Quantifying the male gain curve

How much pollen is enough?

Monty-Python Principle

Every sperm is sacred

Every sperm is good

Every sperm is needed

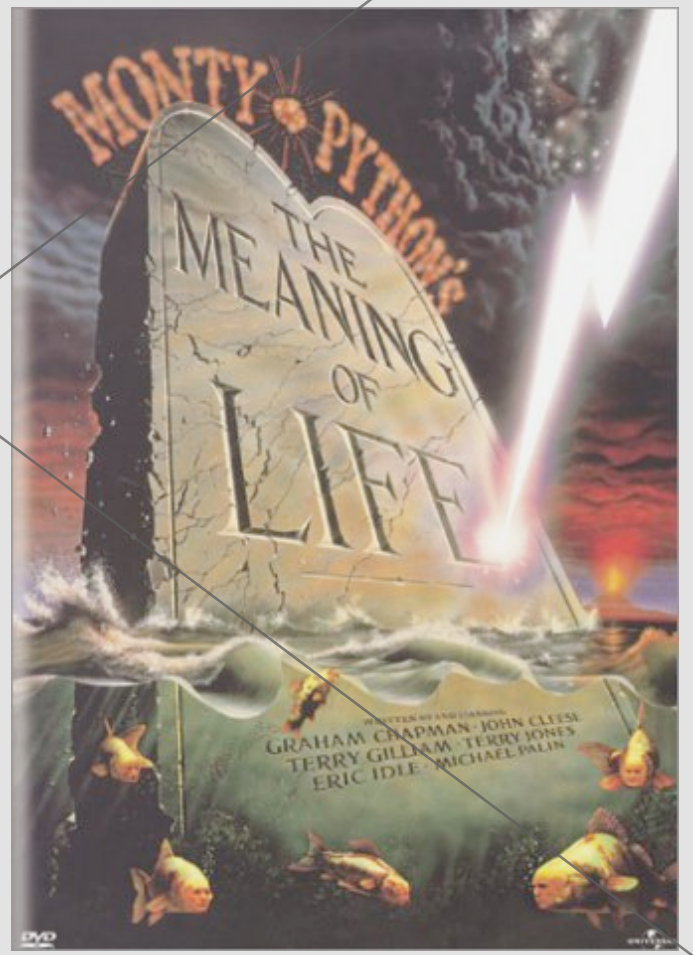
In your neighbourhood

