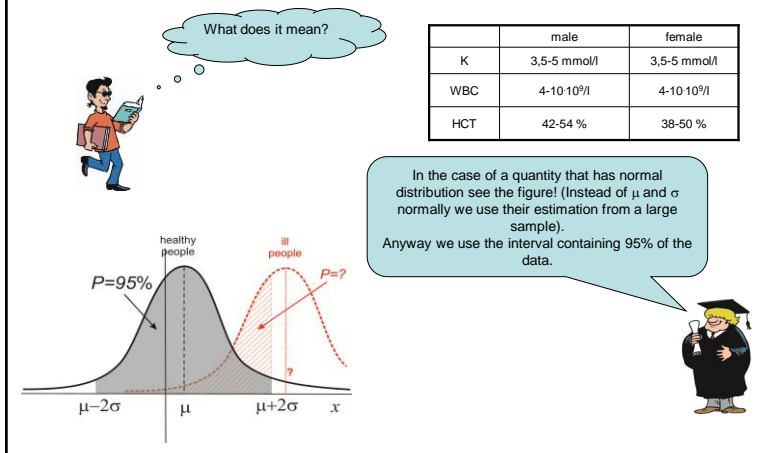
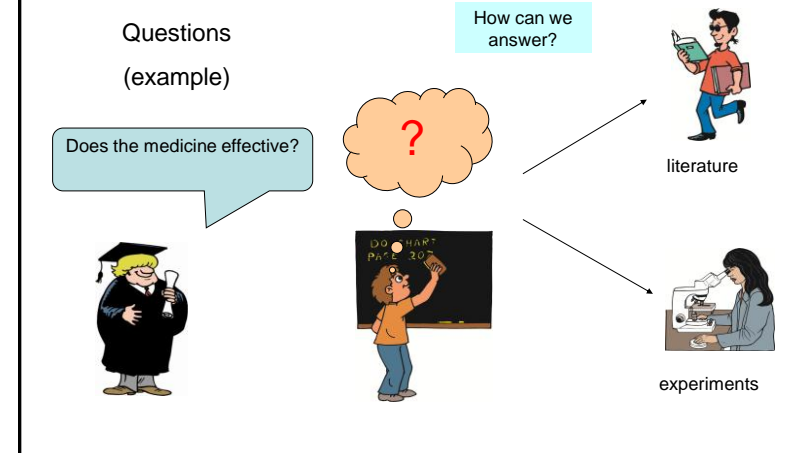


