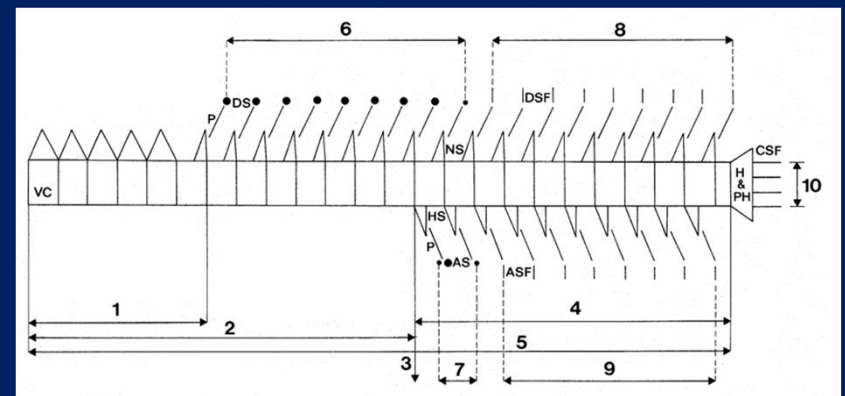
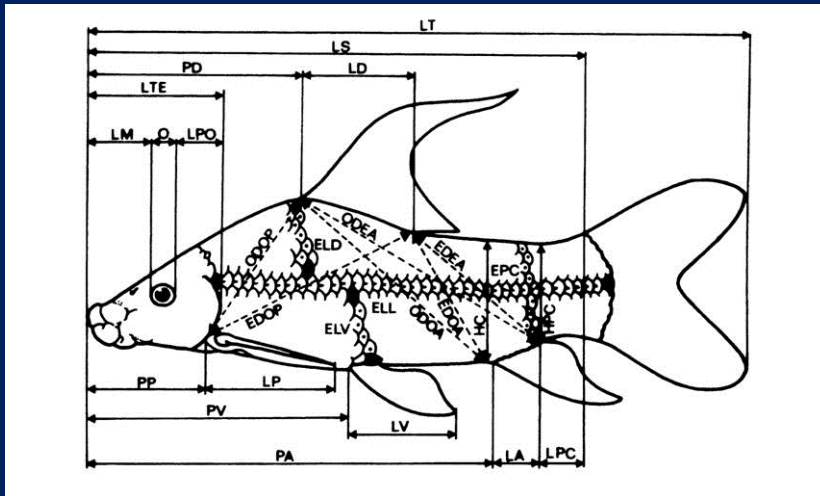
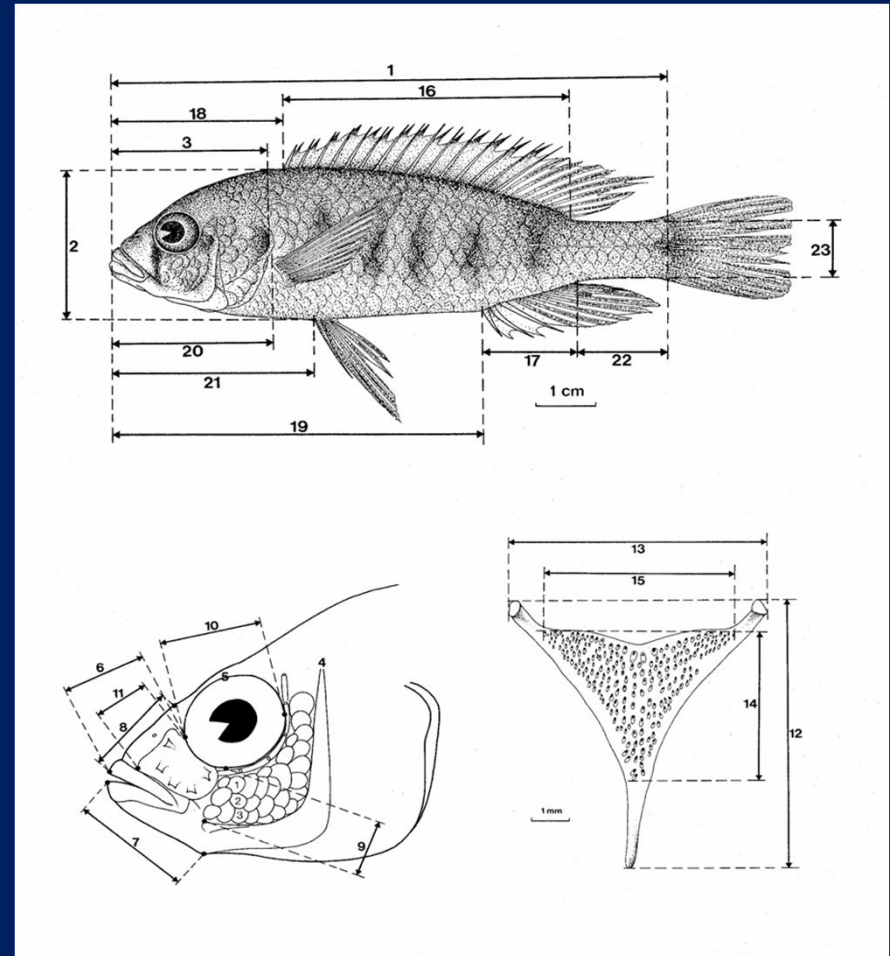


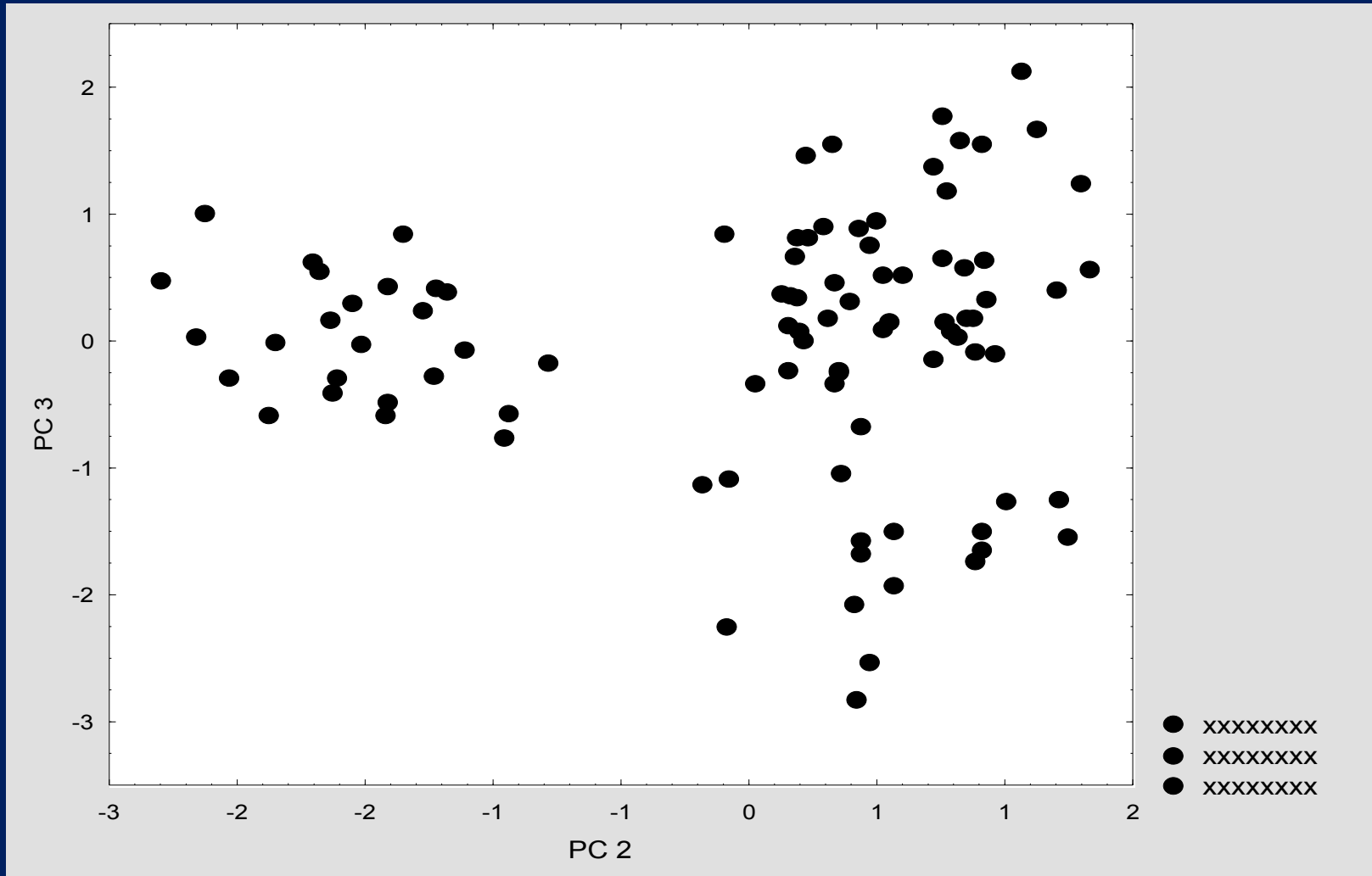
# How ?

