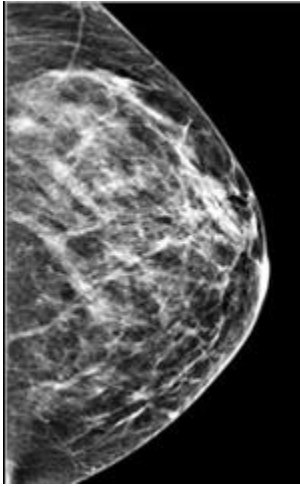No Wonder Mammograms are Controversial!
Bill Menke, October 2010

A woman's lifetime risk of developing breast cancer is 12%. That means that 88% percent of women don't develop it over the course of their adult lives. Thus, the annual rate of *not* developing it is $(0.88)^{1/50}$ or 99.7%, assuming a 50 year adult lifespan. Of 10,000 women who have an annual mammogram, 9,970 don't have breast cancer and 30 do.

The success rate of detecting breast cancer with a mammogram is about 90% (meaning the rate of *false negatives* is about 10%). Thus, the test correctly diagnoses 27 of the 30 as having the cancer and misses 3.

The rate of *false positives* is about 6%. Superficially, this number seems pretty low. Consider, however, that it implies that of the 9,970 women who didn't have cancer, 598 are incorrectly diagnosed as having it.

So here's the upshot. A total of 27+598=625 women test positive for breast cancer, but only 27 of them have the disease. If you test positive in a mammogram, the chance that you actually have breast cancer is only 27/625, or about 4%.

Four percent! No wonder mammograms are controversial[1]!

Screening for a rare condition using an imperfect test is problematical, because the small number of true positives is overwhelmed by a huge number of false positives. This would be merely a technical issue of importance only to lab managers if follow-up testing could be performed surreptitiously, with the woman being notified only when a diagnosis was reasonably certain. It *is* a problem with mammograms, because follow up requires a second doctor's visit and an anxious wait for the results (and in the case of a biopsy, an invasive and painful procedure, too). It's simply not acceptable to tell the 96% who endured such rigors that it was all a *mistake*.

[1]Kolata, Gina, Mammograms' Value in Cancer Fight at Issue, NY Times, September 22, 2010.