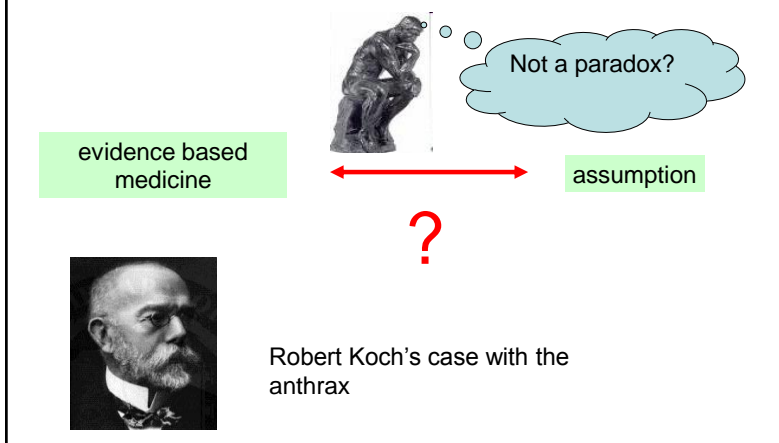
Reference or normal range



Hypothesis test



Hypothesis = assumption



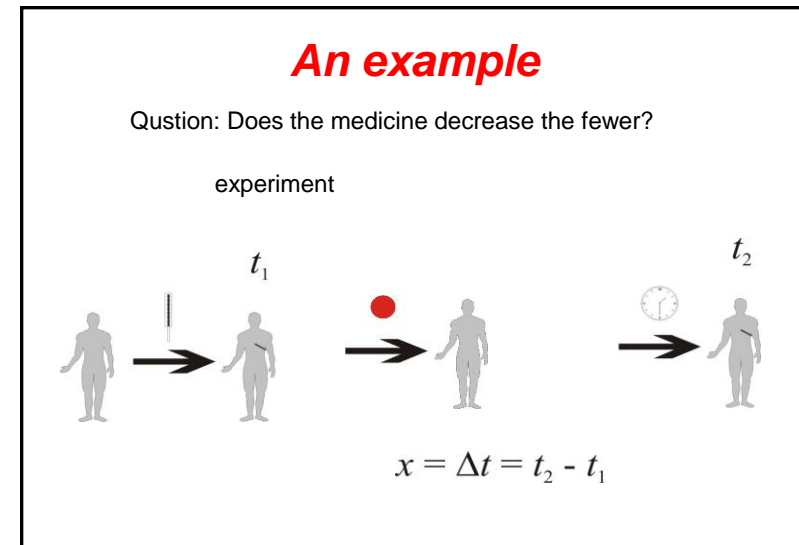
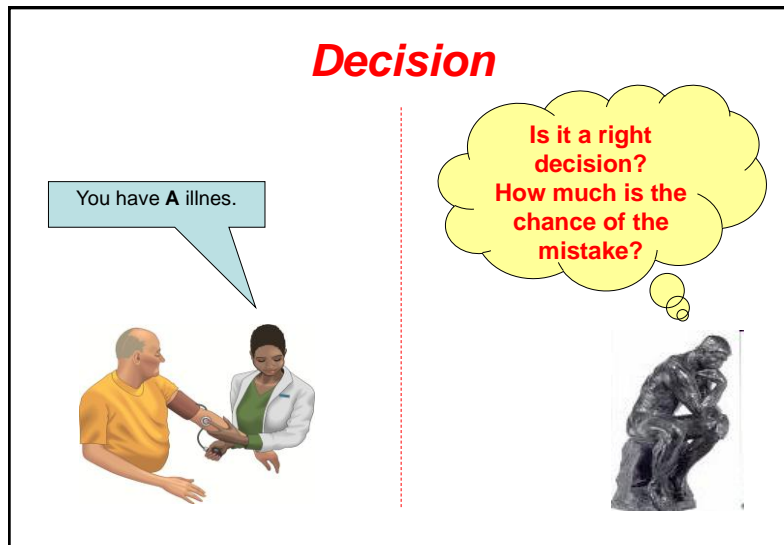
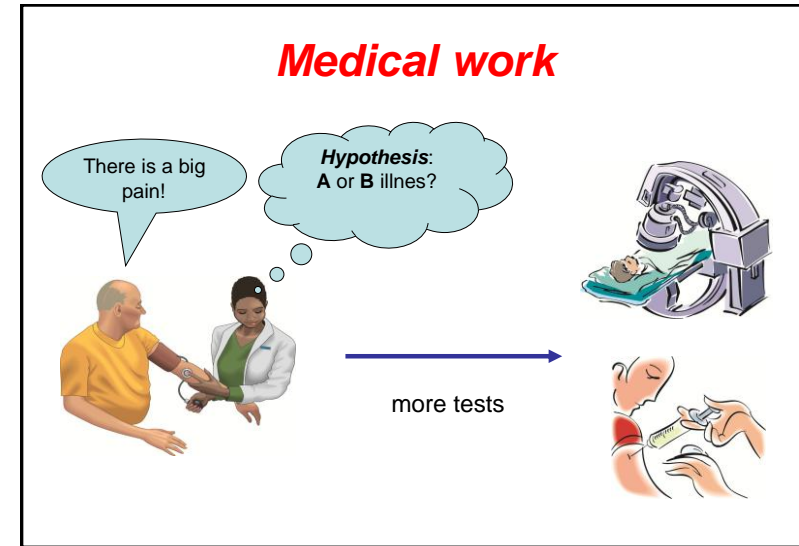
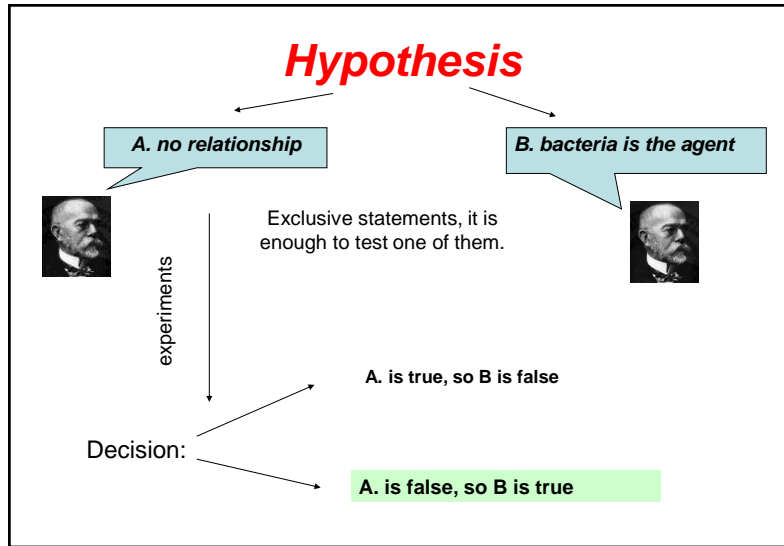
anthrax

bacteria

Facts, data

Robert Koch

Question: Bacteria is the agent or not?



