JABLONSKI DIAGRAM

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- The Jablonski diagram represents the energy levels within a molecule where valence electrons can be excited.
- Is an energy diagram, arranged with energy on a vertical axis.

S (singlet state)
T (triplet state)
V (vibrational state)

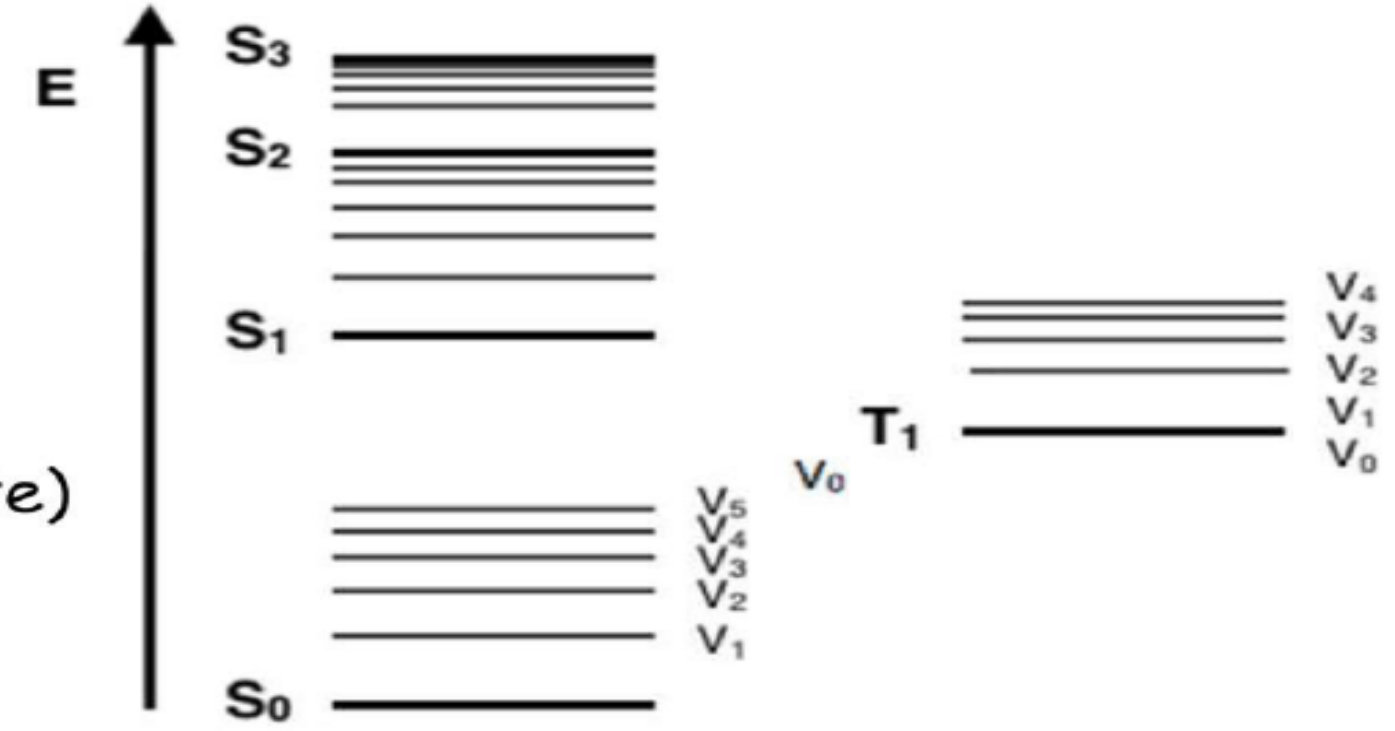

Figure : The Foundation of a typical Jablonski Diagram

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- Every column usually represents a specific spin multiplicity for a particular species.
- Column contains electronic energy state (S, T)
- Within each electronic energy state are multiple vibronic energy states (V)
- As electronic energy states increase, the difference in energy becomes continually less
- As the electronic energy levels get closer together, the overlap of vibronic energy levels increases.

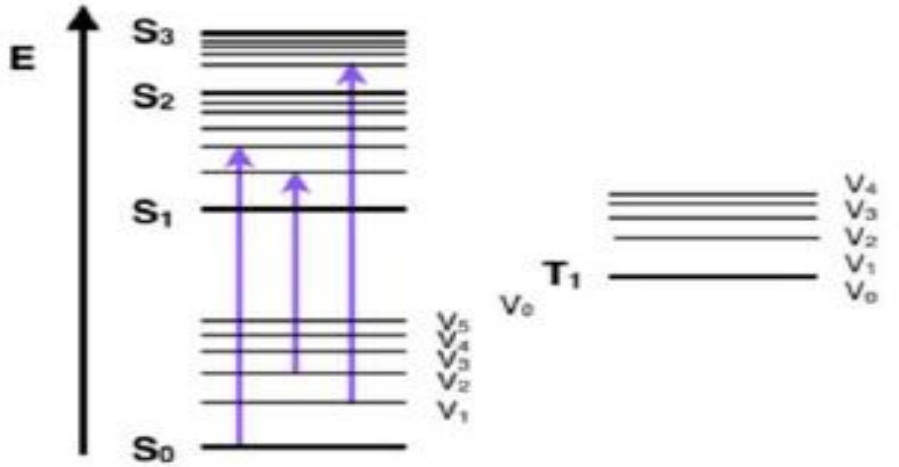
[Usually only a portion of these vibrational energy states are represented due to the massive number of possible vibrations in a molecule]