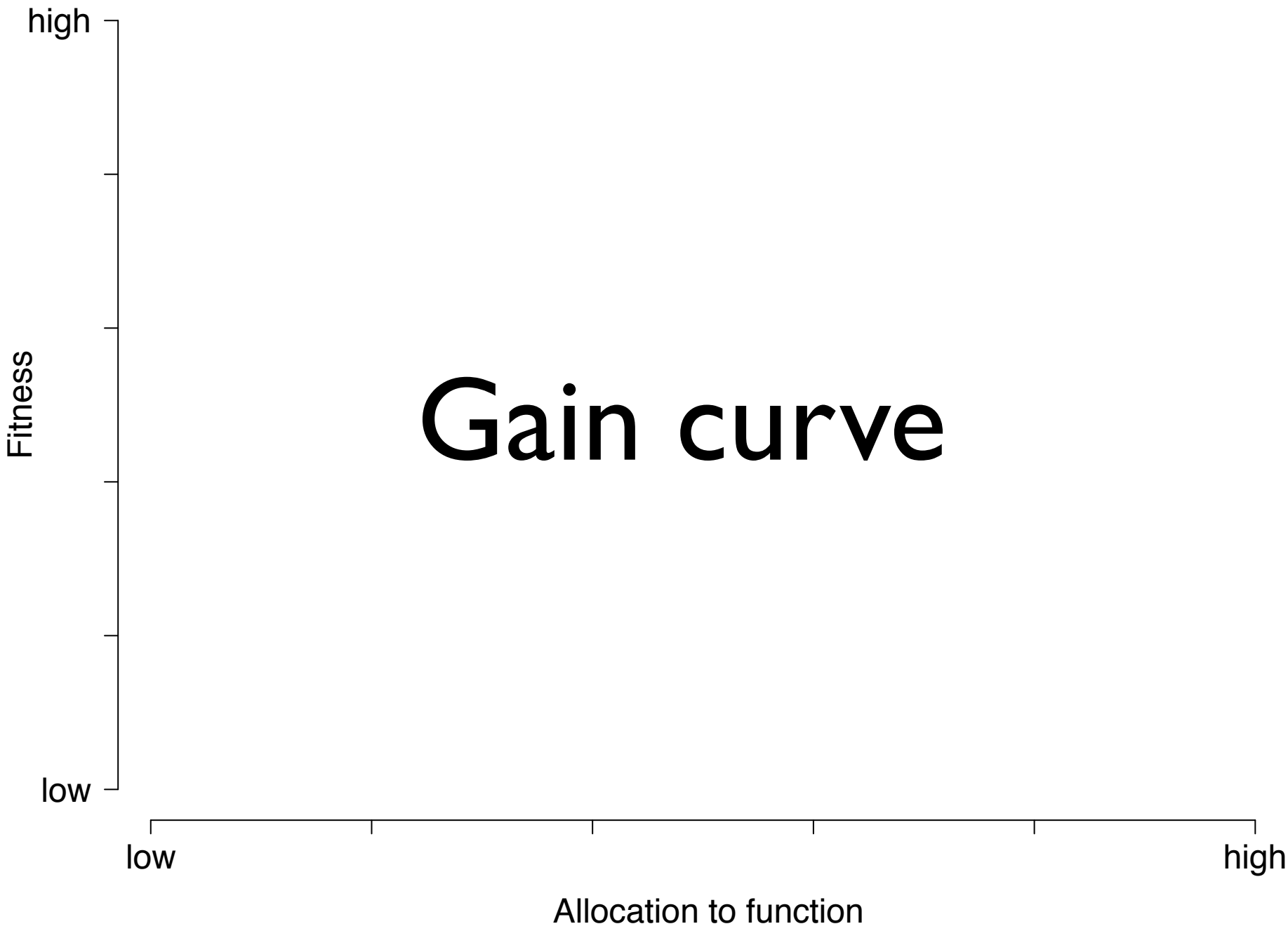
Every sperm is sacred

Every sperm is great

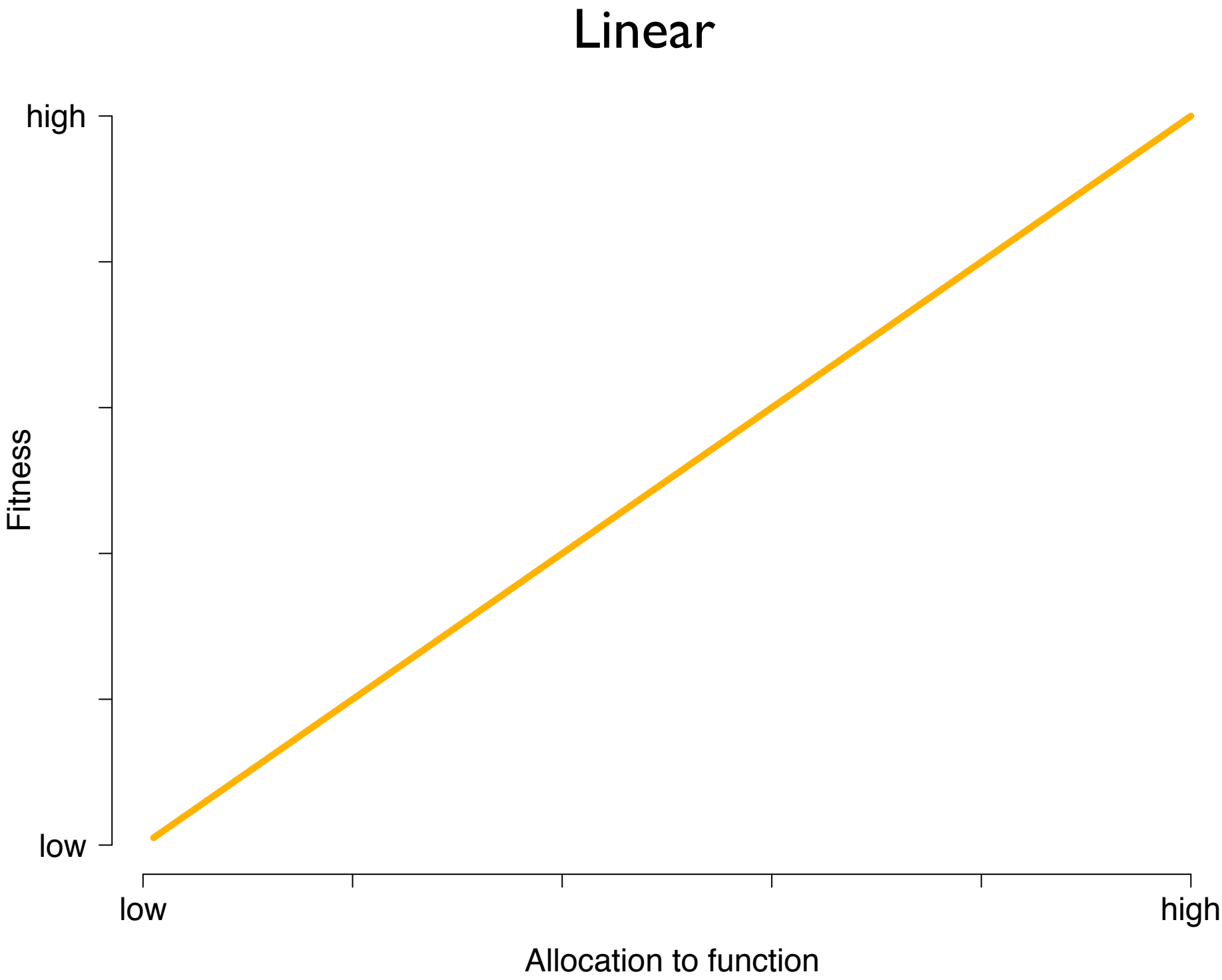
If a sperm is wasted

God gets quite irate

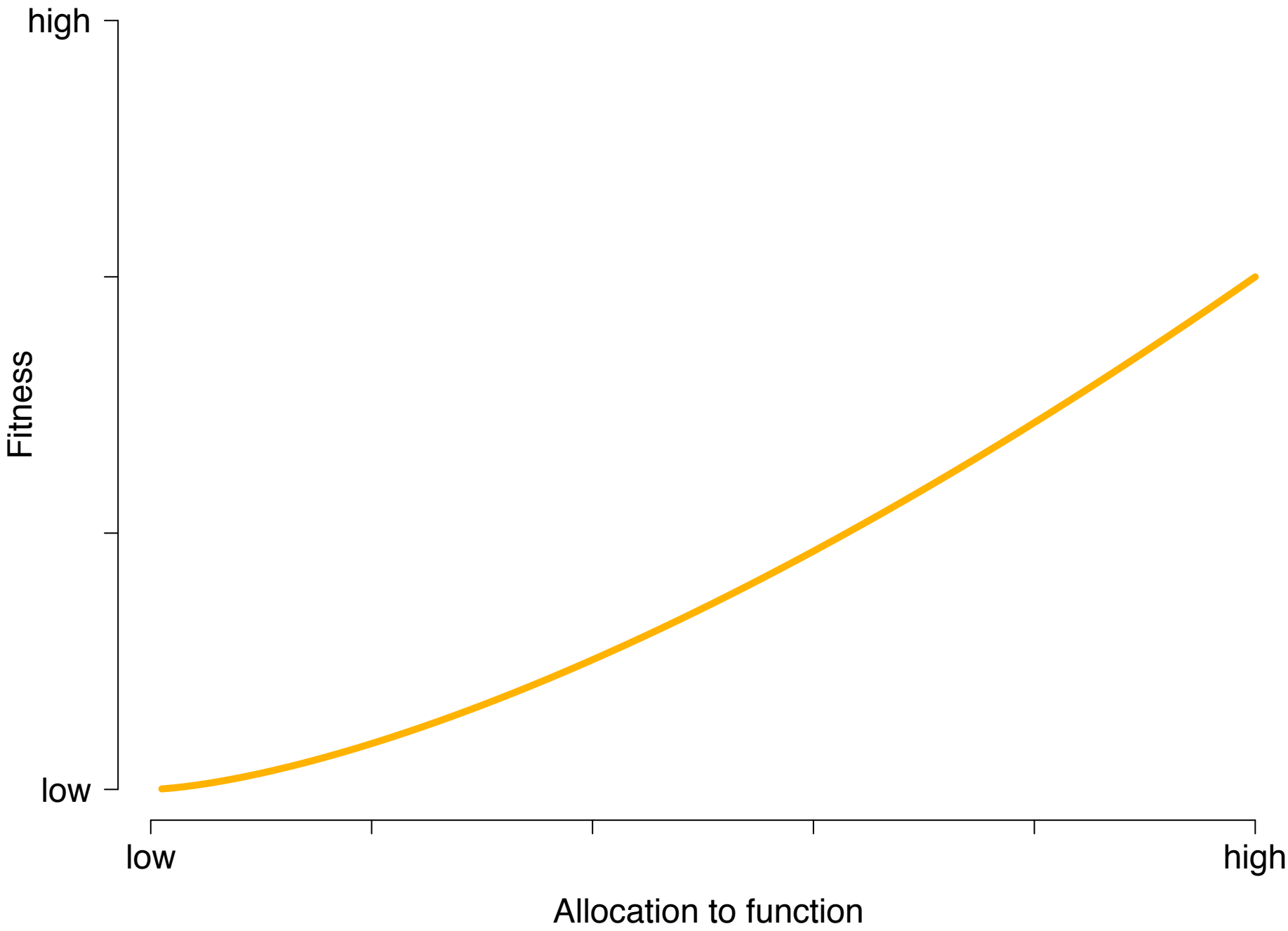