How many trial is necessary?

Outcome: 1. $\Delta t > 0$; 2. $\Delta t = 0$; 3. $\Delta t < 0$.

Is there a right decision?

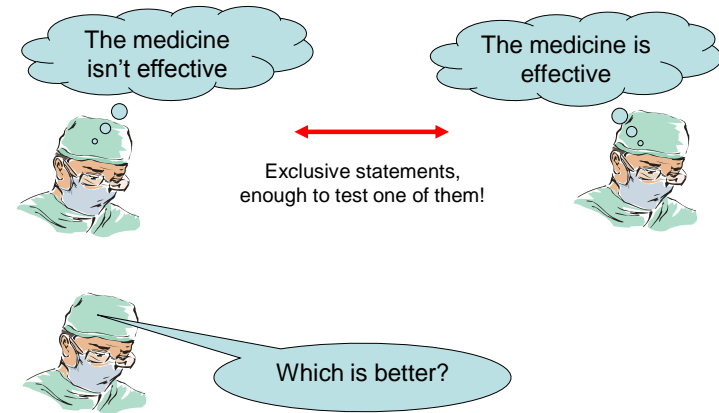
Not only the medicine
influences the body
temperature!



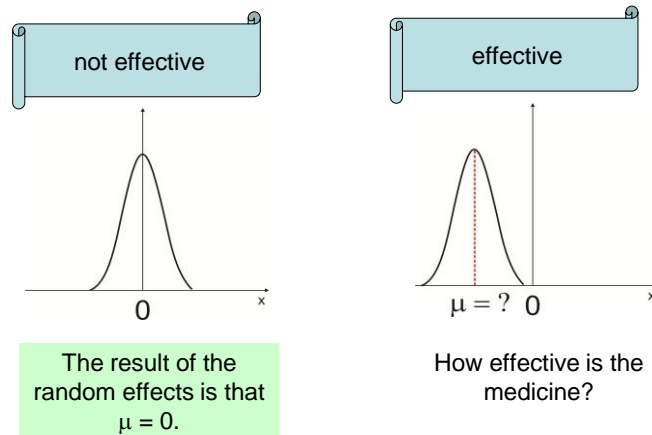
Assumption!

The other effects are
random!

Hypothesises



The distribution of the observed quantity



**If we know the
population!!! (we are able
to calculate μ !)**

result:

$\mu = 0$

$\mu < 0$

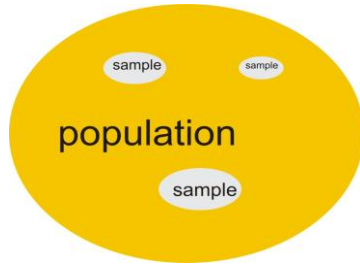
conclusion:

The medicine isn't
effective.

The medicine is effective
and μ characterizes the
effectiveness.

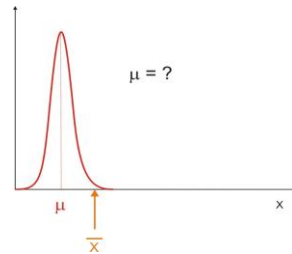
The situation is more difficult

Normally the population is unknown.



The sample differs from the population!

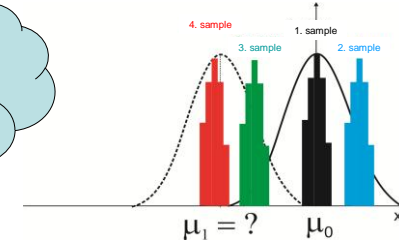
E.g. the averages fluctuate around the μ !



Select hypothesis!



Which is the right population?



Known distribution!

Usual point of origin: **nullhypothesis.**

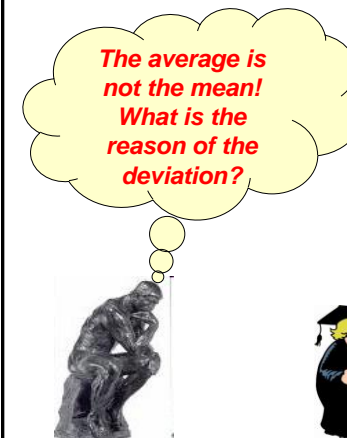
Nullhypothesis: (H_0)

The deviation of the sample or samples from the population or populations is a random deviation due to the sampling error. Frequently it is a negative answer. (e.g.: the medicine is not effective.)



