

Carotenoid Excited State Processes by Femtosecond Time-Resolved Pump-Probe and Multi-Pulse Spectroscopies

Ph.D. Thesis

ERRATUM

June 14th, 2018

M. Sc. Robert G. West

The following corrections should be made for this thesis. All references explicitly mentioned below should be added to the end of the list of references on page. 65.

Page 2 – In the first paragraph “The oldest geological record of carotenoids have been found in chloroplasts of the unicellular algae *Prochloron*, which is cyanobacteria.” should read “The oldest geological record of carotenoids have been found in the unicellular algae *Prochloron*, which is cyanobacteria, supposed to be the predecessor of chloroplasts.”

Page 4 – Due to an error in compiling, in figure 1.1, the caption “Figures obtained from refs. 16, 17, 18, 19, and 20, respectively” does not provide the correct references. The correct references are four references. It should read, “Figures are obtained from refs. 43, 150, 151, and 20.” Where *the following references shall be added to the reference list on page 65:*

150. Scholes, G.D. et al., 2011. Lessons from nature about solar light harvesting. *Nature Chemistry*, 3, pp.763–774.
151. Nelson, N. & Ben-Shem, A., 2004. The complex architecture of oxygenic photosynthesis. *Nature reviews. Molecular cell biology*, 5(12), pp.971–982.

Page 7 – In the first paragraph under subsection heading 1.1.2, the sentence “The purpose of antenna systems is, firstly, to funnel energy to the reaction

center (RC) where stable energy products for processes are manufactured” should read “The purpose of antenna systems is, firstly, to funnel energy to the reaction center (RC) where charge separation occurs.”

Page 10 – In the caption of Figure 1.3, the final phrase “Adapted from ref. [48] in addition to ref. [49]” should be “Adapted from ref. [90] in addition to ref. [91]” where reference [91] shall be added to the list of references on page 65:

Ostroumov, E., 2010. Ultrafast relaxation dynamics of carotenoid excited states. *Inaugural Dissertation*. Heinrich Heine Universität Düsseldorf.

Page 17 – The caption in Figure 1.7 should not refer to “ref. [17]” but “ref. [43].”

Page 31 – The first sentence of the first paragraph “When in closer proximity, intermolecular energy transfers have low dipole strength (Eq. 1.9) and thus low probability (Eq. 1.7) of occurring only if spin is not accounted for.” should be stated, “When in closer proximity, the weak coupling of Förster’s theory breaks down, and orbital interactions between donor and acceptor may occur.”

Page 31 – The sentence in the second paragraph “Whereas, H_{21}^{Dexter} signifies a spin exchange between the molecules...” should be truncated at “.” and changed to “Whereas, H_{21}^{Dexter} signifies an electron exchange by which the spin states of the molecules change.”

Page 38 – Equation 1.13

$$“ \Delta A_{\ell}(\lambda, t) = \frac{\varepsilon_{\ell} L}{V} (C_{\ell,exc}(\lambda, t) - C_{\ell,0}(\lambda, t)) “$$

should be expressed in terms of moles n , not concentration C :

$$“ \Delta A_{\ell}(\lambda, t) = \frac{\varepsilon_{\ell} L}{V} (n_{\ell,exc}(\lambda, t) - n_{\ell,0}(\lambda, t)) “.$$

Page 38 – Thereafter, the sentence following Equation 1.13 stating “where L is the beam path length through the sample, $C_{\ell,exc}$ and $C_{\ell,0}$ represent the concentrations of species ℓ ...” should, rather, state “where L is the beam path length through the sample, V is the volume of sample probed, and $n_{\ell,exc}$ and $n_{\ell,0}$ are the number of moles of species ℓ ...”

Page 167 – 171 – Due to an error in enumeration, the references after reference [15] are incorrect. Their value should be one number higher; so, reference [16] should be labeled [17], [17] should be labeled [18], and so on up to reference [48] having the label [49]. The missing reference on page 167, the paper by Enriquez et. al., should be labeled [16].

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