JABLONSKI DIAGRAM

Absorption of light

- The absorbance of a photon of a particular energy by the molecule result in migration of electrons from lover energy state to higher energy state (excitation)
- This is indicated by a straight arrow pointing up.
- Only certain wavelengths of light (photon) are possible for absorbance, that have energies that correspond to the energy difference between two different energy states of the particular molecule.

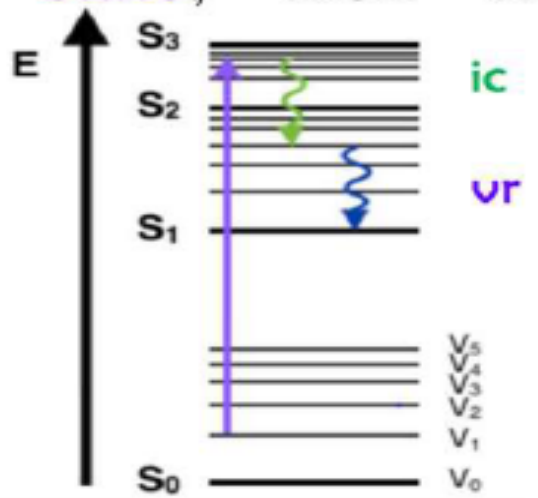
Drugs	Light absorption (Max. absorption at about)
Diclofenac Sod.	440 nm
Omeprazole	500 nm and 600 nm
Prednisolone	240 nrn



JABLONSKI DIAGRAM

Vibrational Relaxation & Internal Conversion

- Migration of electrons from higher energy state to lower energy state by losing their absorbed energy (relaxation).
- This is indicated as a curved arrow between vibrational levels.
- If relaxation occurs between vibrational levels in same electronic state, then this phenomenon is called as Vibrational Relaxation .
- If relaxation occurs between vibrational levels from one higher electronic state to another lower electronic state, then this phenomenon is called as Internal Conversion



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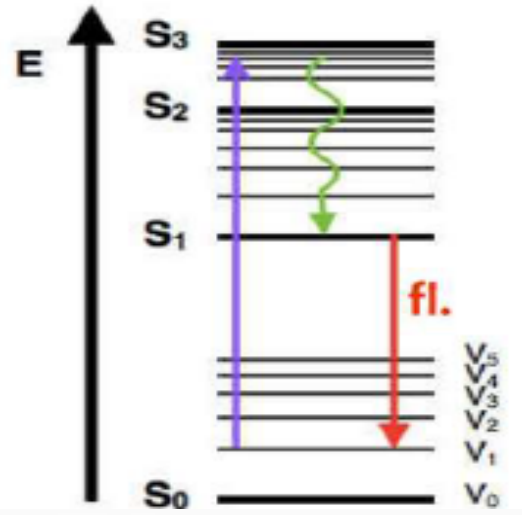
Fluorescence

- Migration of electrons from higher energy state to lower energy state by emitting photons.
- This is indicated as a straight line going down on the energy axis between electronic states.
- Fluorescence is a slow process 10^{-9} to 10^{-7} seconds. it is not a very likely path for relaxation.
- Fluorescence is most often observed between the first excited electron state and the ground state.



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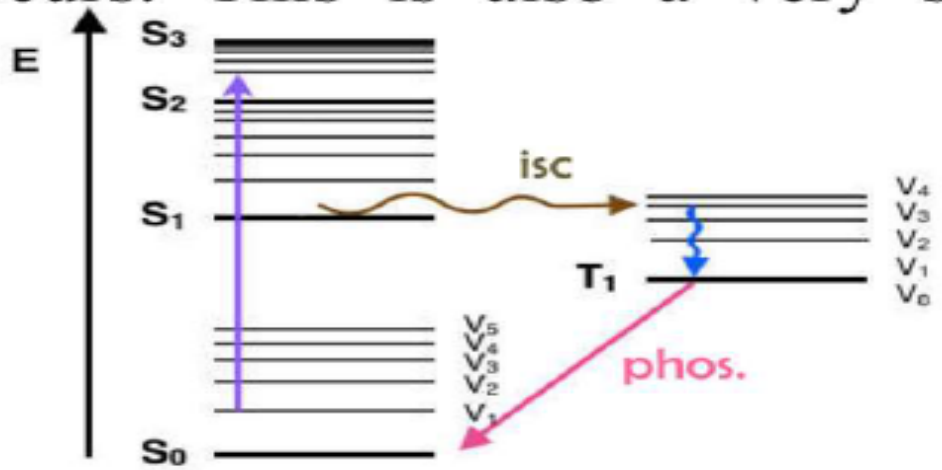
Intersystem Crossing

- The electron changes spin multiplicity from an excited singlet state to an excited triplet state.
- This is indicated as a horizontal, curved arrow from one column to another. This is the slowest process
- After crossing electron back to the ground electronic state via phosphorescence, where a radiative transition from an excited triplet state to a singlet ground state occurs. This is also a very slow, forbidden transition.



