

Sim Pack 5:



Stern-Volmer Kinetics

Version 1.0

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Learning Outcomes:

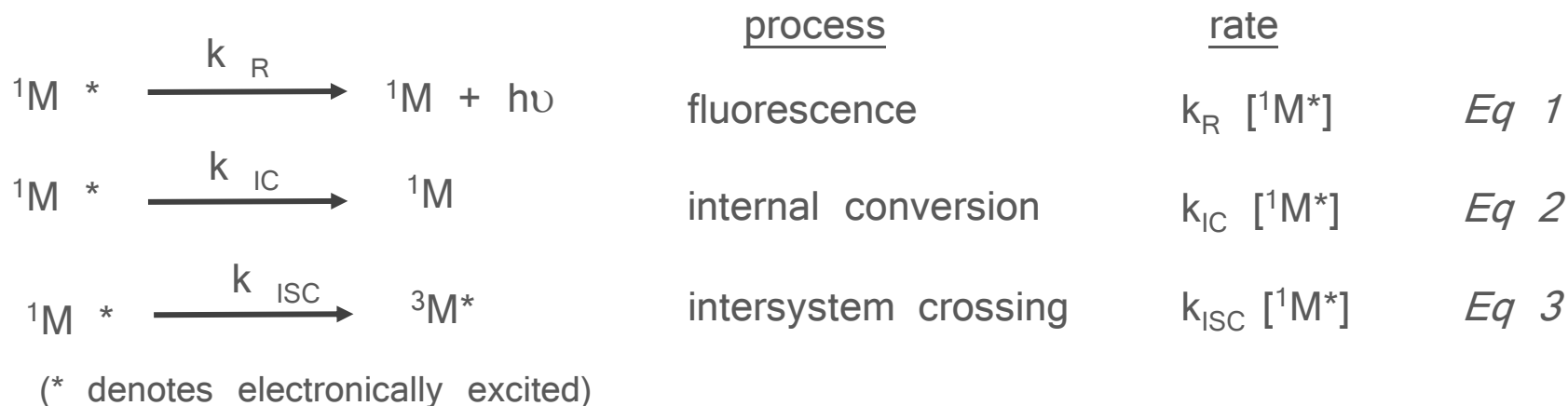
After reading these notes you will learn about the following terms

- **Bimolecular quenching**
- **Stern-Volmer Kinetics**
- **Bimolecular quenching constant**

Bimolecular Processes (Quenching)

3.

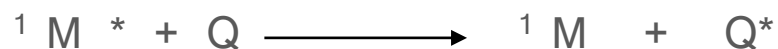
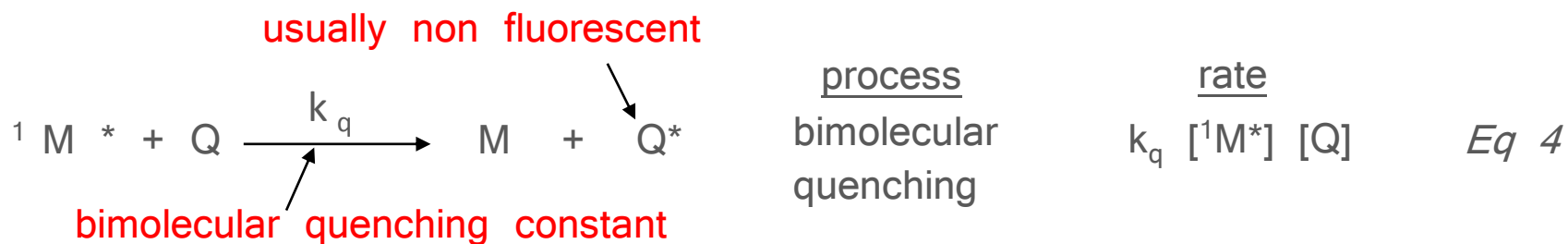
Previously¹ we developed a kinetic scheme to derive an expression for the amount of fluorescence observed (i.e., the quantum yield Φ^0) from an excited state, M^* , as a result of unimolecular deactivation processes:



We can expand the kinetic scheme above to include *bimolecular* interactions where a quencher, Q, deactivates M^* :

Footnote

¹ Sim Pack 1: "Fluorescence", Copyright 2012, sim4t.com



Fluorescence quenching is an example of energy transfer.

Energy exchange occurs through short distances $\sim 2\text{nm}$ (i.e., via collisions between the excited state and Q):



Since, the intensity of fluorescence¹, $I_F \propto$ to the quantum yield¹ of fluorescence, Φ_F

(I_F is the intensity of fluorescence and what is measured “directly” *via* fluorescence steady state spectroscopy¹)

In addition, for dynamic quenching (when one excited state is deactivated by one quencher):

$$\frac{\Phi_F^0}{\Phi_F} = \frac{I_F^0}{I_F} = \frac{\tau_F^0}{\tau_F}$$

(τ_f data can be determined by a fluorescence lifetime spectrometer, e.g., a single photon counter²)

then:

$$\frac{\Phi_F^0}{\Phi_F} = \frac{I_F^0}{I_F} = \frac{\tau_F^0}{\tau_F} = 1 + k_q \tau_F^0 [Q]$$

Eq 17

Footnote:

¹ Sim Pack 1: “Fluorescence”, Copyright 2012, sim4t.com

² Sim Pack 2: “Time Correlated Single Photon Counting”, Copyright 2012, sim4t.com



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