Photophysical properties of J-aggregates based on porphyrinic compounds

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Magneto-chiral dichroism (MChD), which originates from the cross effect of circular dichroism (CD) and magnetic circular dichroism (MCD), is an interesting phenomenon in which the absorption coefficient of a chiral molecule is different for an unpolarized light beam when an externally applied magnetic field is parallel and antiparallel to the propagation direction (Fig. 1) [1-2]. Previously, we succeeded in carrying out the first observation of MChD in organic compounds using chiral J-aggregates of water-soluble porphyrins [3]. This organic MChD originates from the π-electronic properties of aggregates of organic aromatic compounds, in which the orbital angular momentum and exciton chirality result in intense MCD and CD signals, respectively [3-4]. In this study, we demonstrated the presence of MChD in a living organism for the first time by using photosynthetic bacteria containing J-aggregates of organic aromatic compounds. In addition, we successfully simulated the MChD spectrum based on π-electronic properties for the first time. These findings are important not only toward the establishment of a method for evaluating MChD, but also in terms of the future development of asymmetric synthetic methods and magneto-optical devices. Furthermore, the findings provide new clues that may help clarify our understanding of the asymmetry in biological systems.

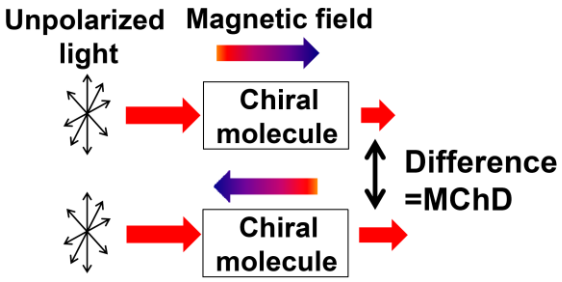

Fig. 1 Magneto-chiral dichroism (MChD)

References

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