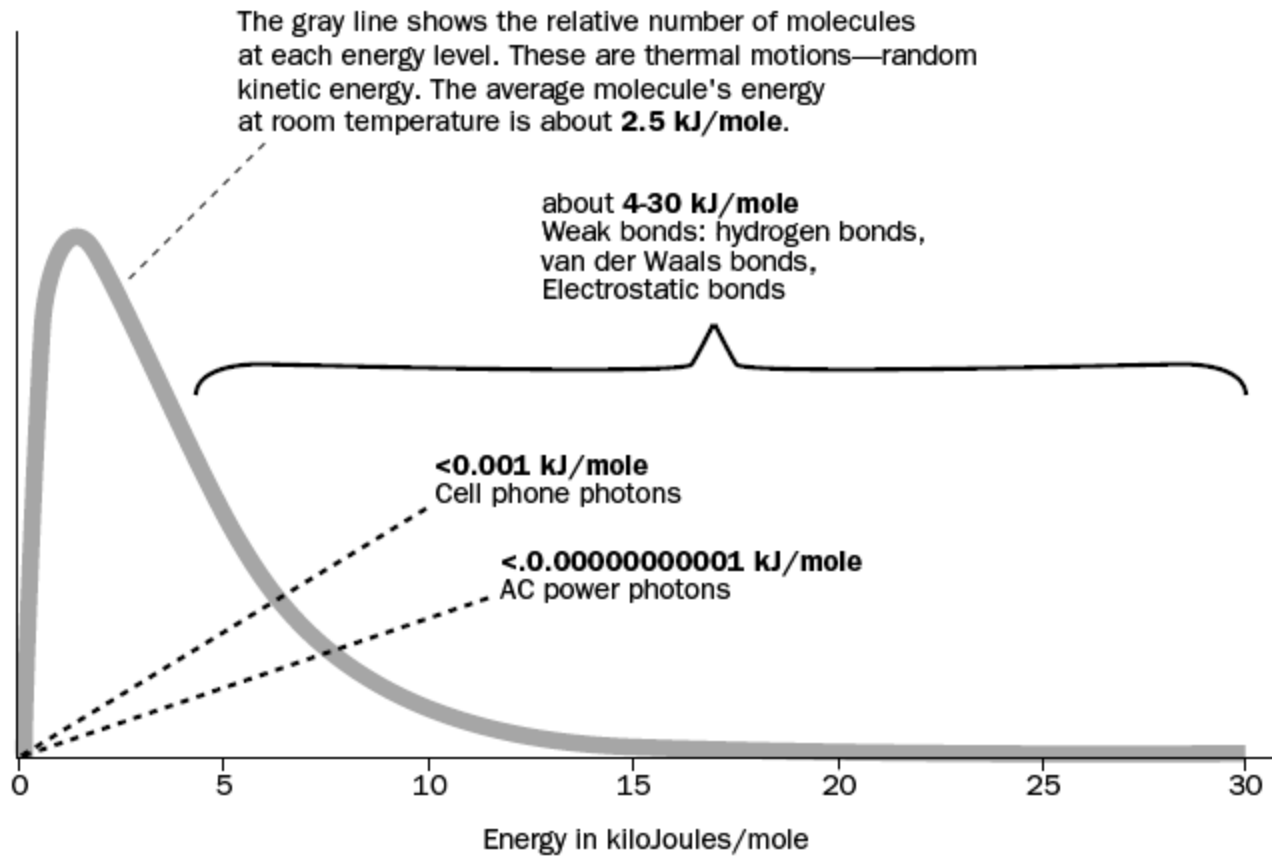
- UV, X-rays, and gamma rays cause cancer
- These photons break chemical bonds
- No other forms of electromagnetic radiation can break any chemical bond
- Therefore, these cannot cause cancer
- Medical researchers believe the first three points, but not the fourth, AND that
- “Physicists don’t understand cancer”



Biochemistry's Energy World



Biochemistry's Low Energy World



Further evidence

- Cell phones do not cause skin cancer
- Cell phones do not break chemical bonds
- Brain tumors not associated with habitual location of cell phone
- Cell phones do not cause benign tumors
- Cell phone microwave power \ll power of many natural and safe biological processes

WHO Interphone Study

- Major international case-control study with 6000 brain cancer patients.
- Cell phone use did not increase the risk of brain cancer (statistically significant)
- Sub-group analysis in an appendix asserted that a sub-group's risk was above average (not statistically significant)
- “More research is needed”

