Crossbridge populations: transition kinetics and mechanical force — review sheet

Use this after attempting the worked examples and practice. Explain each claim in words before calculating.

Key ideas

- Attachment and detachment fluxes depend on the available source fractions.
- Equal opposing fluxes give a steady population fraction without stopping individual transitions.
- For positive rate sum, equilibrium is f/(f+g) and relaxation time is 1/(f+g).
- A fixed-force readout adds assumptions that occupancy alone does not establish.

Common errors and repairs

Treating a rate constant as a fraction or a total flux. Rates have units 1/s; multiply by the available fraction to obtain a transition flux.

Doubling both rates must double the final fraction. The ratio is unchanged, so the equilibrium is unchanged; the approach is faster.

A force trace validates a force-velocity theory. The model does not contain velocity or strain, so that claim exceeds its equations.

Retrieve without your notes

- At f = 3/s, g = 1/s and A = 0.75, what are the two fluxes?
- What is carried across an instantaneous change in rate constants?
- Name one independent observation needed to test the occupancy explanation.

Readiness check

- Separate a state fraction from an attachment or detachment rate.
- Compute the competing transition fluxes and predict whether attachment increases.
- Find the equilibrium fraction by balancing gains and losses.
- Explain why scaling both rates changes the timescale but not the equilibrium.
- Identify what additional information is needed to predict shortening or metabolic energy.