R basics

Assignments, numbers, vectors

```
> x <- 5
> x
[1] 5
```

Assign number 5 to variable x

```
> 5*x^2+7
[1] 132
```

Calculate $5*x^2+7$

```
> y <- c(1, 2, 3, 4, 5)
> y
[1] 1 2 3 4 5
```

Create vector, assign to variable y

```
> x*y
[1]  5 10 15 20 25
```

Multiply each element in y with the number in x

Strings

A string contains text:

```
> name <- "Claus Wilke"
> name
[1] "Claus Wilke"
```

A vector of strings:

```
> animals <- c("cat", "mouse", "mouse",
"cat", "rabbit")
> animals
[1] "cat"    "mouse"  "mouse"  "cat"
"rabbit"
```

Factors

Factors keep track of distinct categories (levels) in a vector:

```
> animals
[1] "cat"    "mouse"  "mouse"  "cat"
"rabbit"

> factor(animals)
[1] cat    mouse  mouse  cat    rabbit
Levels: cat mouse rabbit
```

Data frames

We use data frames to store data sets with multiple variables:

```
> pets <- data.frame(
    family = c(1, 2, 3, 4, 5),
    pet = animals
  )

> pets
  family     pet
1      1     cat
2      2   mouse
3      3   mouse
4      4     cat
```

Data frames

We access individual columns in a data frame with $ + the column name:

```
> pets$family
[1] 1 2 3 4 5


> pets$pet
[1] cat    mouse  mouse  cat    rabbit
Levels: cat mouse rabbit
```

Data frames

R has many built-in data frames:

```
> cars
   speed dist
1      4    2
2      4   10
3      7    4
4      7   22
5      8   16
6      9   10
7     10   18
8     10   26
9     10   34
```

Data frames

The `head()` function shows the first few lines of a data frame:

```
> head(cars)
  speed dist
1     4    2
2     4   10
3     7    4
4     7   22
5     8   16
6     9   10
>
```

Hypothesis testing: a quick review

H_o and H_A: Null and alternative hypothesis

H_0: Null hypothesis, assumption that the data show no signal, that nothing has happened.

H_A: Alternative hypothesis, opposite of H_0, assumption that something has happened.

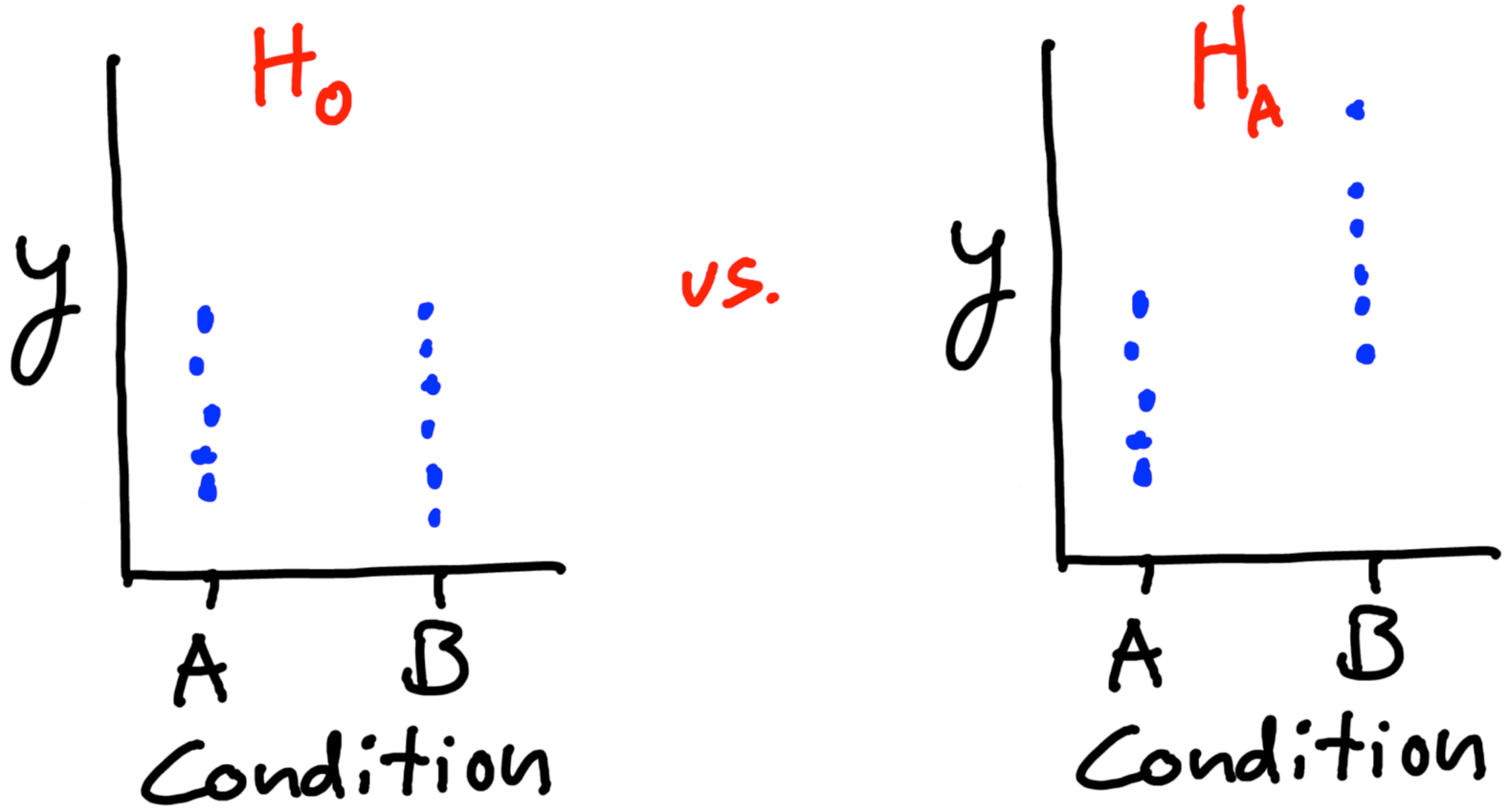
The *P* value tells us how unexpected the data are