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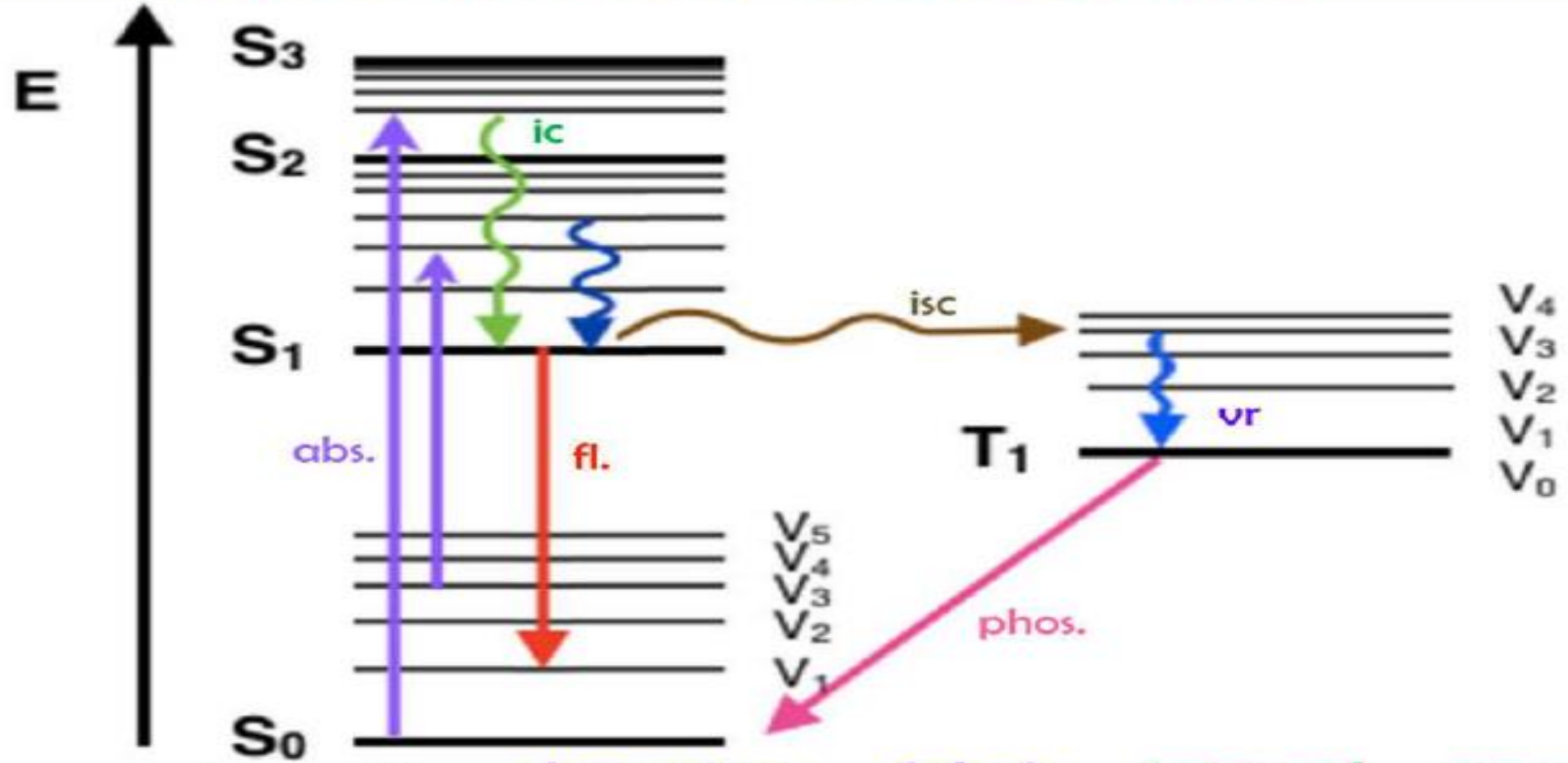

Possible scenario with absorption (abs.), internal conversion (ic), vibrational relaxation (vr), Fluorescence (fl.), intersystem crossing (isc) and phosphorescence (phos.) processes shown.

Reference

- https://www.slideshare.net/AZCPh/jablonski-diagram-physical-chemistry

P., Atkins, P., de Paula, J. Atkins' Physical Chemistry, 8th edition (2006), page 494, Oxford University Press. ISBN 0-7167-8759-8

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THANK YOU