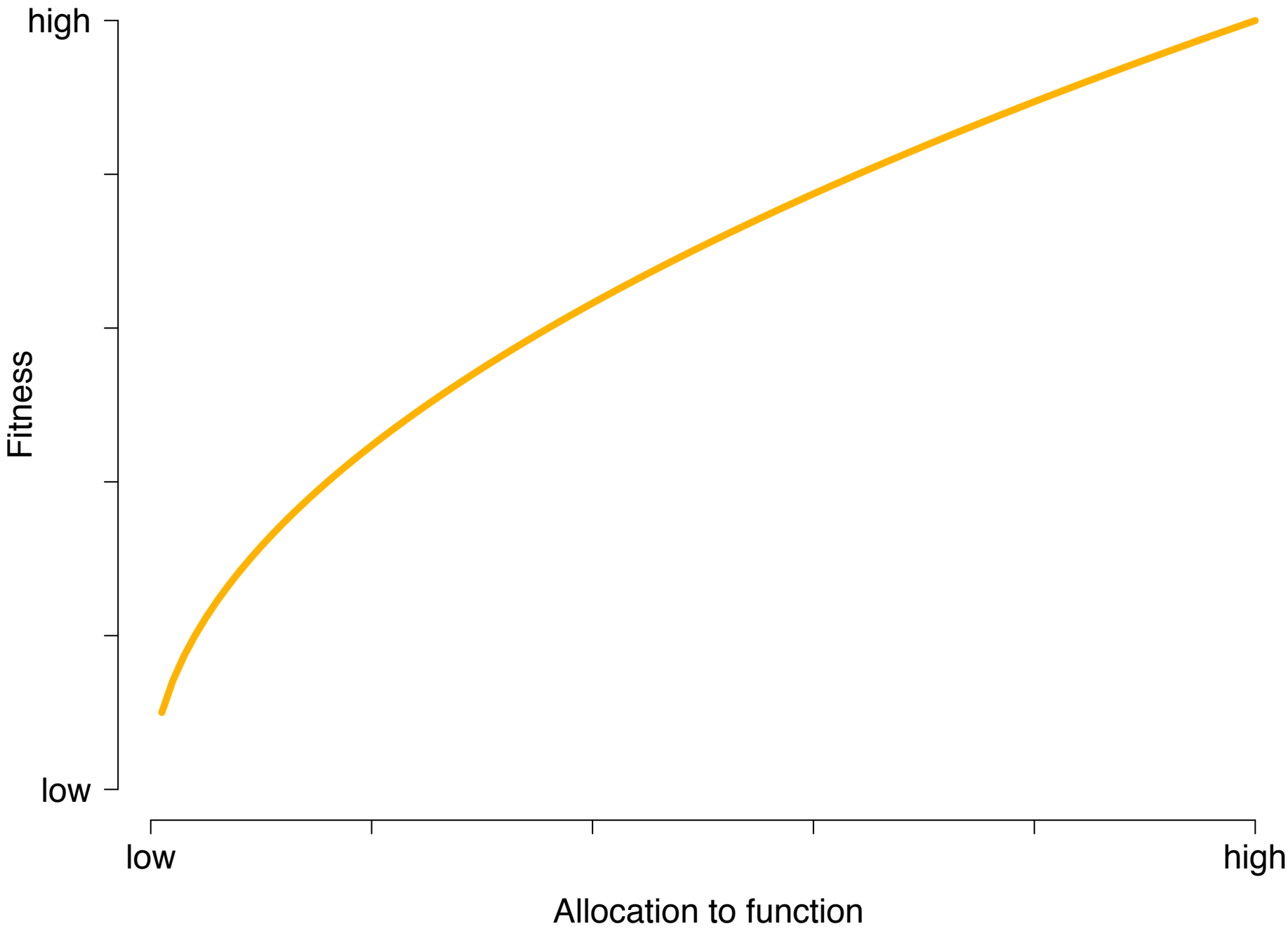
Gain curve


Linear
high
low
Fitness
low
high
Allocation to function

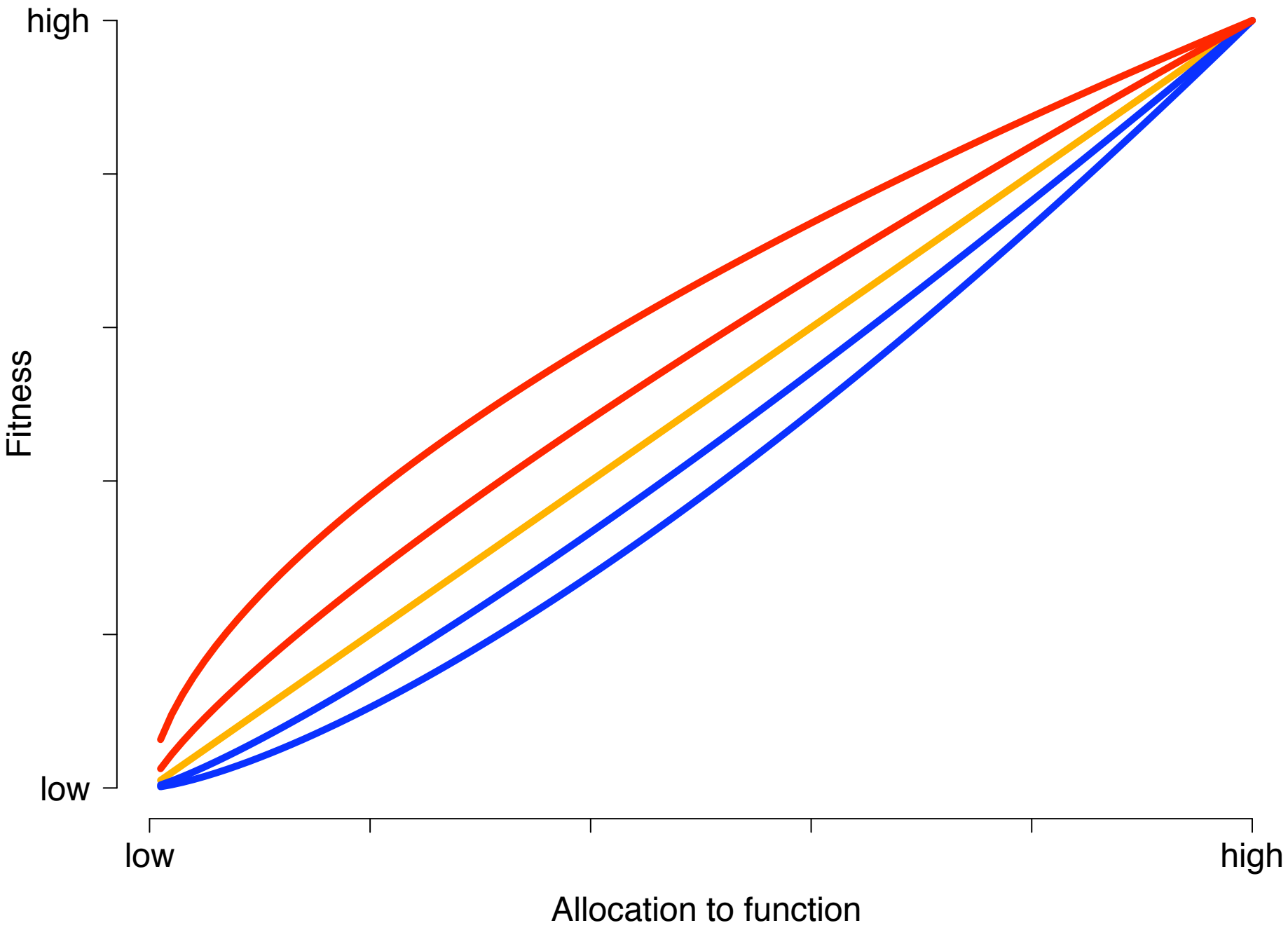
Accelerating

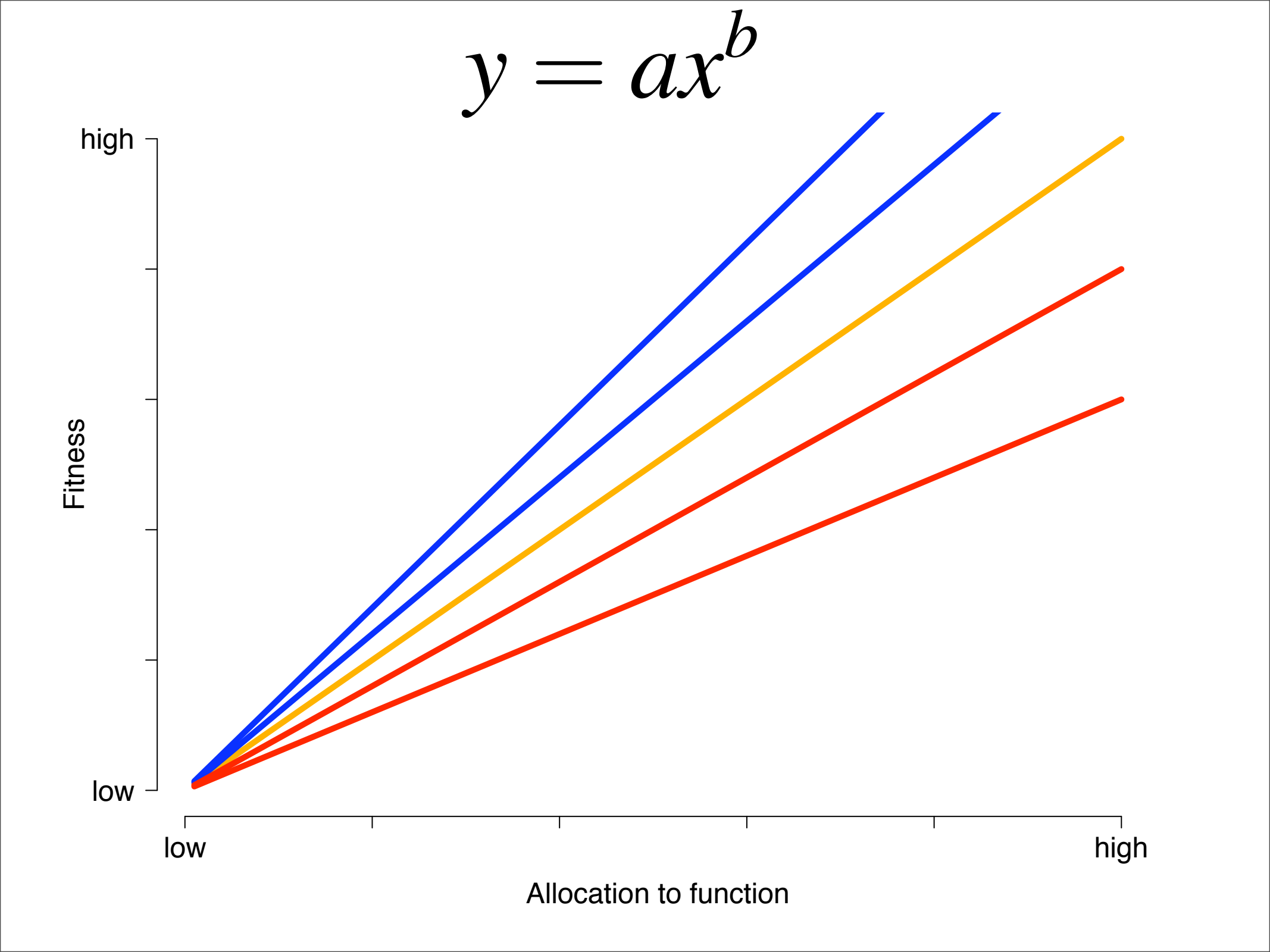


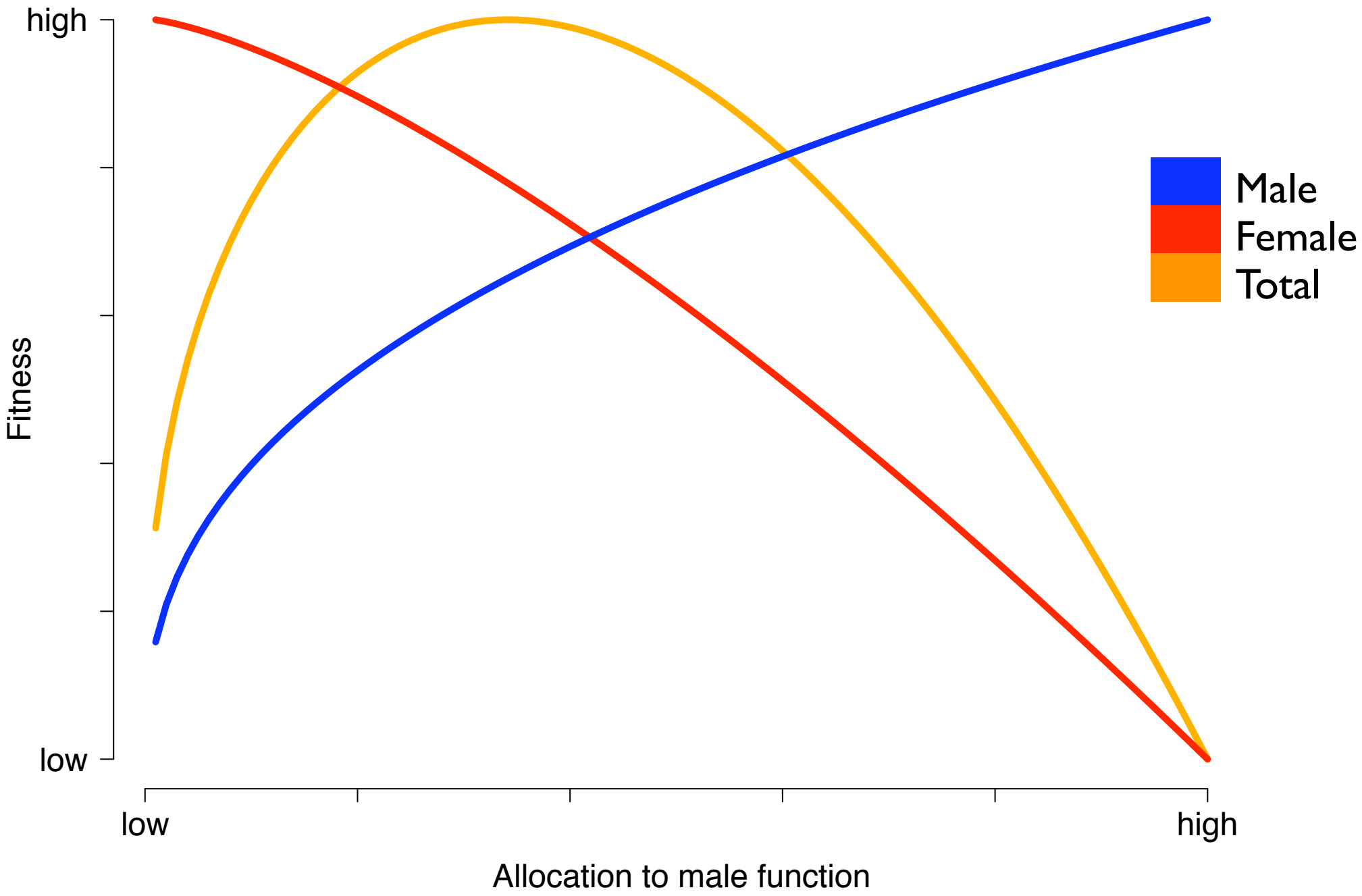