P value: Probability to observe the given data under the assumption that H_0 is true

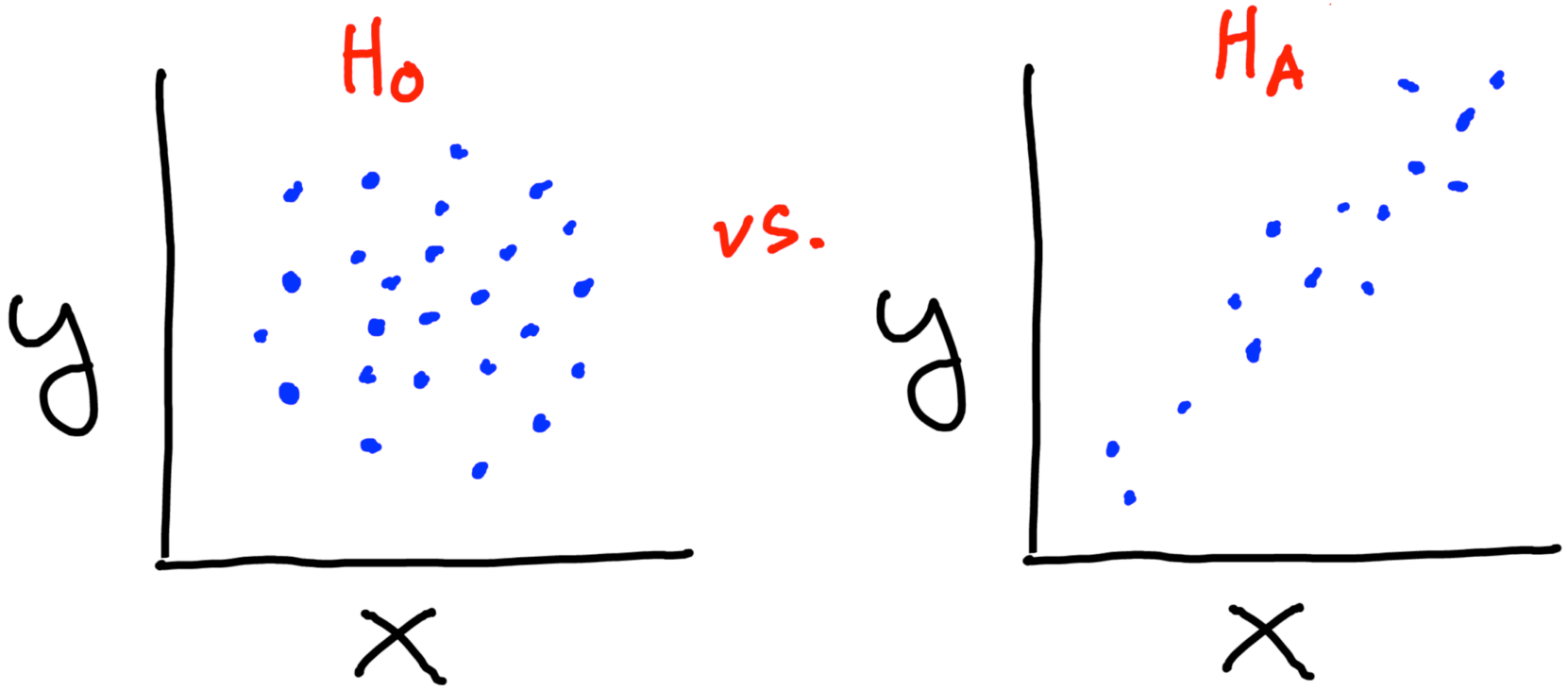
We generally reject H_0 if $P < 0.05$

We **never** accept H_A

t test: Do two groups of numerical measurements have the same mean?



Correlation: Do two numerical variables have a relationship with each other?



Multivariate regression: Which predictors have an effect on the response variable?

Example: