**Title**: Ioannidis (2005)

**Background**: “Most Published Research Findings Are False.” It is a bold claim, and an interestingly reflexive one (research on research)! This article builds on previous work in molecular genetics demonstrating a high rate of non-replication and a so-called “Proteus effect” of rapidly alternating claims and refutations. Ioannidis defines and quantifies these concerns by introducing a statistical model for the proportion of research claims that are actually true, or positive predictive value (PPV), which offers insights for improving research methodology.

**Findings**: Ioannidis frames the PPV of a study as a function of (type I error), (type II error), and R (ratio of “true relations” to “no relations” tested in a field):   
where and can adjusted by (proportion of otherwise claimed-false hypotheses that were reported as true due to selective bias), and (number of independent studies).

This provides an explicit statistical framework for identifying factors that contribute to false claims, and for estimating the PPV of certain types of studies under various conditions. Ioannidis names six corollaries of his model – (1) study size, (2) effect size, (3) selection of tested relationships, (4) design flexibility, (5) outside interests and prejudices, and (6) popularity of a field – which impact PPV. Ioannidis applies this model to an example of a genome-wide association study with low pre-study odds (0.0001) mild bias (0.10), decent power (0.60), and then-standard p-value cutoff (0.05), pursued by 10 independent teams, and concludes that the PPV is hardly higher than the prior. Applying the same ideas broadly, Ioannidis concludes that most research findings are false for most research designs and for most fields, and that the effect sizes of research findings in a null field may accurately measure the prevailing bias.

**Conclusions**: Although most research claims may be statistically sound in a vacuum, unconsidered or outside factors may render a large majority of them false. Ioannidis’ model provides a framework for quantifying this effect, while identifying six areas for improving the reliability of research claims.