1)

- Correct: Assuming the medication has zero effect in the population, you'd obtain the sample effect, or larger, in 3% of studies because of random sample error.

- Incorrect: There's a 3% chance of making a mistake by rejecting the null hypothesis.

2)

P value	Probability of rejecting a true null hypothesis
0.05	At least 23% (and typically close to 50%)
0.01	At least 7% (and typically close to 15%)

3)

Why is that the case? Imagine that we perform 100 studies on a population where the null hypothesis is true. If we use a significance level of 0.05, we'd expect that five of the studies will produce statistically significant results—false positives. Afterward, when we go to look at those significant studies, what is the probability that each one is a false positive? Not 5 percent but 100%!

4)
You might be asking, "Is this really a problem, or is it just semantics?" Make no mistake; the correct and incorrect interpretations are very different. If you believe that a P value of 0.04 indicates that there is only a 4% chance that the null hypothesis is correct, you're in for a big surprise! It's often around 26%!

5)
Simulation studies find that lower false positive rates are associated with lower P values. For example, a P value close to 0.05 often has an error rate of 25-50%. However, a P value of 0.0027 often has an error rate around 4.5%. That error rate is close to the rate that is often erroneously ascribed to a P value of 0.05.

6)
It's important to note that there is no directly calculable relationship between P values and the false positive rate. However, simulation studies and the Bayesian approach can produce ballpark estimates of the false positive rate.

7)
I explain how to interpret P values correctly in a different post. Of particular importance to this discussion is the fact that P values are misinterpreted frequently. Often, a P value of 0.05 is misinterpreted as a 5% chance of a false positive. This probability seems like a safe bet. Unfortunately, the actual probability is often between 25-50%! These probabilities are based on

simulation studies and Bayesian analyses. The article we'll explore shines a nice empirical light on this matter.