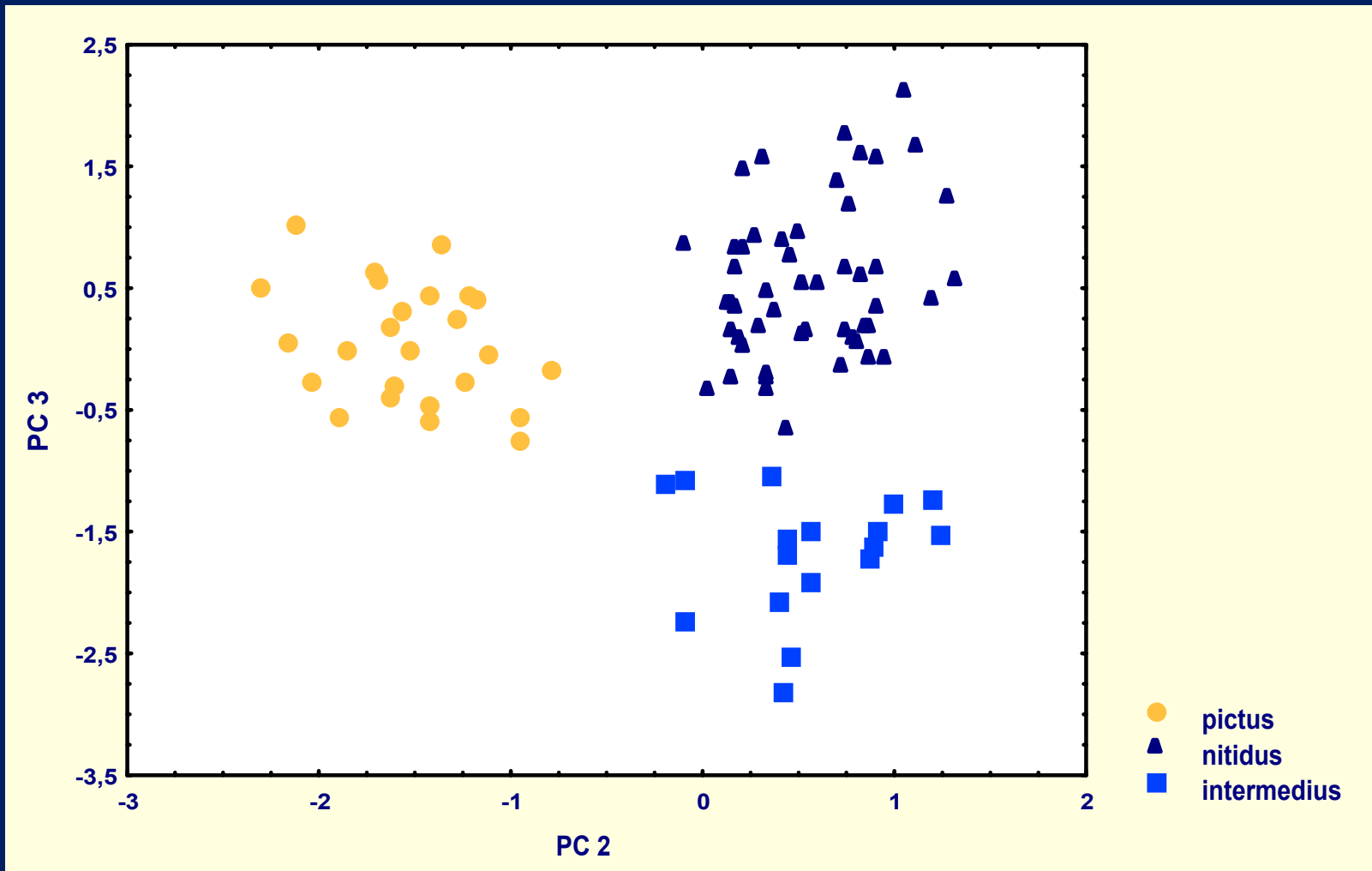
## morphometrics

- measurements, counts, qualitative observations
- univariate and multivariate data analyses



