Risk in the Pharmaceutical Industry

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History – Stan at Eli Lilly

Long-term rodent carcinogenicity studies.

Rats/mice; males/females; Cont/Trt; hundreds of tumors.

NTP ~800-1000 statistical tests of hypothesis

Statistics – massively excessive statistical testing.

Biology – Rats and mice are not men!

Peter Westfall – 1985 Biometrics. **Adjusted confidence limits**.

Symmetry

To clear a drug:

1. $800,000 to $1.8B.
2. Two 0.05 independent clinical trials.
3. Expert risk/benefit analysis.

To kill a drug:

Essentially NO rules – wild, wild west.

Why not two independent epi studies?

Cox-2 Lesson

1. All drugs have side effects.

2. Follow on studies are larger than original clinical trials.

3. New side effects will be found.

4. No drug is save.

=> Sell your drug stocks.

Greatest Dangers

Epidemiology

Trial lawyers

FDA – Government

Technical Challenges

1. Massive health data sets.
2. Massive multivariate response.
3. Massive numbers of diffuse predictors.
4. Decision science – risk/benefit.
5. Hidden multiplicity.

Multiple testing solutions

1. Test fewer questions – clinical trials.
2. Test and holdout data sets.
3. Resampling-based multiple testing.
4. Require replication – clinical trials.

Etc.

Repeat findings, not p-values, are the thing.

What can you do?

1. Take up a technical challenge.

2. Write letters.

   Science – data sharing.
   JAMA – Randomness as a “prime mover”.

Track www.junkscience.com
www.quackwatch.org

Come to multiple testing workshop.

Individual versus Society

Republican Rome versus United States

Many/most ethical conundrums are

a confusion of individual good

versus good for society.

Dangers - 2

Ignorance

1. Incorrect knowledge.
2. Poor reasoning.
3. Human focus on one-thing-at-a-time.