Modern Plant Breeding - "Advanced" Level
Power of an experiment

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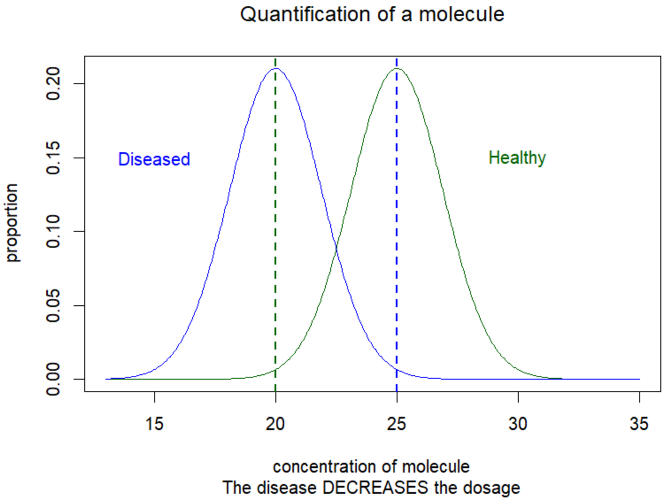
Syllabus

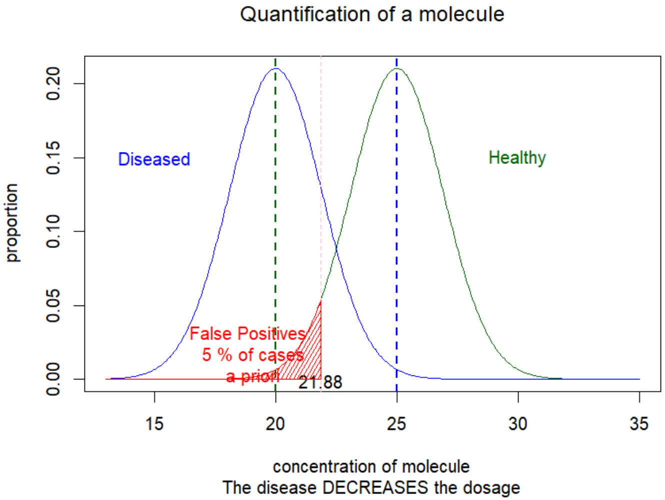
1. Power or ‘how NOT to spend your budget for useless results’

Power or ‘how NOT to spend your budget for useless results’