Decelerating

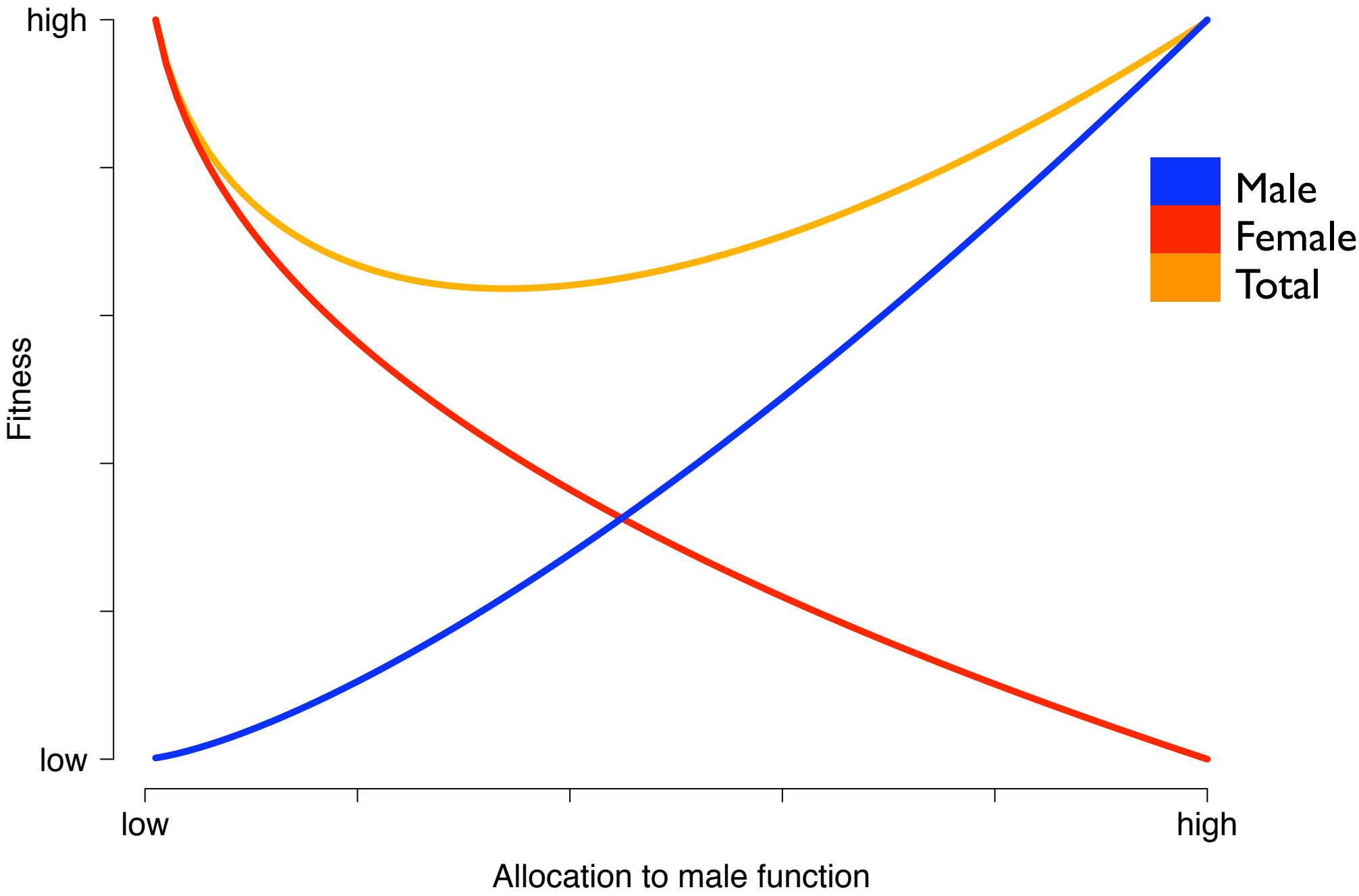


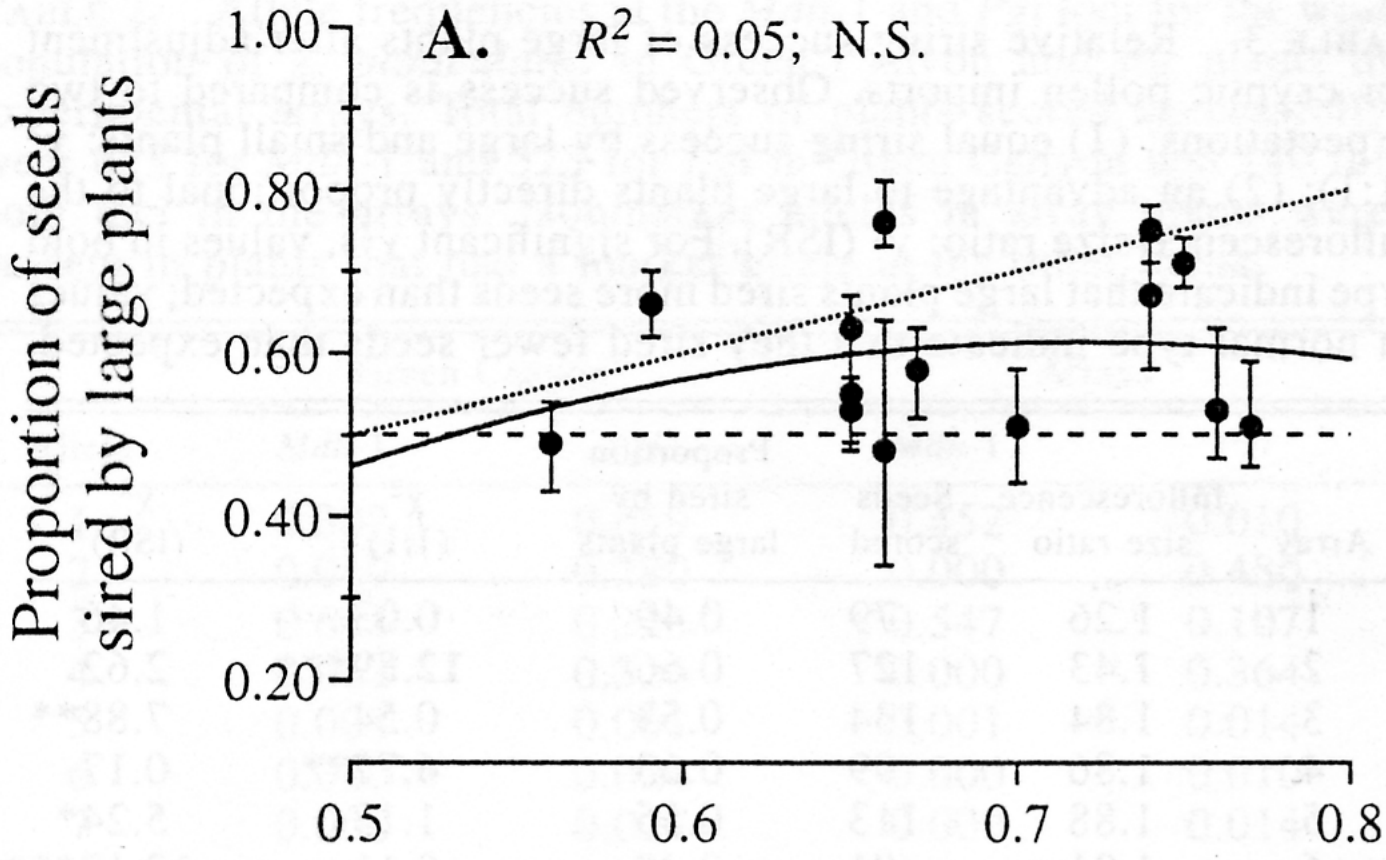
$$y = ax^b$$



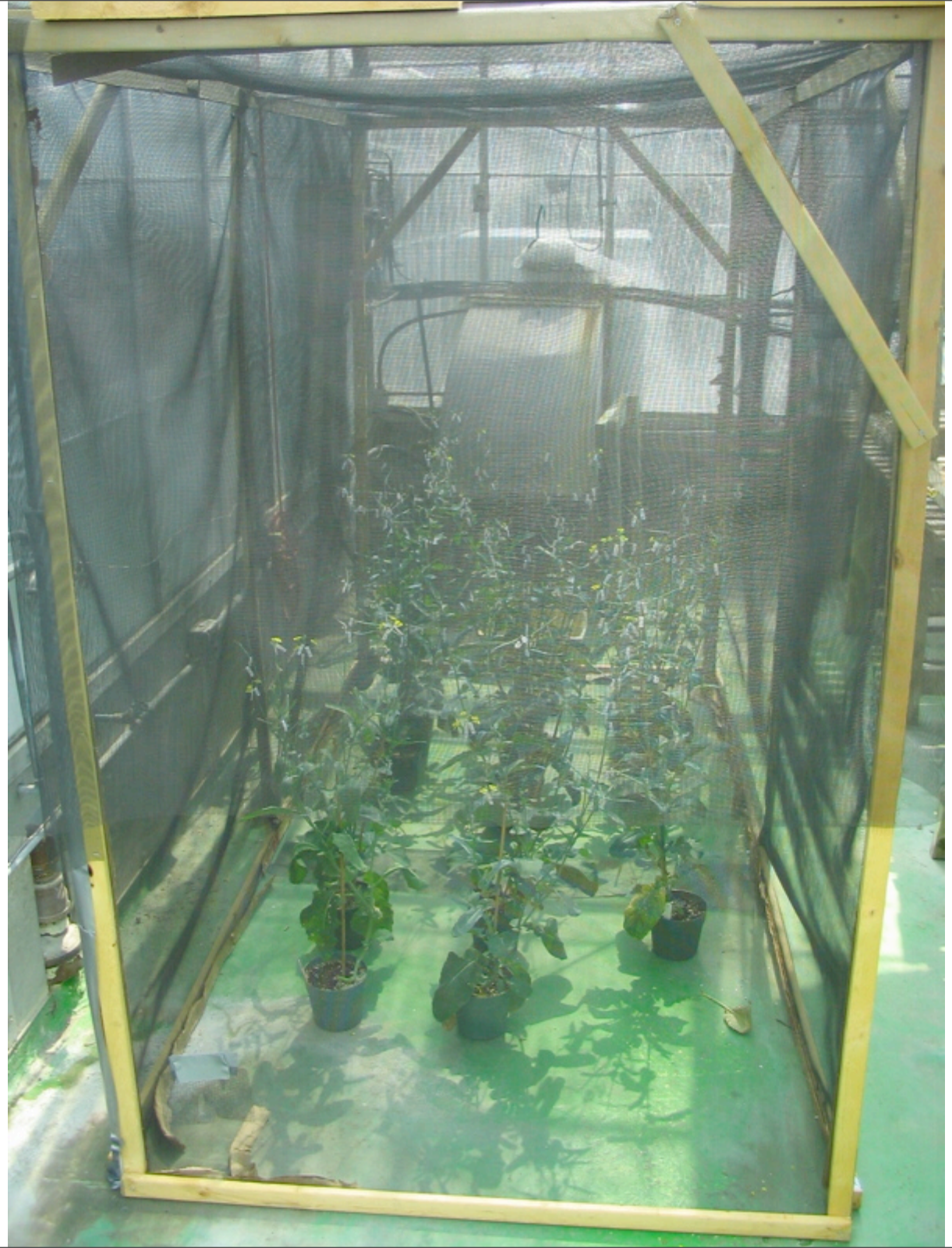

$y = ax^b$
high
low
Fitness
low
high
Allocation to function