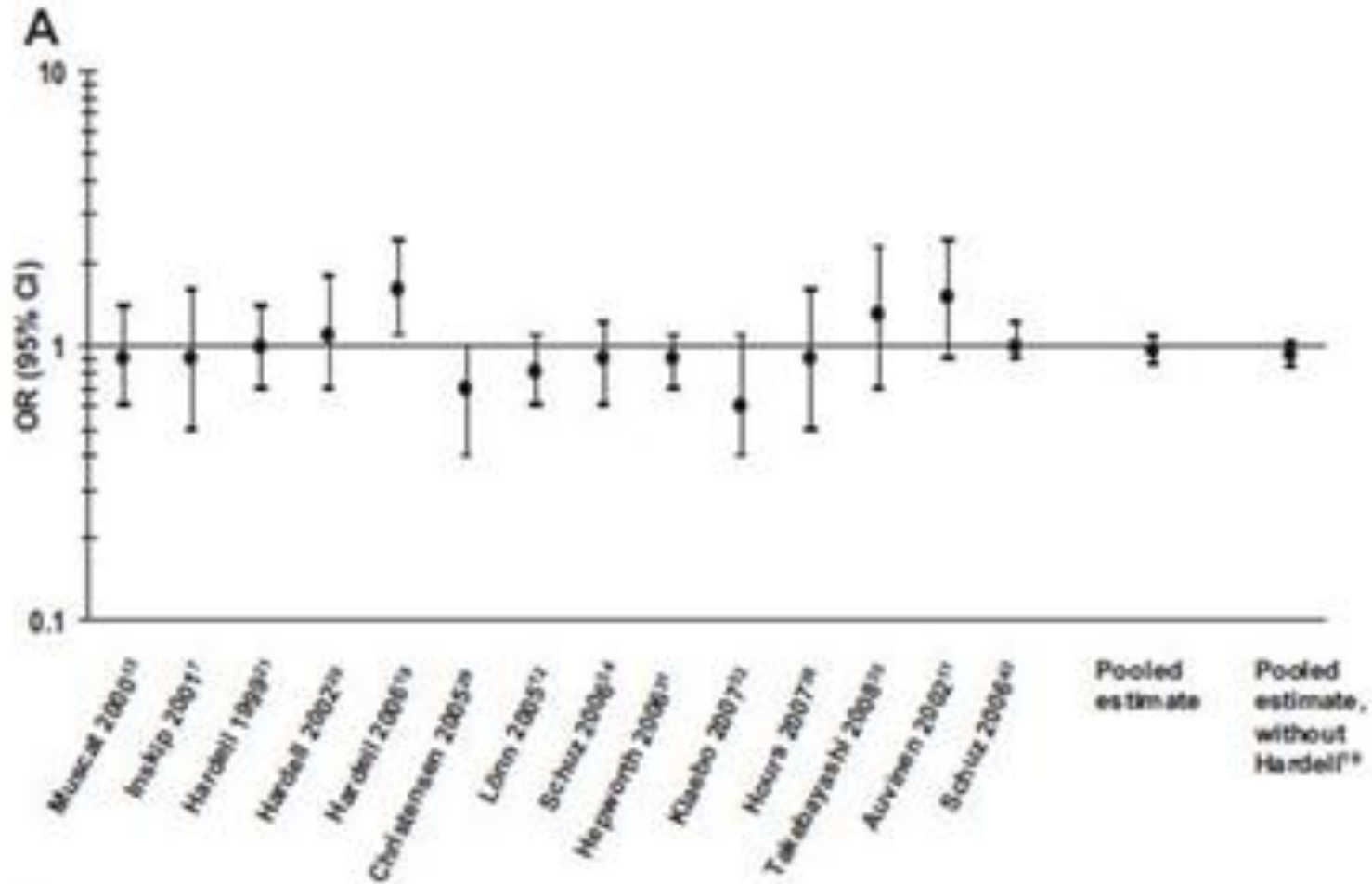
WHO IARC

- IARC declared cell phone microwaves to be “possibly carcinogenic”
- Same category as many chemicals, pickles, carpentry
- “possibly carcinogenic” means IARC believes evidence of carcinogenicity is weak but likely to strengthen and show risk