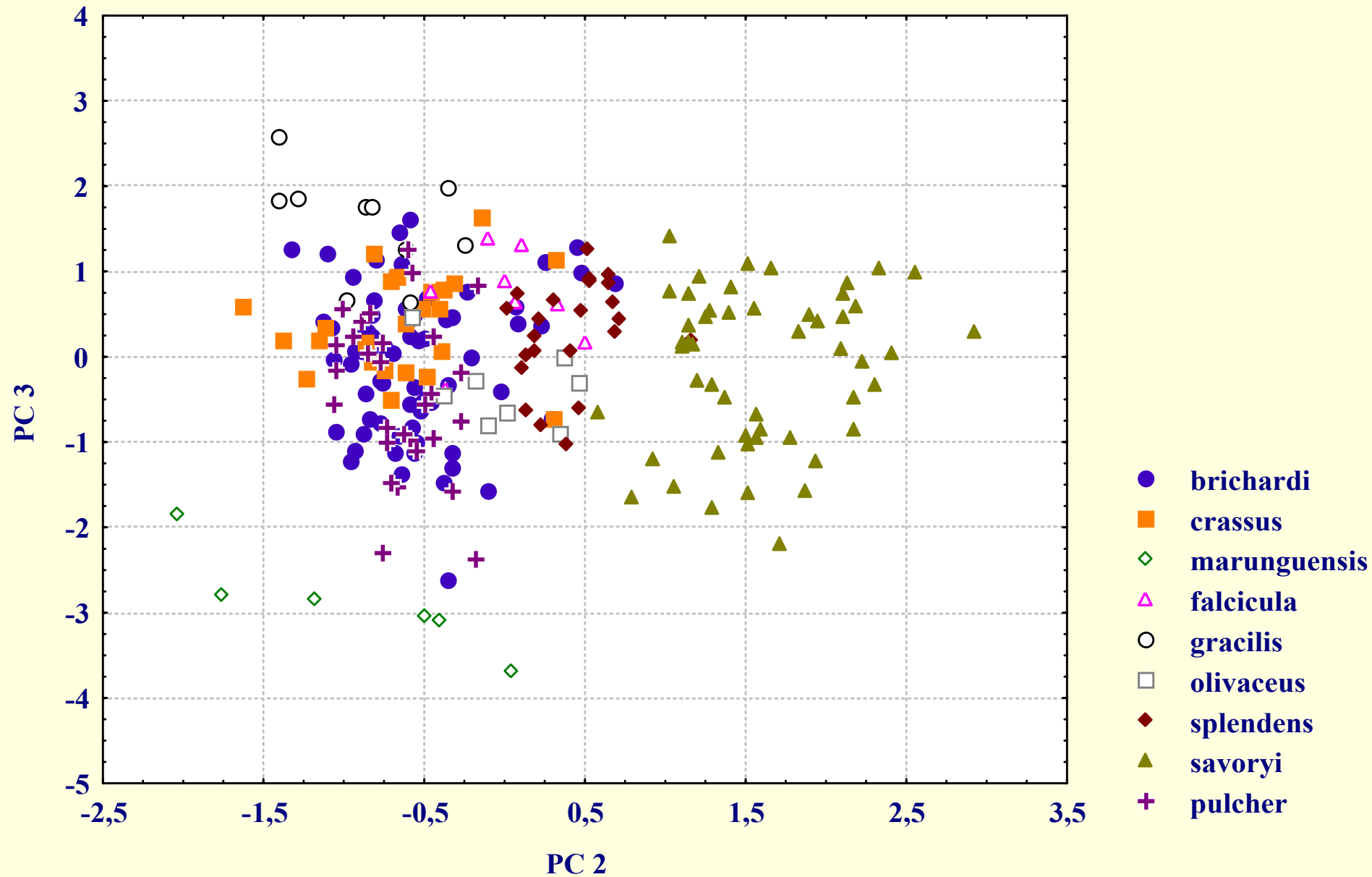
# A taxonomist's wet dream



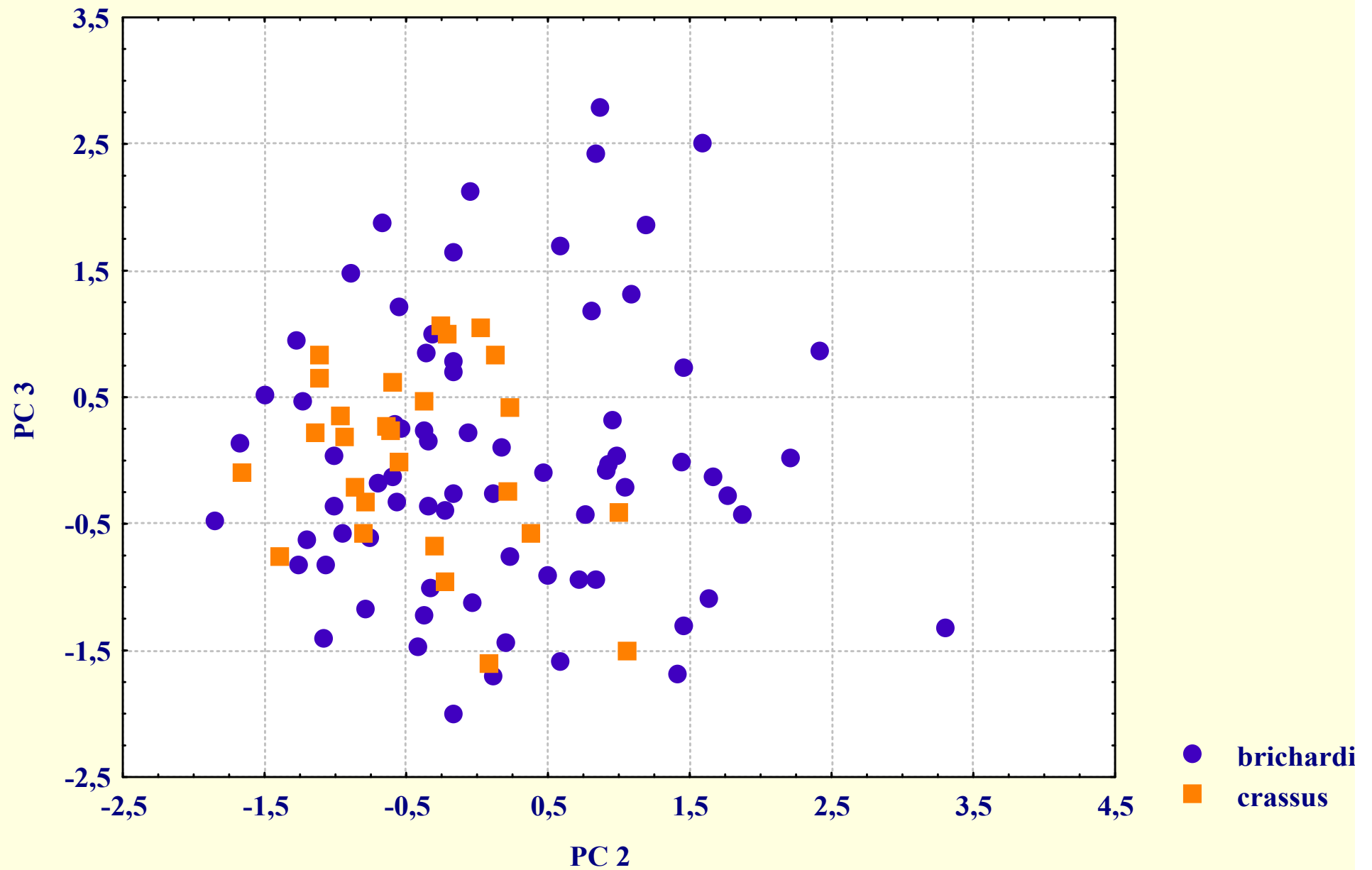


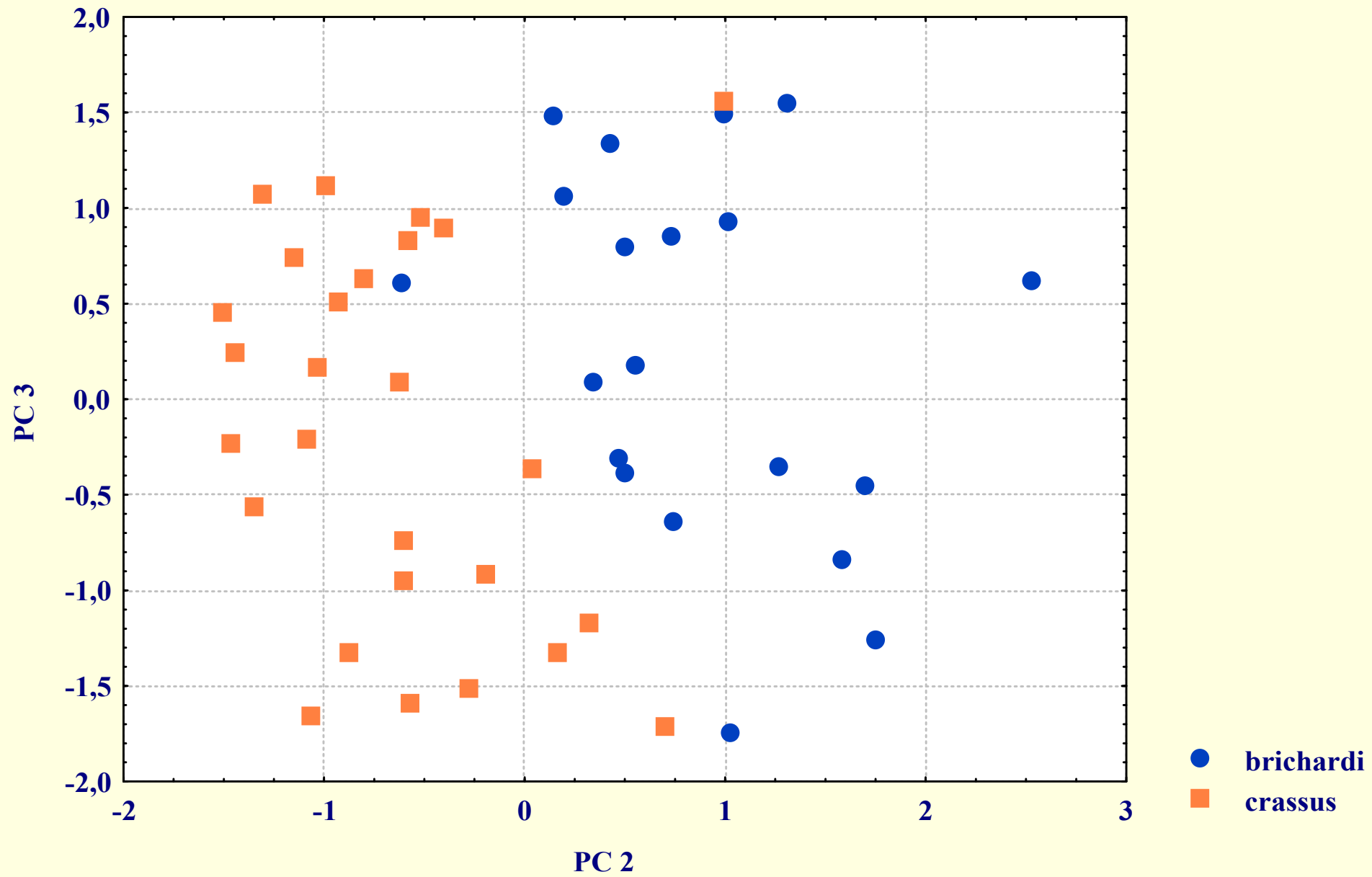






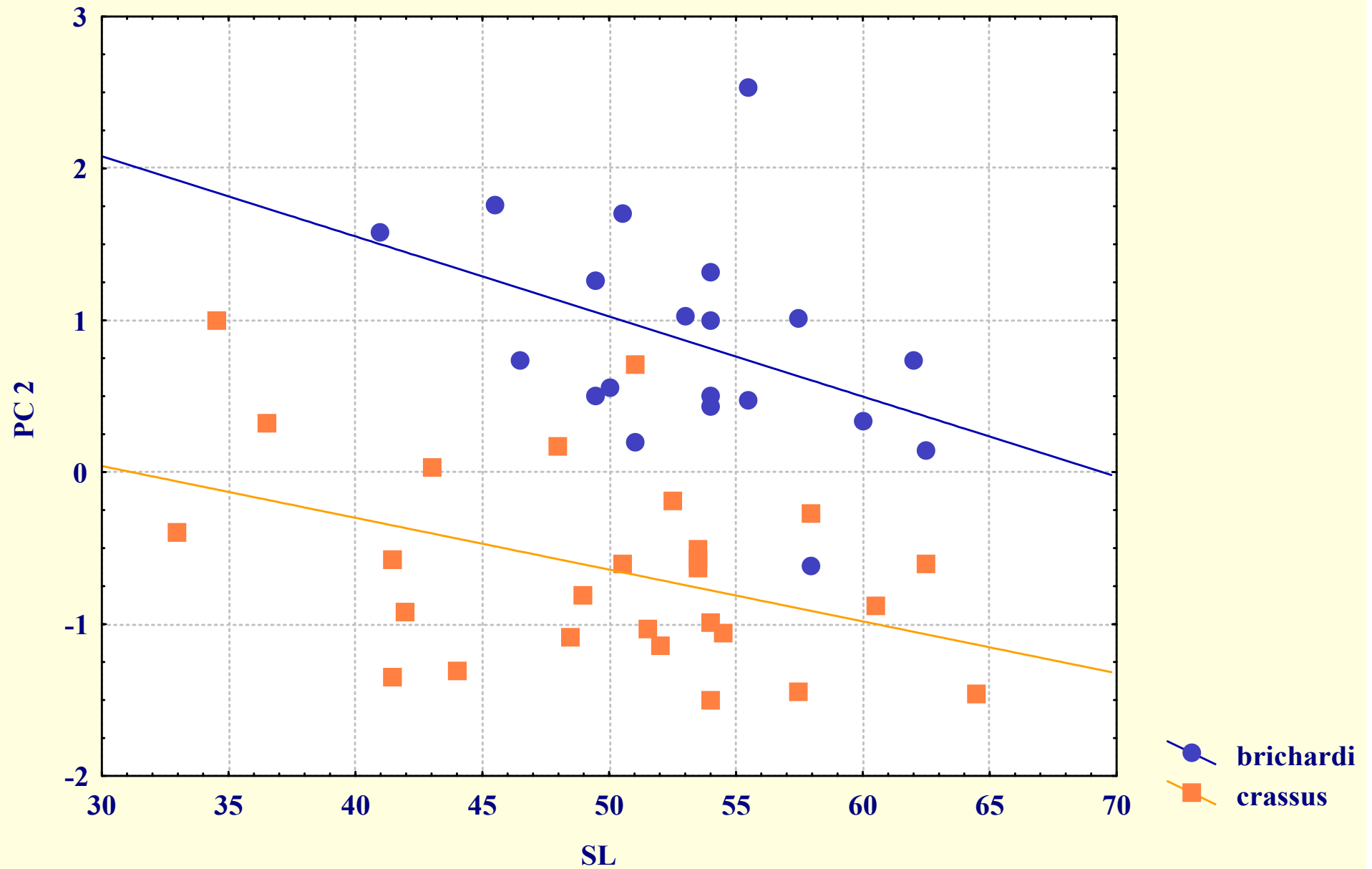
# The much underestimated art of interpretation



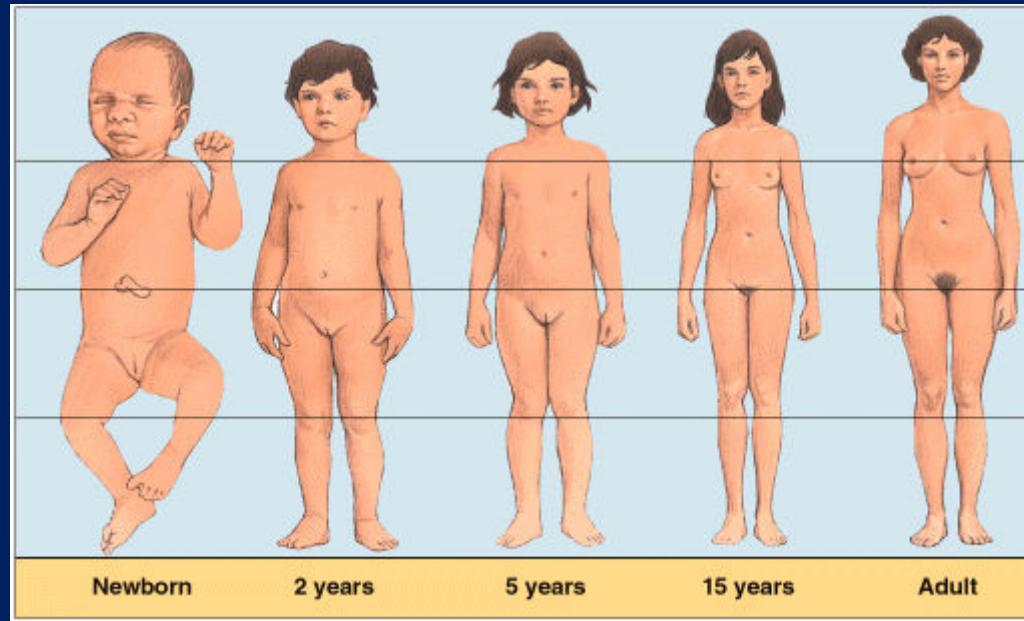




# Allometry is often neglected



# Allometry



Differential growth of one structure compared to another (usually length); covariation of different morphological elements

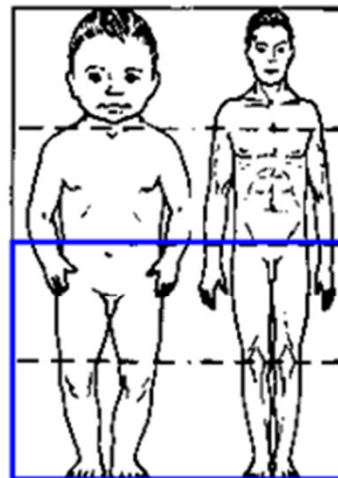
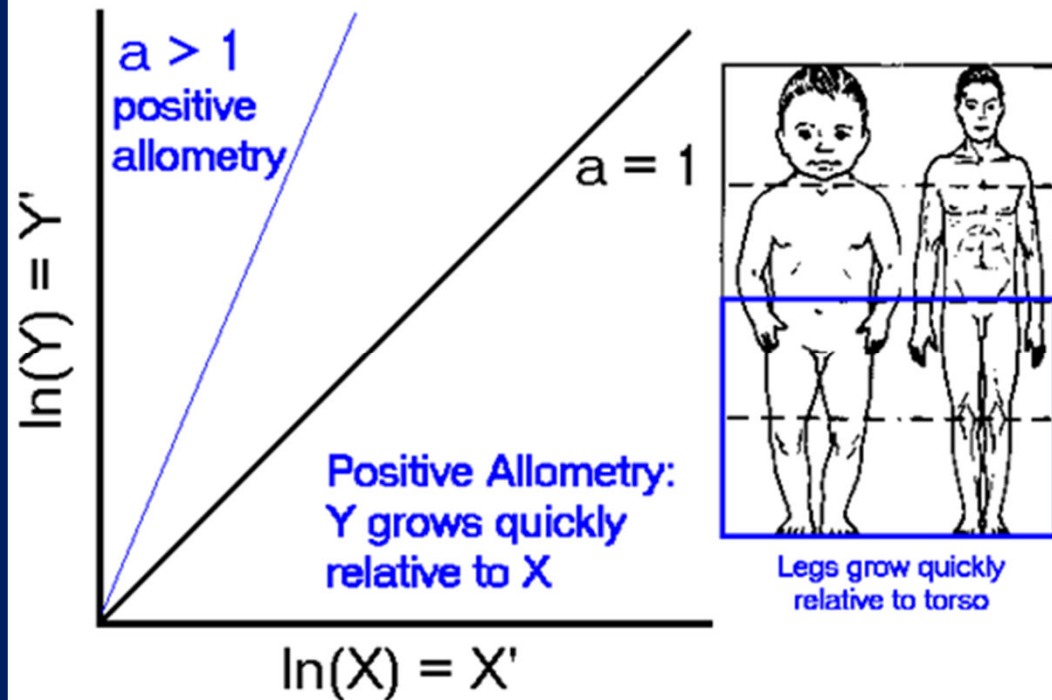
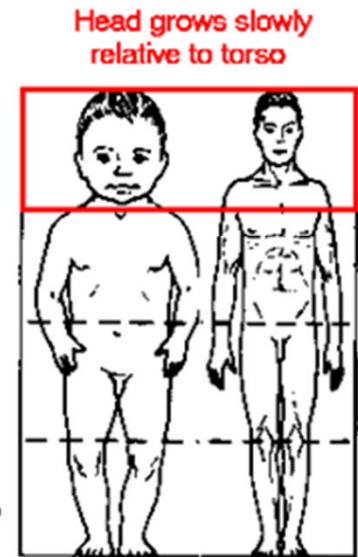
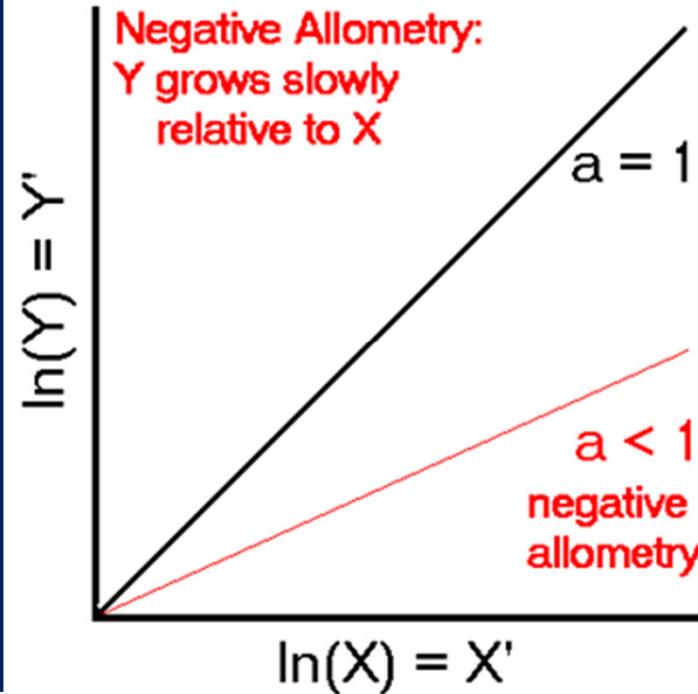
# Allometry

$$y = bx^a$$

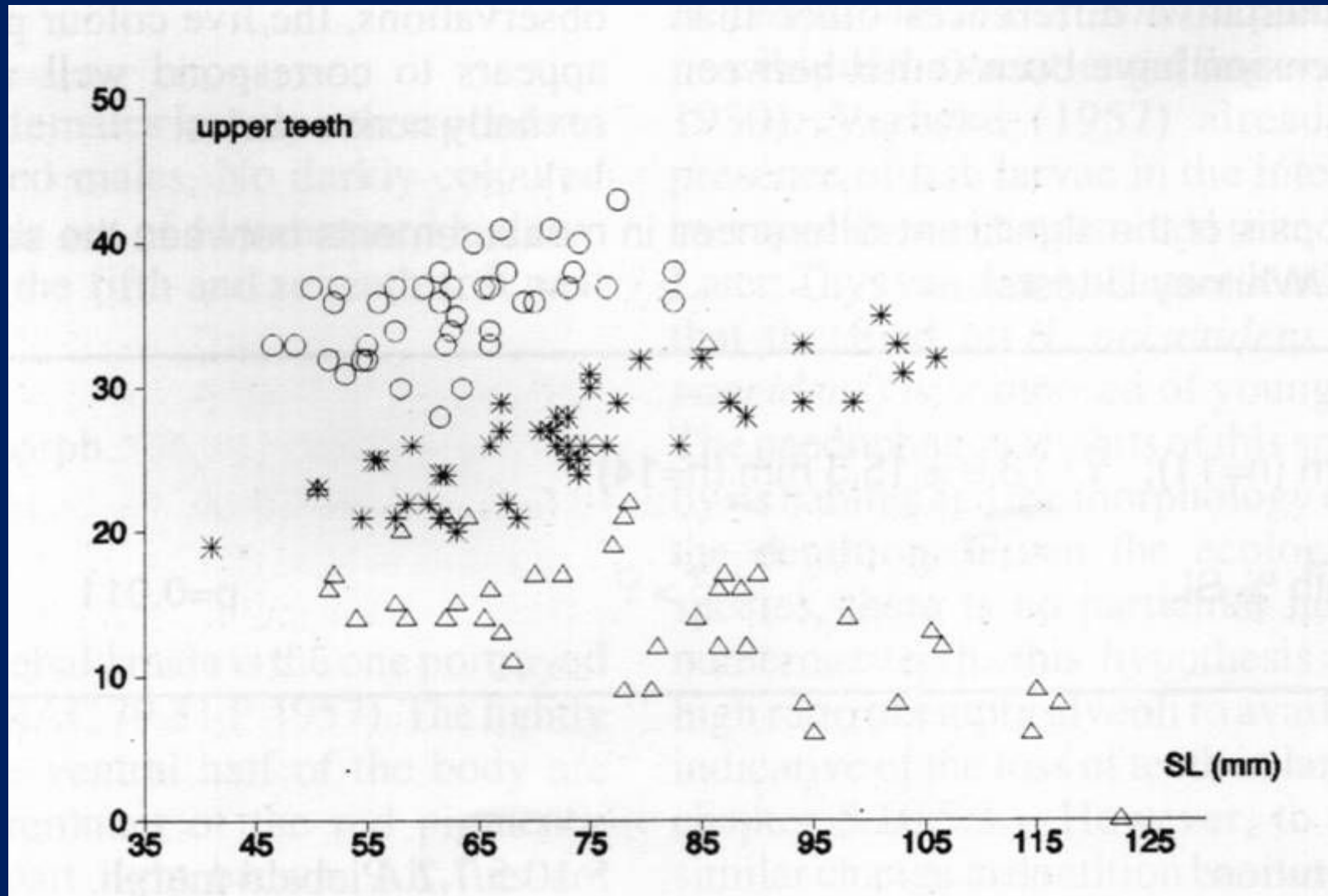
$$\log y = \log b + a \log x$$

$\log b = \text{intercept}$

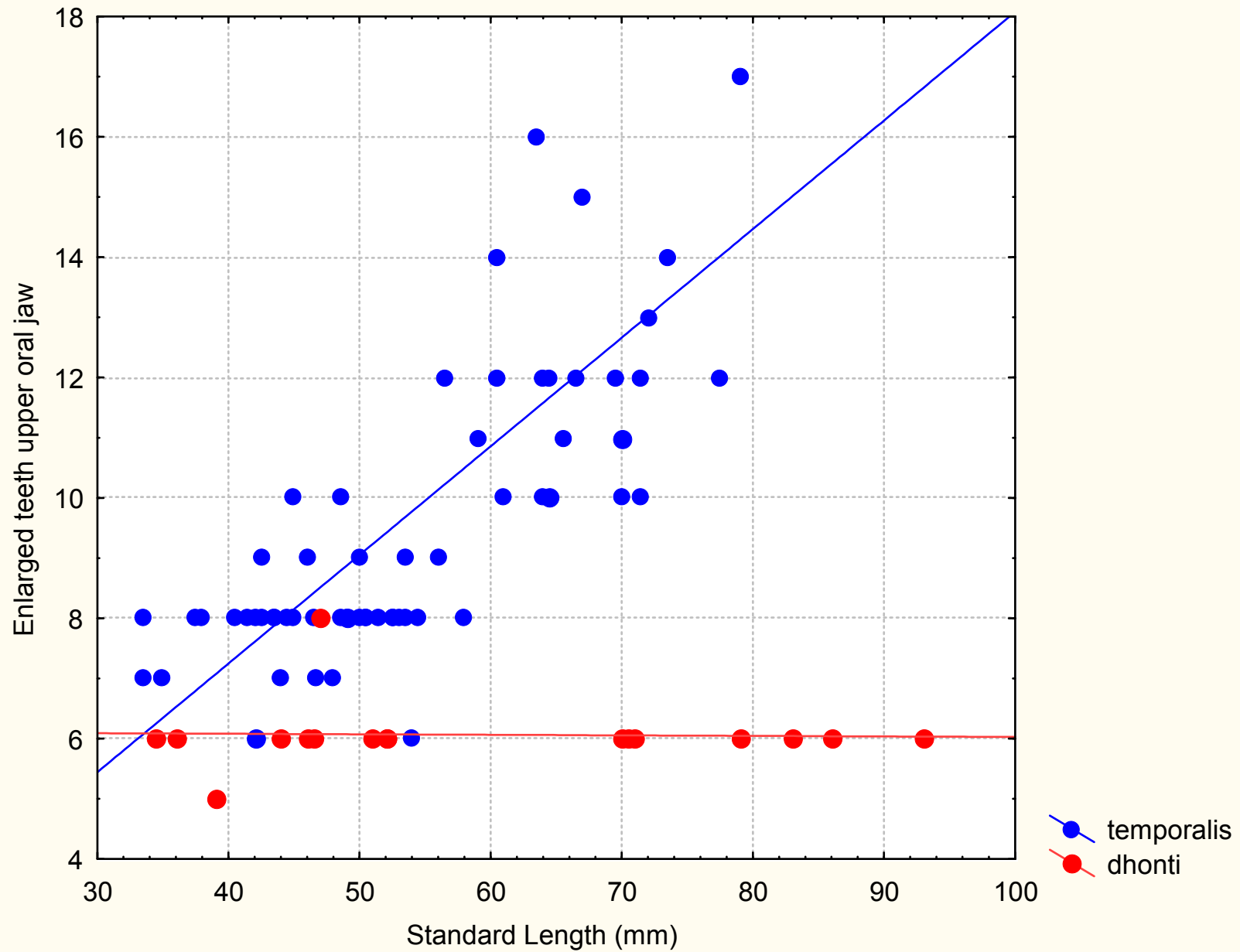
$a = \text{constant, determines slope}$



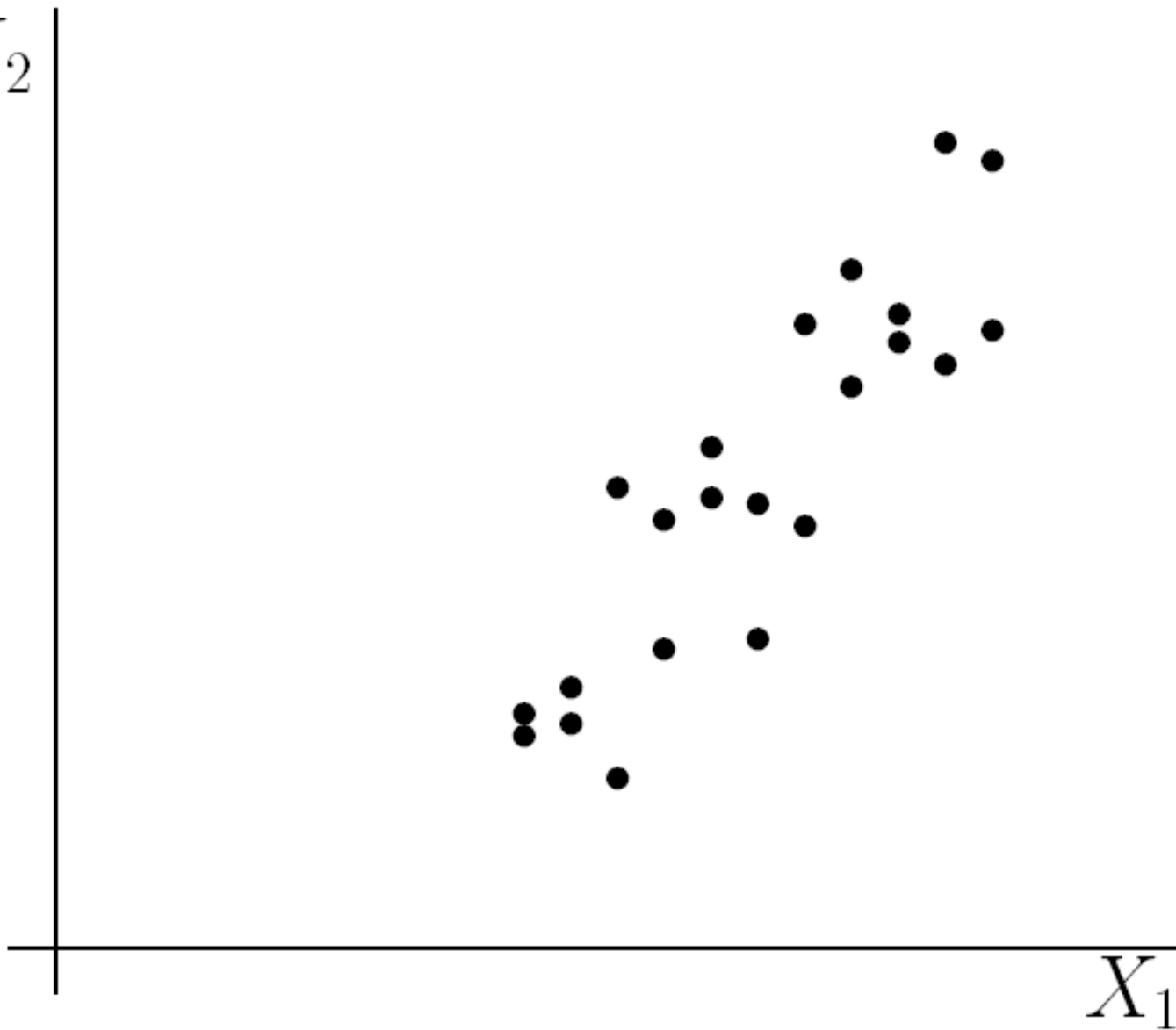
## Size is important



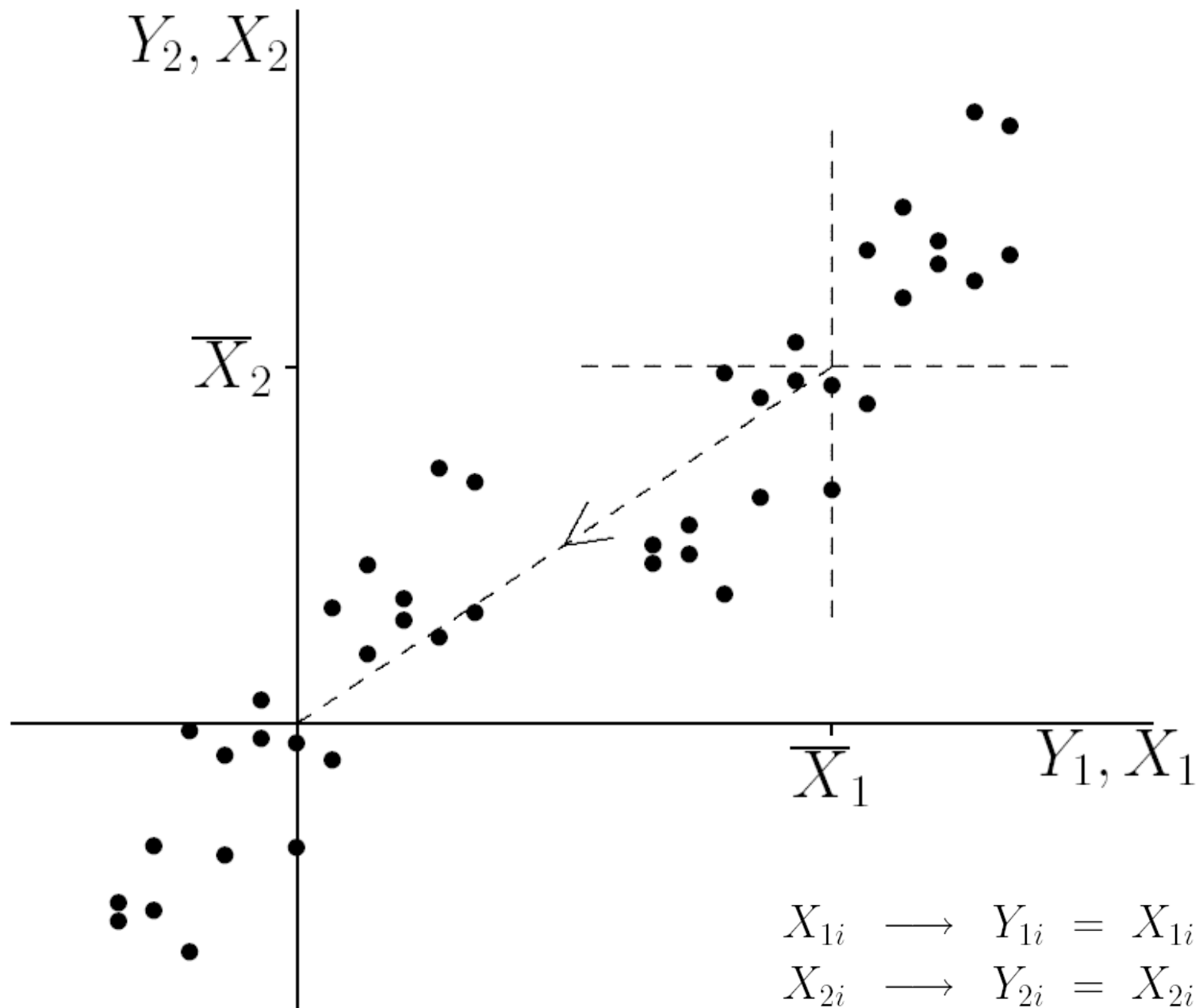
# Size is important



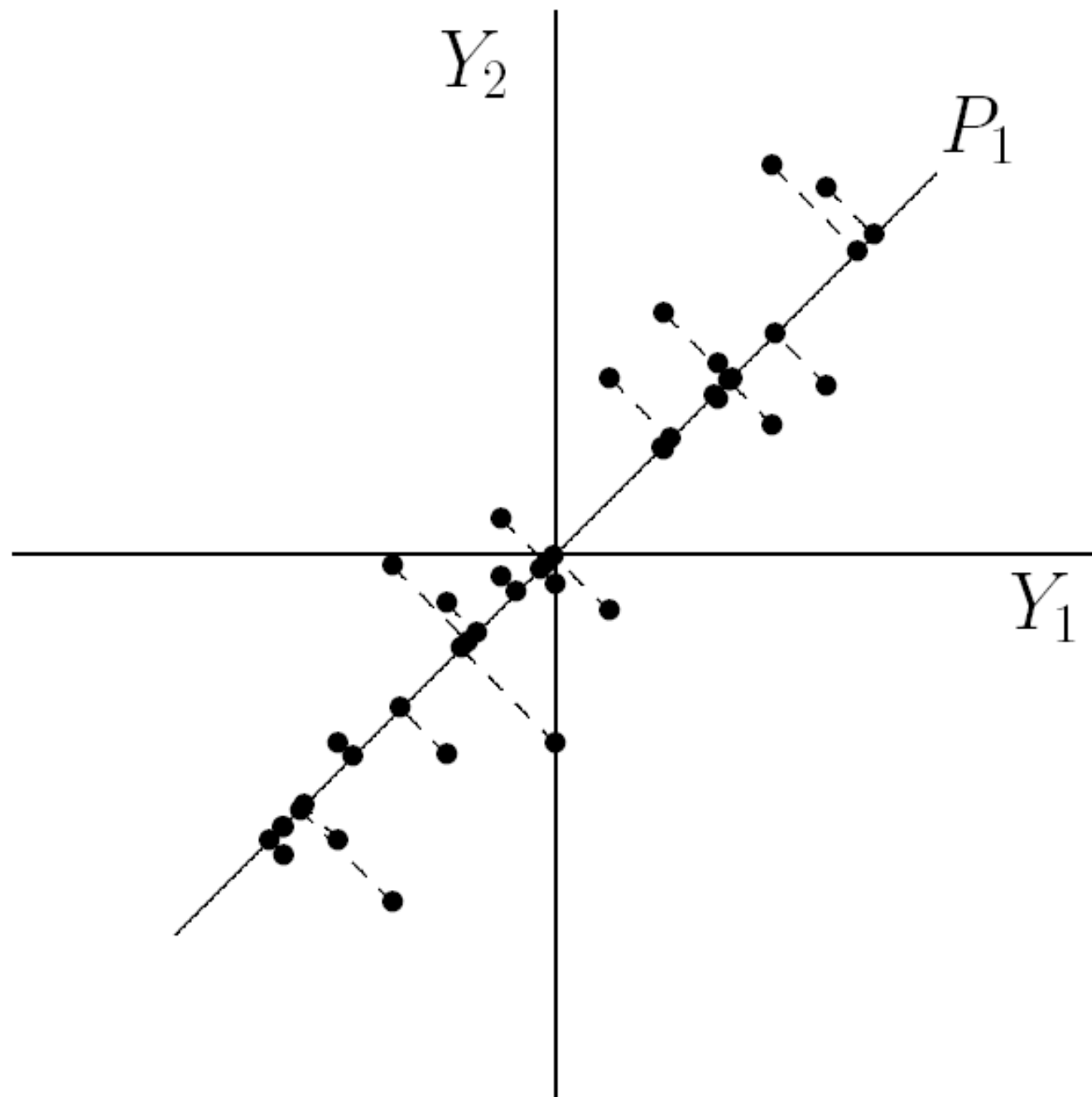
$X_2$



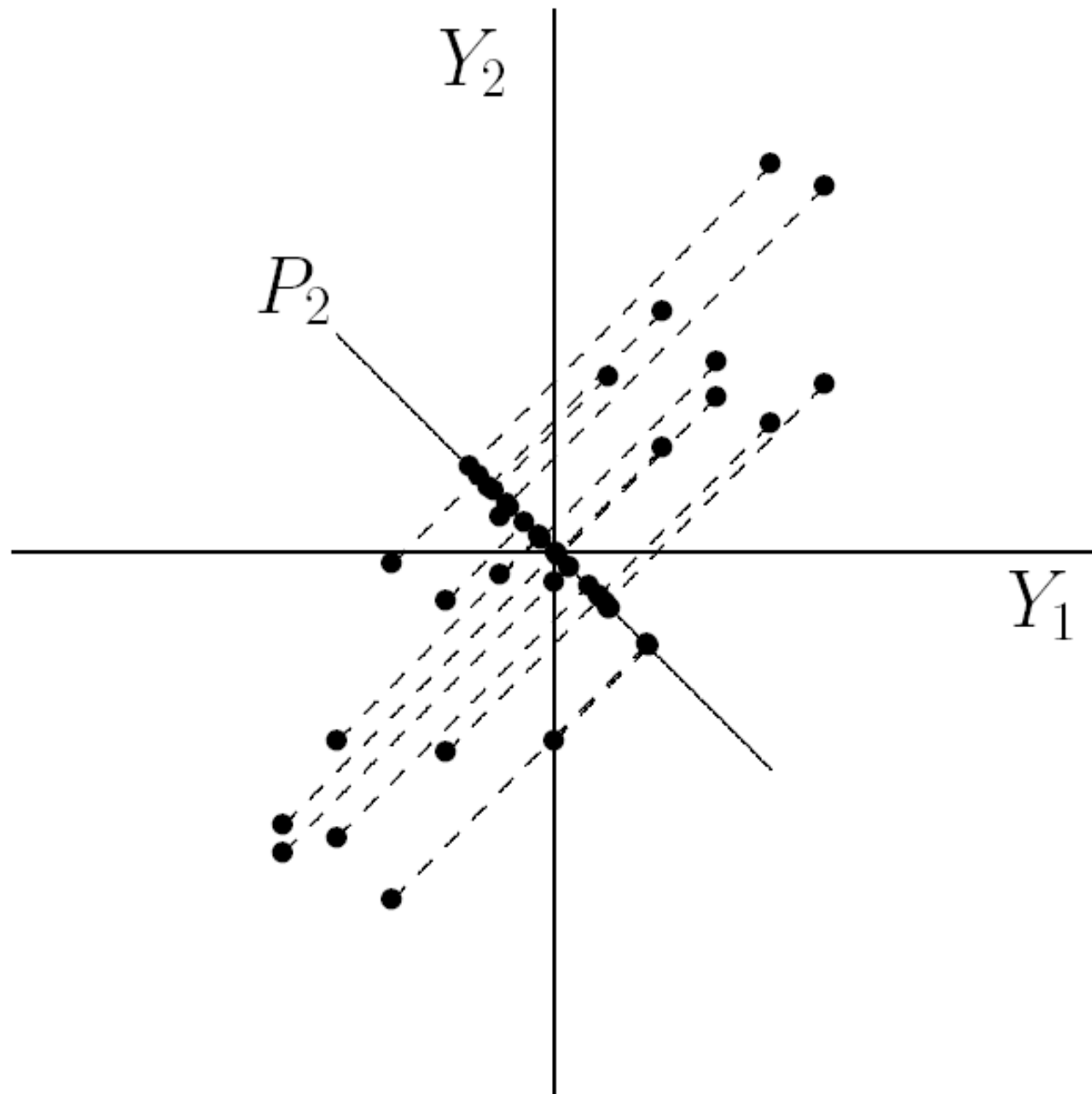
$X_1$