high
low
Fitness
low
high
Allocation to male function
Male
Female
Total


high
low
Fitness
low
high
Allocation to male function
Male
Female
Total



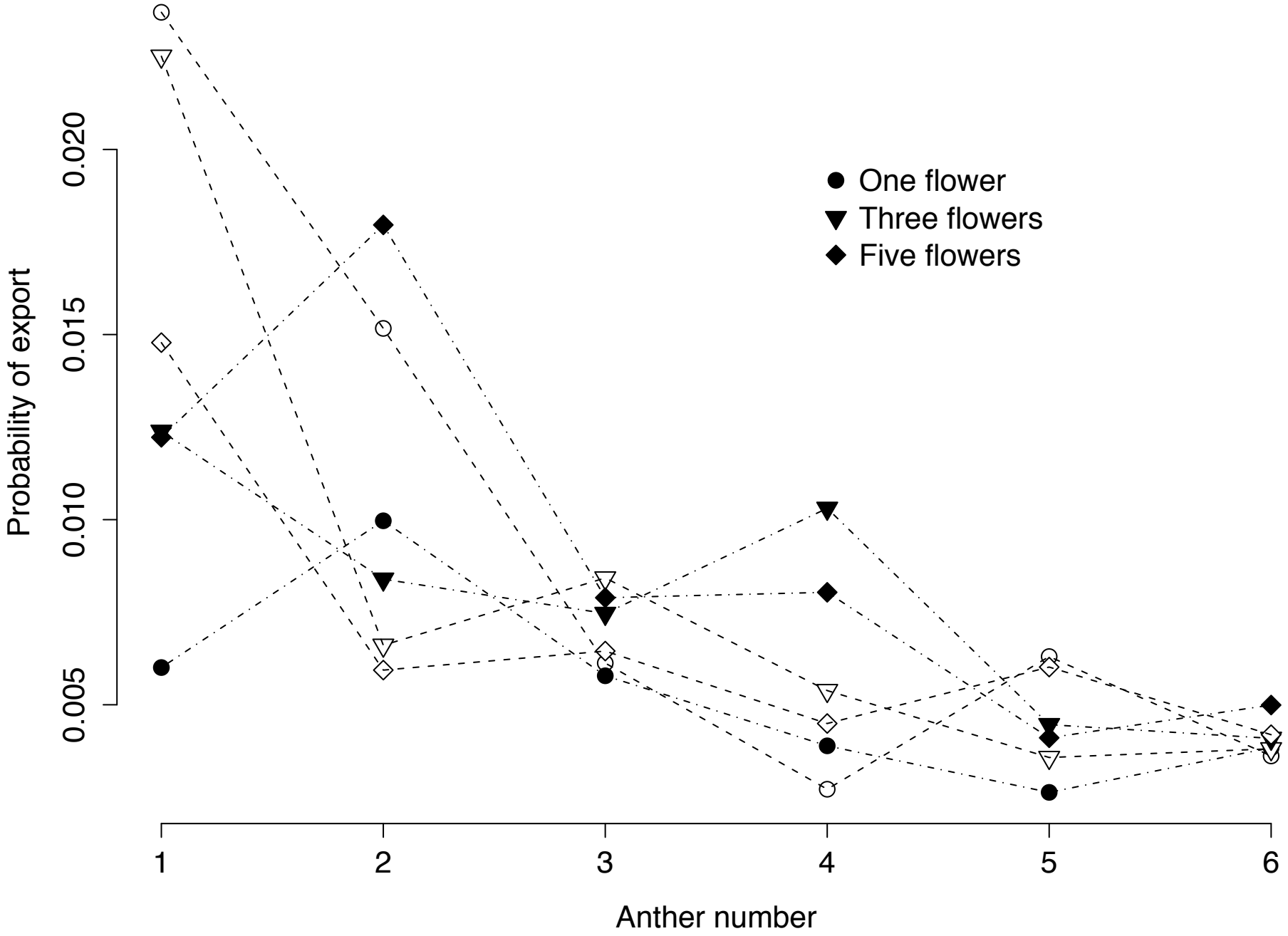
Emms et al. 1997

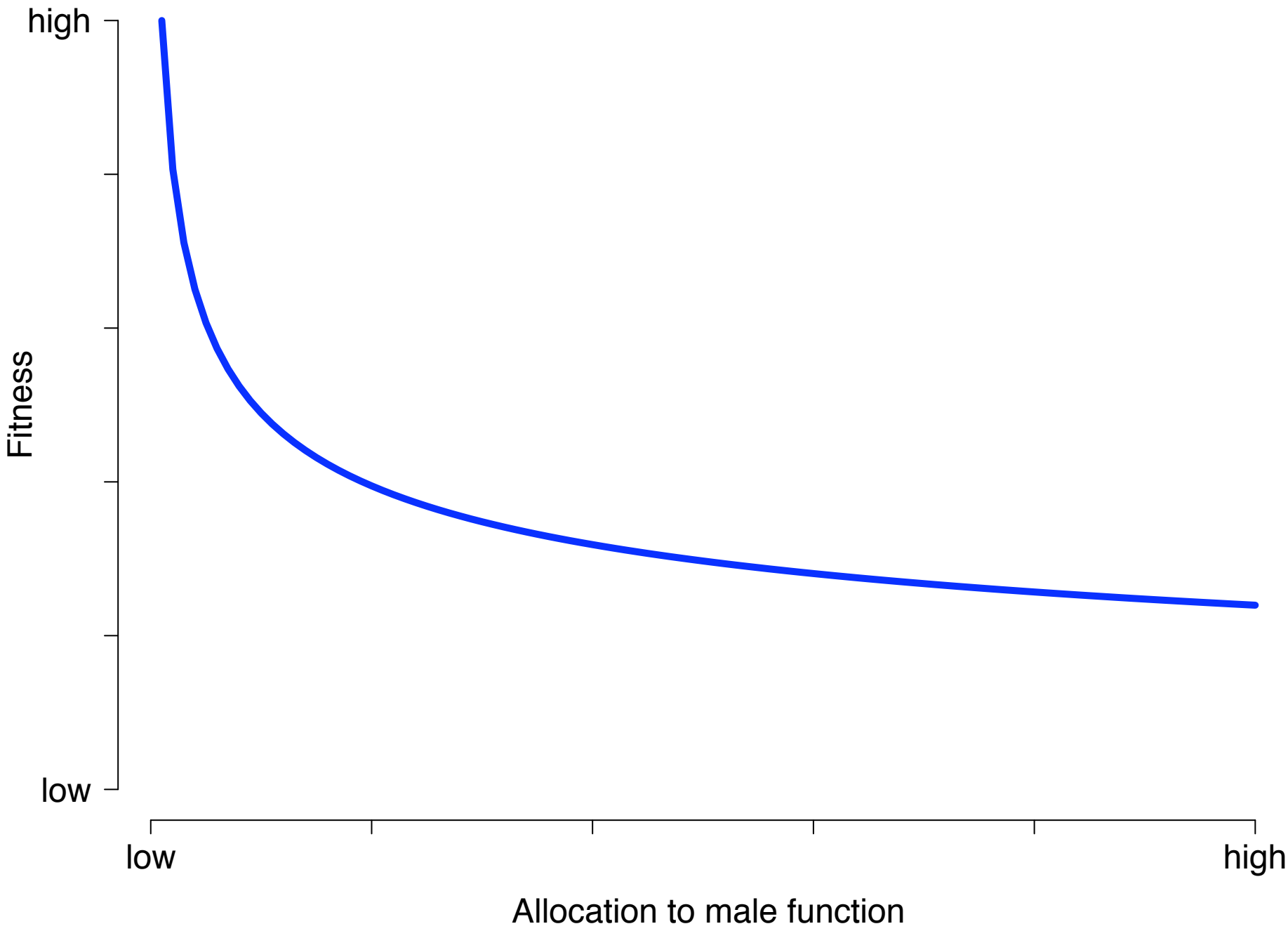


Experimental Design

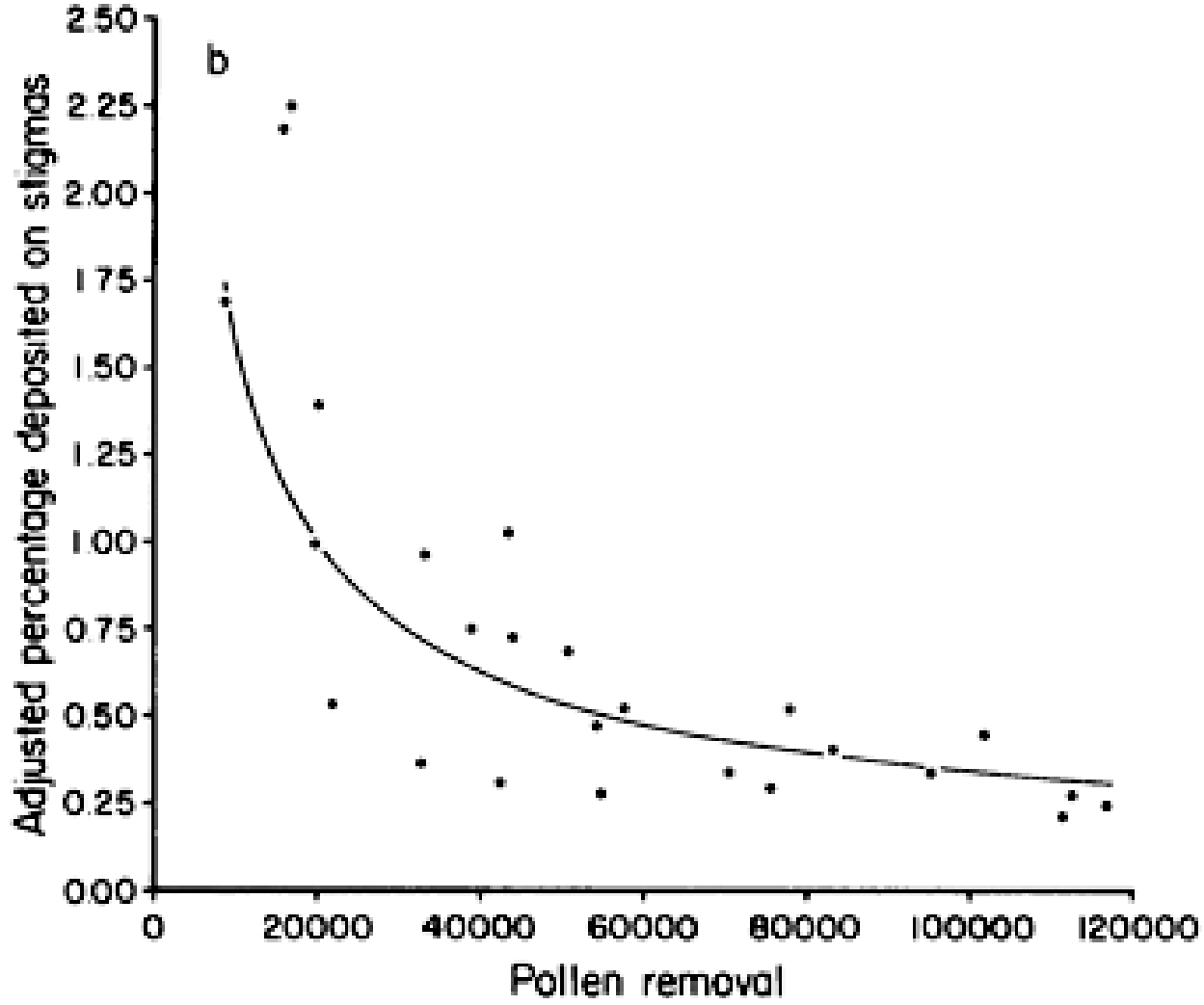
Anthers/ flower	Plants	Anthers/ array
1	30	30
2	15	30
3	10	30
4	7	28
5	6	30
6	5	30

Bombus impatiens
BIOBEST