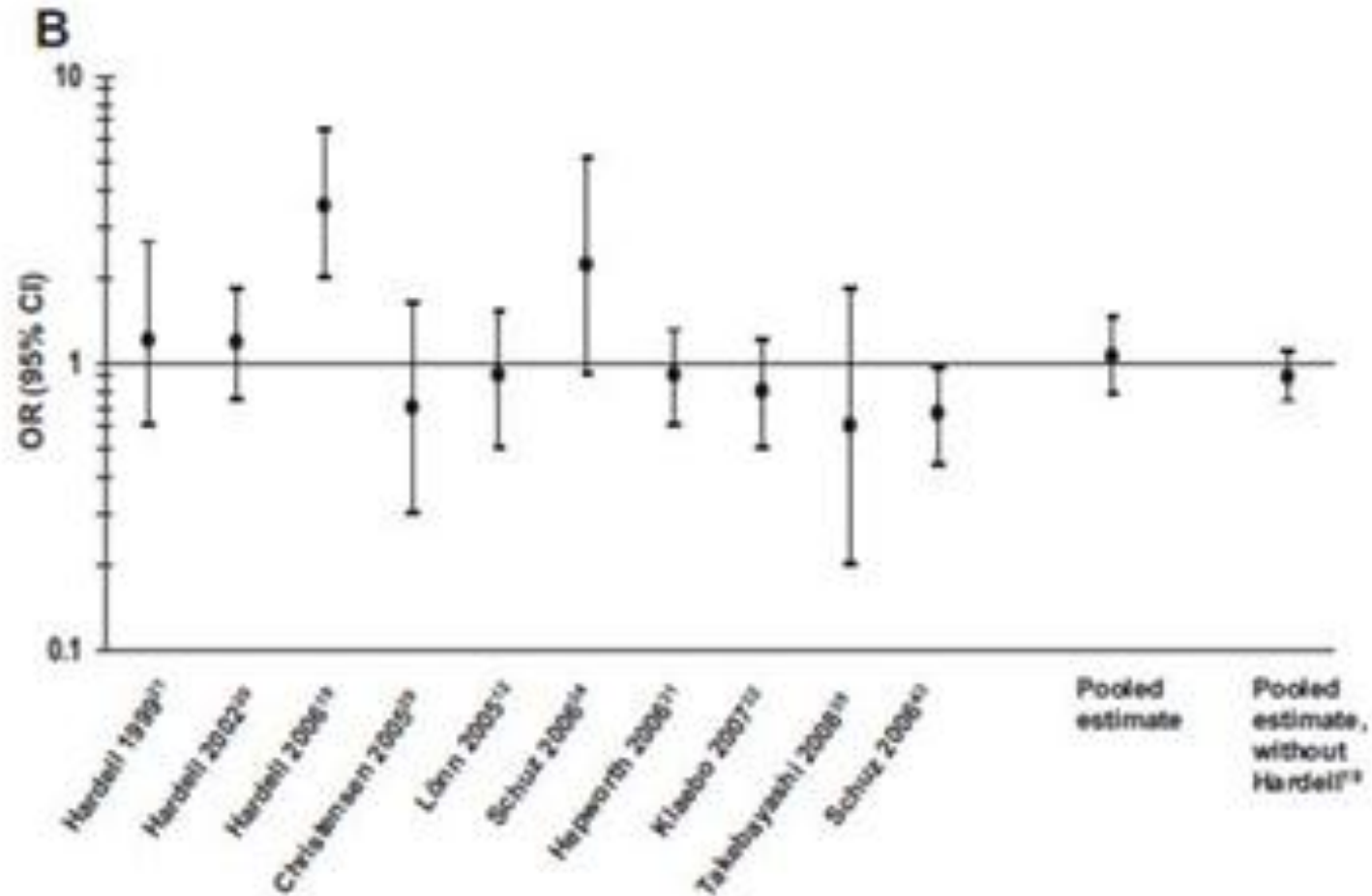
Danish case-control study

- Nationwide cohort included 420,095 persons
- First cellular telephone subscription was between 1982 and 1995
- Cohort followed through 2002 for cancer incidence
- 14 249 cancers observed (SIR = 0.95; 95% confidence interval [CI] = 0.93 to 0.97 -- 15 001 cases were expected)
- Cellular telephone use was not associated with
 - brain tumors (SIR = 0.97),
 - acoustic neuromas (SIR = 0.73),
 - salivary gland tumors (SIR = 0.77),
 - eye tumors (SIR = 0.96), or
 - leukemias (SIR = 1.00).
- Cellular telephone use was not associated with increased risk for brain tumors (SIR = 0.66, 95% CI = 0.44 to 0.95) in long-term subscribers of 10 years or more

Meta-analysis (<5 yrs phone use)



Meta-analysis (> 5 yrs phone use)



Bayesian Considerations

New Probability = Old Probability X New Data

$$0 \leq 1$$

$$0 \leq 1$$

Extraordinary claims require extraordinary evidence

Cromwell's Principle – Prior \neq 0 or 1

Allow for possible mistakes

Hume's Principle – Evidence for a miracle is always less than evidence for natural law

What is the responsibility of epidemiologists?

- Epidemiological evidence of risk is weak
- Epidemiological evidence of safety is strong
- No known mechanism
- Physicists strongly assert there is no unknown mechanism
- Does the precautionary principle apply?