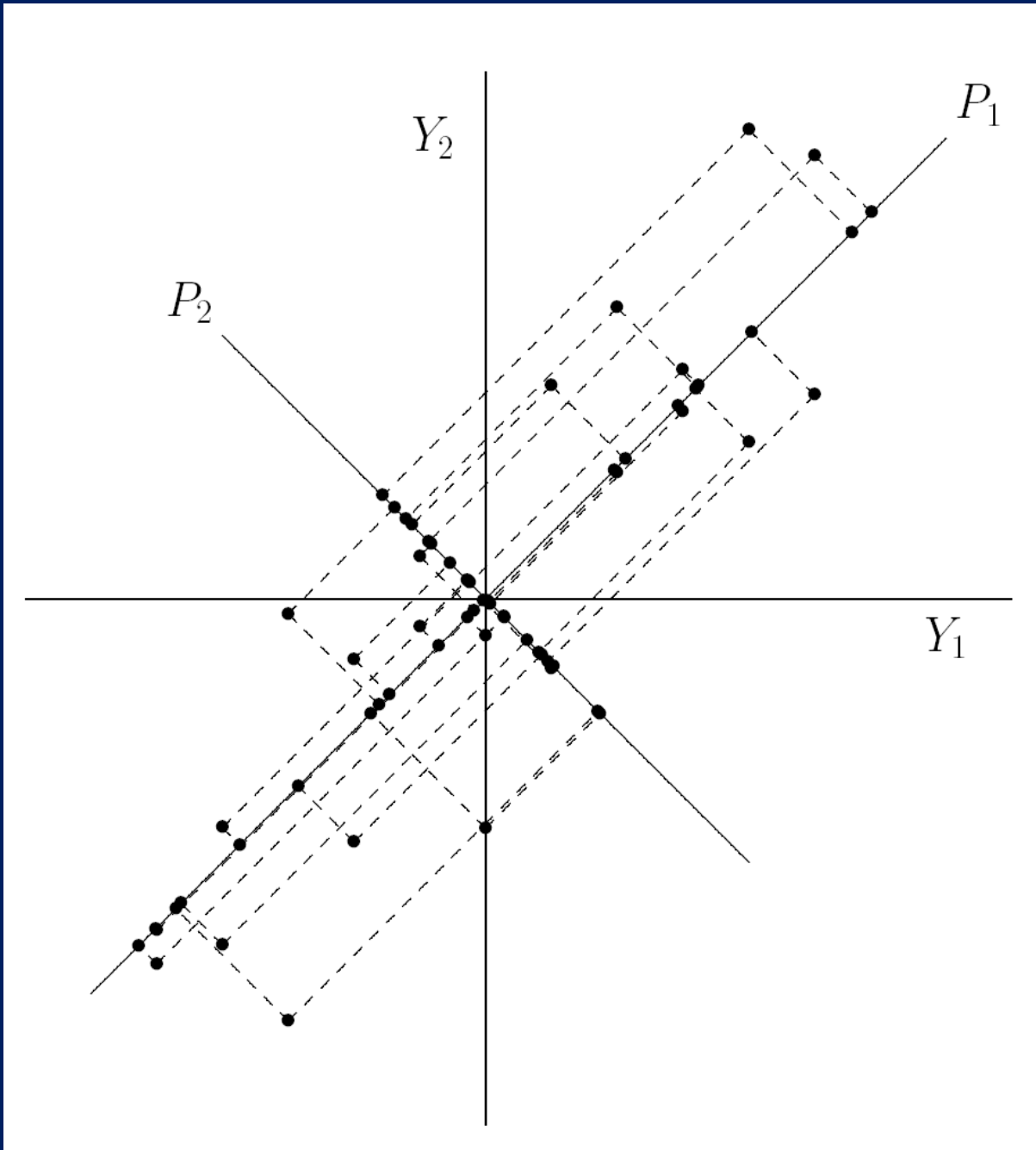


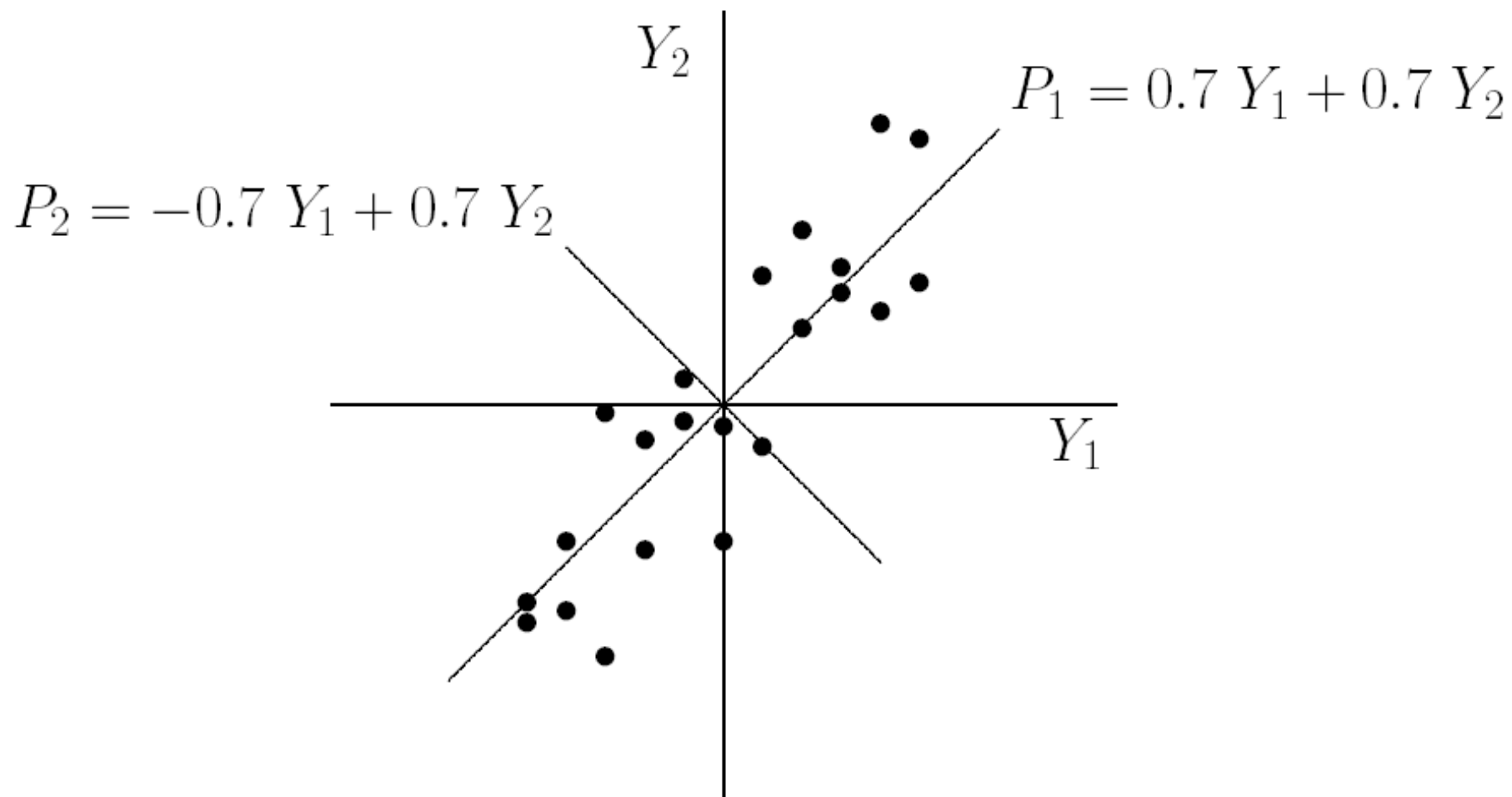
$$\begin{aligned}
 X_{1i} &\longrightarrow Y_{1i} = X_{1i} - \bar{X}_1 \\
 X_{2i} &\longrightarrow Y_{2i} = X_{2i} - \bar{X}_2
 \end{aligned}$$