BUMBLEBEE POLLINATION

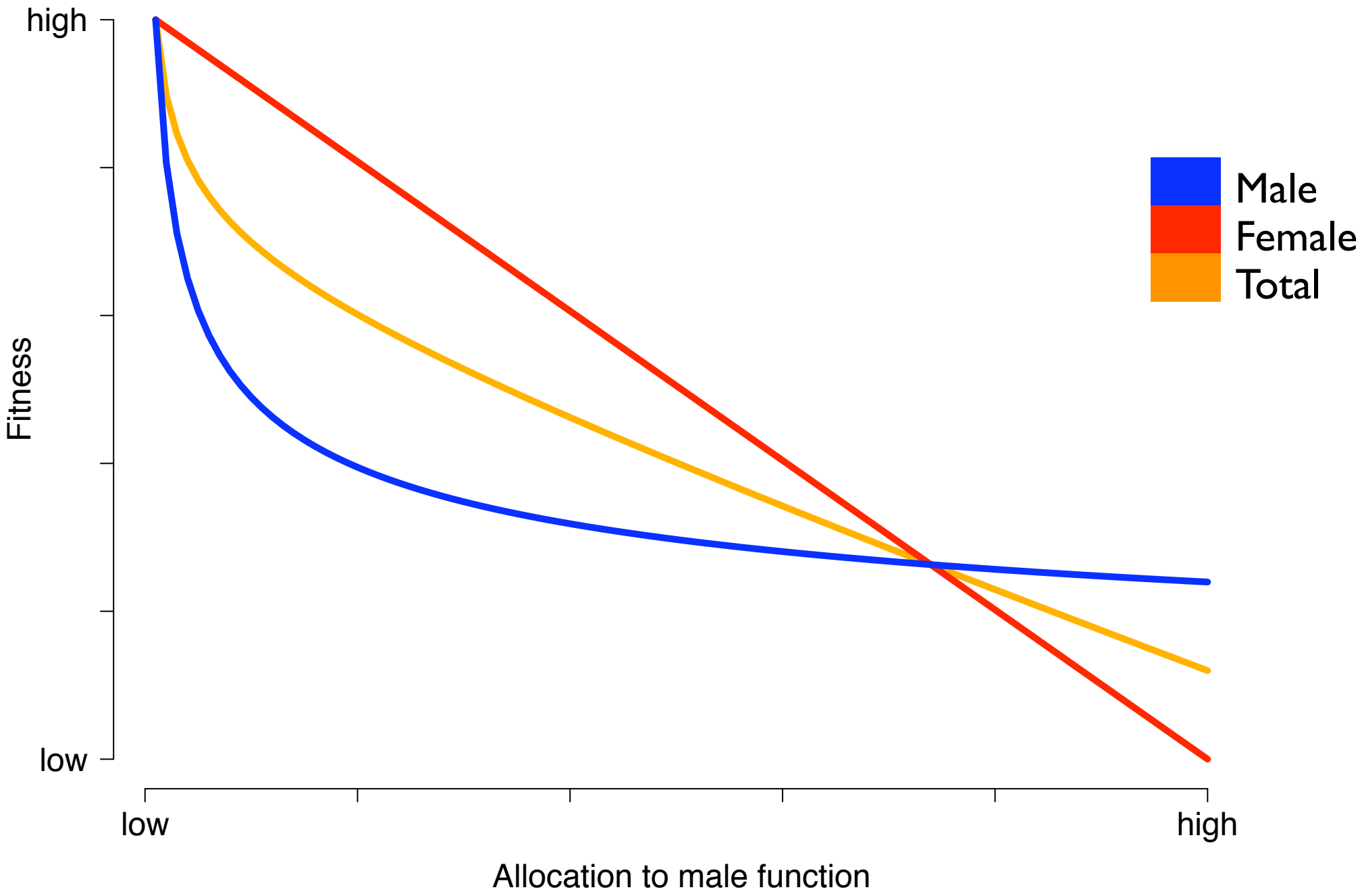

Probability of export
0.005
0.010
0.015
0.020
1
2
3
4
5
6
Anther number
One flower
Three flowers
Five flowers


high
Fitness
low
low
high
Allocation to male function

Diminishing returns



Harder & Thomson 1989


high
low
Fitness
low
high
Allocation to male function
Male
Female
Total

Why so many anthers?

- Male-male competition
- Pollinator attraction
- Structural feature
- Constraint