Problem Set 6 Solutions:

Arguments for a linear non-threshold model:

1. A single molecule may be sufficient to initiate an irreversible effect.
2. Chemicals produce tumors similar to those that arise spontaneously, so there is not a novel mechanism which would be associated with a threshold.
3. Experiments with radiation have not revealed a statistically reliable threshold.
4. It is impossible to demonstrate a no-effect level in small groups of animals that would be statistically valid for a billion humans.
5. How do you determine the threshold?
6. How do you account for the diversity of the human population?
7. It is prudent to assume the worst case in pursuit of a public policy toward cancer risk from chemicals.

Arguments against a linear non-threshold model:

1. It is statistically so unlikely to have a single molecule initiate cancer that we must reject the hypothesis.
2. Since initiation of cancer is a multi-stage process, the probability of failure at one stage is reasonable.
3. Metabolic processing of chemicals makes likely that the toxic form will not reach its target.
4. Defense mechanisms exist at every stage of the process, so one would have to assume that all pro-carcinogenic steps succeed, while all defense steps fail.
5. Extrapolation of doses from test animals to humans by orders of magnitude is scientifically invalid.
6. Use of non-threshold models presents goals that are economically and technologically infeasible.