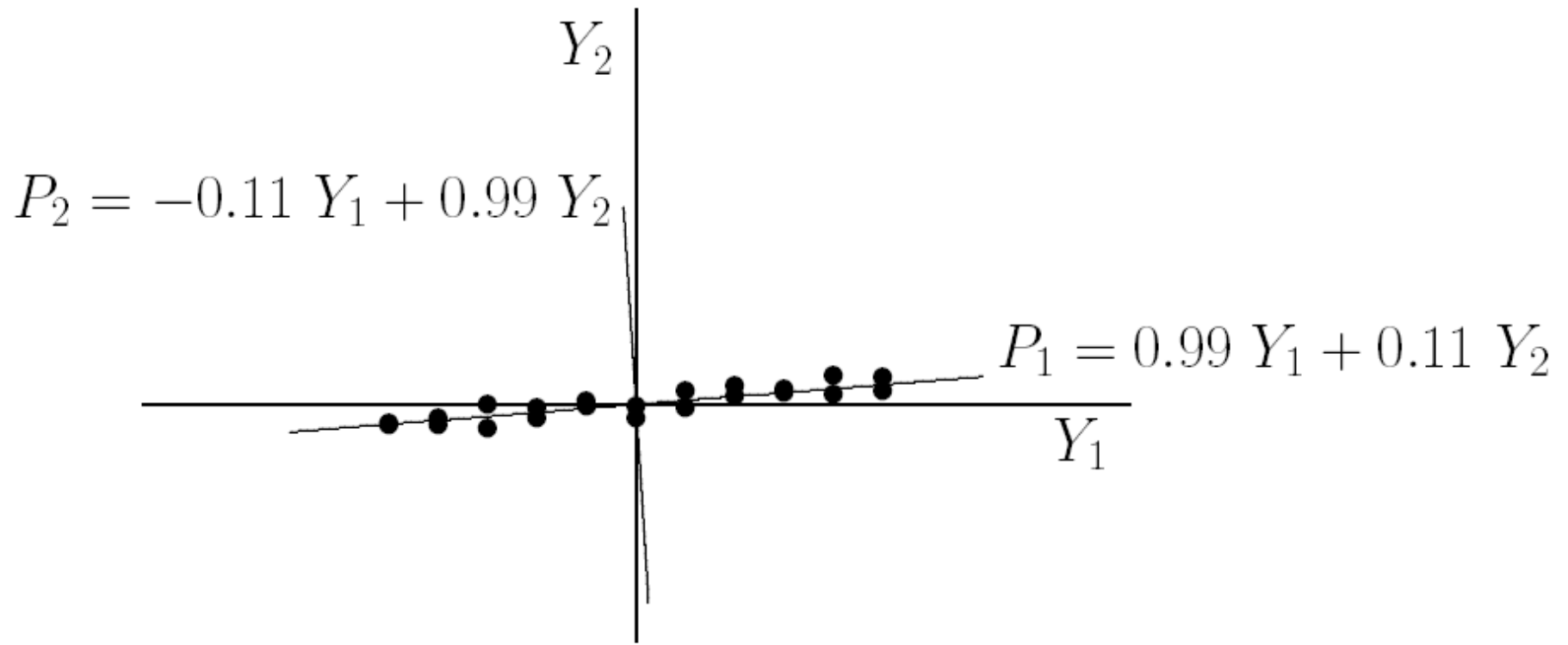


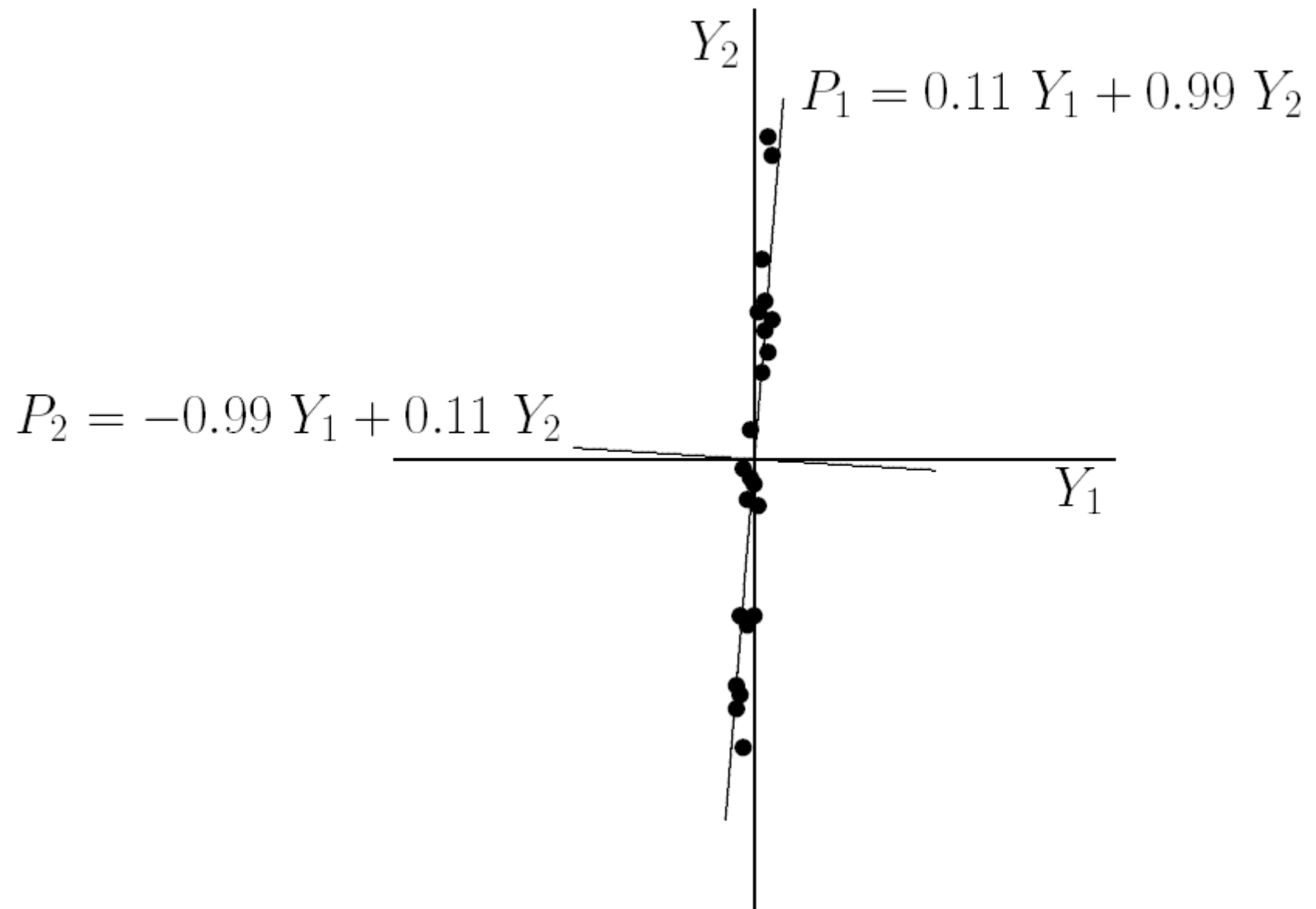




$$P_1 = a_1 Y_1 + a_2 Y_2$$

$$P_2 = b_1 Y_1 + b_2 Y_2$$





30,5

31,7

34,2

30,9

32,0

33,3

33,5

32,9

30,9

33,7

32,1

32,4

32,8

36,2