Alternative hypothesis: (H_1)

The deviation of the sample or samples from the population or populations is not a random deviation. (e.g.: the medicine is effective)



The average is not the mean!
What is the reason of the deviation?

Sampling error,
random fluctuation.
(Our hypothesis is right!)



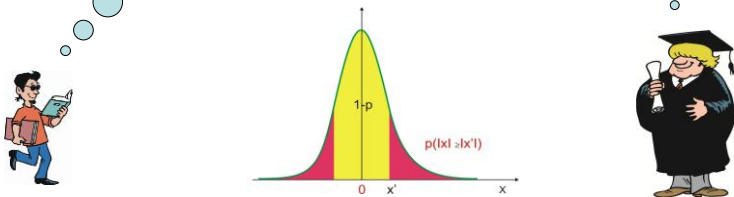
The hypothesis is false (mistake!).
The deviation is non-random.



What is the base of the decision?

How much is the chance to derive from the given population?

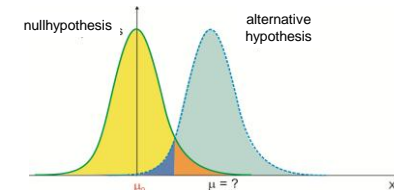
We must know the parameters of the distribution!



Decision

What is the base of decision?

We must have variables in which case we know the parameters!

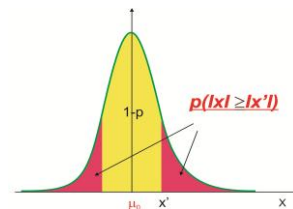


Nullhypothesis

How probable is the random deviation?

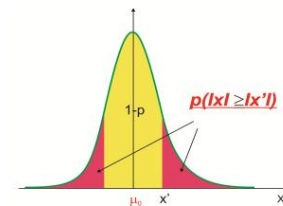
In the case of known distribution we are able to determine!

(The shape of the distribution not always gaussian, but it is known!)



Significant?

If the p is enough large, may be random, if the p is enough small we say that the difference is significant!



p is the probability to be random deviation!



Significance level

Enough large,
enough small?

Select a limit!
This is the significance
level.



Symbol: α .
In medical practice this value
is frequently 5%.



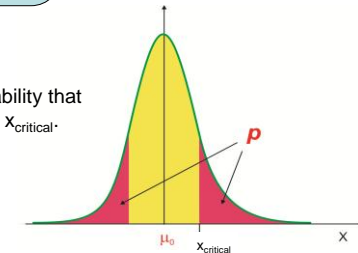
The base of the decision

If the p is enough small, there is a
big chance, that the nullhypothesis
is not true. So the alternative
hypothesis is more probable.

x_{critical} : the value
belonging to the
significance level

$x_{\text{calculated}}$: the value
calculated from the
sample

p is the probability that
 $|x_{\text{calculated}}| \geq x_{\text{critical}}$

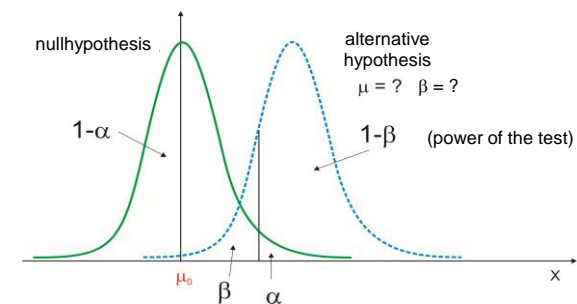


Decision

- 1. If the probability of the random deviation is small ($p(|x| \geq |x_{\text{crit}}|) \leq \alpha$) – we **reject** the nullhypothesis.
- 2. If the probability of the random deviation is large ($p(|x| \geq |x_{\text{crit}}|) > \alpha$) – we **accept** the nullhypothesis.

The answer is newer yes – no or true - false!!!

Quantities which characterise the decision



α : **significance level**. (The probability that we reject the
nullhypothesis when it is true.)

β : the probability that we accept the nullhypothesis when it is false.

The possibility of the error

		decision: the nullhypothesis is	
		accepted	rejected
reality: the nullhypothesis	true	Right decision	I. Type error (α)
	false	II. Type error (β)	Right decision

Hypothesis test