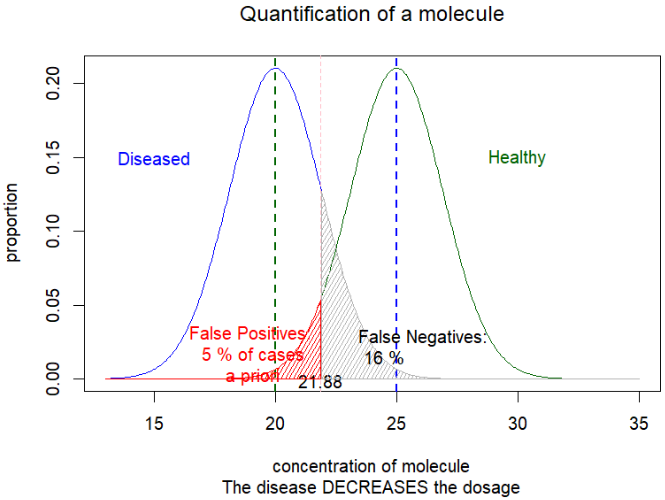
Disease and molecule - 1



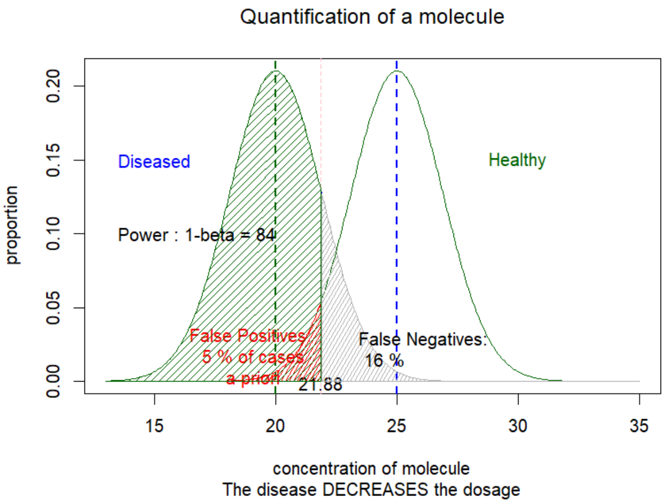
Disease and molecule - 2



Disease and molecule - 3



Disease and molecule - 4



Disease and molecule : Summarize

- If the mean concentration in `Healthy` persons (called μ_0) is 25
- If the mean concentration in `Diseased` persons (called μ_1) is 20
- if the standard error of measures (σ) is 6, then :
  - at the risk level defined by the scientist of $\alpha = 5\%$, the critical value to decide a person is sick is 21.88
  - in that case, the proportion of **false positive** person (lower than critical value BUT Healthy) is thus $\alpha = 5\%$
  - we can compute that the proportion of **false negative** person (greater than critical value BUT Diseased) is $\beta = 16\%$
  - we thus **detect the disease** in $1 - \beta = 84\%$ of diseased persons.

Performances of the test

	'Healthy': case H_0	'Diseased': case H_1
True Diagnostic	95%	84%
Wrong Diagnostic	5%	16%

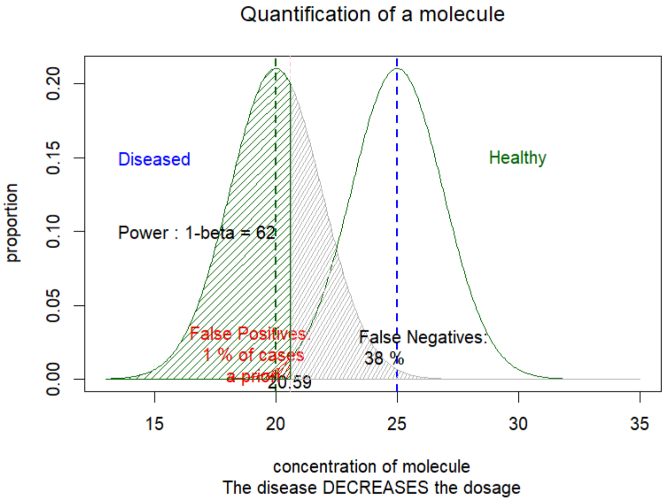
- $n = 10$ persons per group were used to determine the reference values
- $\mu_0 = 25$
- $\mu_1 = 20$
- critical value $= 21.88$
- $\sigma = 6$

Risks associated to a test / a decision.

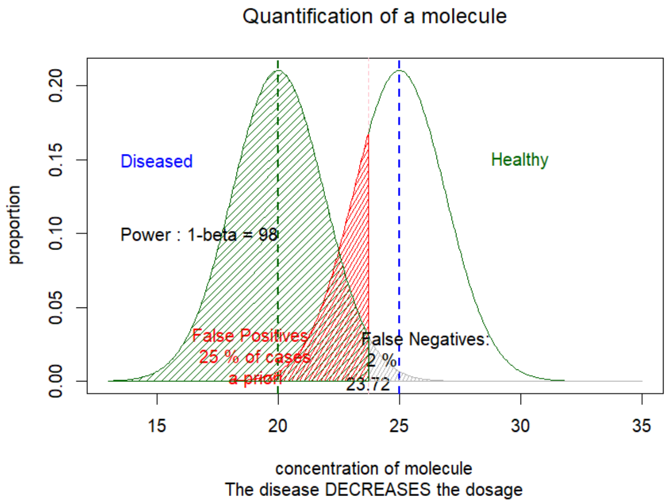
	H_0 true	H_1 true
Accept H_0	$1-\alpha$	β
Reject H_0	α	$1-\beta$

- α : *risk of the first kind* or significance level - reject H_0 when it is true
- $1-\alpha$: probability to accept H_0 when it is true
- β : *error of the second kind* - accept H_0 when it is false
- $1-\beta$: power of the experiment - reject H_0 when it is false

Disease and molecule - decrease α ?



Disease and molecule - OK ... increase α ... but create panics



Wich criteria influence the power ?

- the difference between μ_0 and μ_1 : look for / use the most contrasted conditions
- the variance of the measures: look for the greatest repeatability
- number of data : often the more easy to perform
- the risk of the first kind α : often a bad solution

Let’s go practical and play with power computations using R

We will illustrate the use of *a priori* power computations using the `pwr` library.

At your keyboard

- Explore `Power-Independance.R`