Relationship of function and higher order structure of abnormal hemoglobin.

2001 Fiscal Year Final Research Report Summary

Relationship of function and higher order structure of abnormal hemoglobin.

Research Project

Project/Area Number

10670115

Research Category

Grant-in-Aid for Scientific Research (C)

Allocation Type

Single-year Grants

Section

一般

Research Field

General medical chemistry

Research Institution

Kanazawa University

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1998 – 2001

Keywords

Hemoglobin / UVCD / UV resonance Raman / Allostery / Ouaternary structure transition / Aromatic amino acids / T-state marker / Oxygen equilibrium

Research Abstract

In order to address the relationship between oxygen binding function (allostery) and quaternary structure changes of hemoglobin A (Hb A), we have studied on structure and function of abnormal hemoglobin by ultraviolet (UV) circular dichroism (CD) and UV resonance Raman (UVRR) spectroscopy. The results were summarized as follows :
(1) A study of quaternary structure change of Hb by UVCD : We examined UVCD spectra of abnormal hemoglobin with amino acid substitution at α1-β2 subunit interface (References, 1, 2).
(1) Heme and protein structure of Hb M Iwate and Hb M Boston characterized by UV and visible resonance Raman study (References, 3, 4).
(2) Structural and functional relationship of hemoglobin by UVRR : Tyr and Trp RR bands excited with 235nm changed upon deoxy->oxy(or CO) structure transition. We

clarified which Tyr or Trp residue contributed to these changes using abnormal hemoglobin, NO and metal-hybrid Hb (References, 5-7).
From these results, we have elucidated that Tyr and/or Trp residues at α1-β2 subunit interface are critically important for hemoglobin allostery. These aromatic residues contribute not independently but cooperatively to higher order protein structure transition of hemoglobin.

Research Products (14 results)

All | Other

All | Publications

[Publications] R.Li, Y.Nagai, M.Nagai: "Contribution of α14OTyr and β37Trp to the near-UVCD spectra on quaternary structure transition of Hb A"Chirality. 12. 216-220 (2000)

[Publications] R.Li, Y.Nagai, M.Nagai: "Changes of Tyr and-Trp residues in human hemoglobin by oxygen binding : near-and farUVCD of hemoglobin"Journal of Inorganic Biochemistry. 82. 93-101 (2000)

[Publications] M.Nagai, M.Aki, R.Li, Y.Jin, T.Kitagawa: "Heme structure of Hb M Iwate : A UV and visible resonance Raman study"Biochemistry. 43. 13093-13105 (2000)

[Publications] S.Nagatomo, Y.Jin, H.Hori, M.Nagai, T.Kitagawa: "Changes in the abnormal α-subunit upon CO-binding to the normal β-subunit of Hb M Boston"Biophysical Chemistry. (in press). (2002)

[Publications] M.Nagai, H.Wajicman, S.Nagatomo, T.Kitagawa: "Quaternary structure sensitive tyrosine residues in human hemoglobin : UV resonance Raman study"Biochemistry. 38. 1243-1251 (1999)

[Publications] S.Nagatomo, N.Nagai, T.Yonetani, T.Kitagawa: "UV resonance Raman studies of α-NO hemoglobin derivatives"Biochemistry. 38. 9659-9666 (1999)

[Publications] S.Nagatomo, M.Nagai, N.Shibayama.T.Kitagawa: "Differences in changes of the α1-β2 subunit interface : UV resonance Raman of Ni-Fe hybrid hemoglobin"Biochemistry. (in press). (2002)

[Publications] R. Li, Y. Nagai, and M. Nagai: "Contribution of α140Tyr and β37Trp to the near-UV CD spectra on quaternary structure transition of human hemoglobin A"Chirality. 12. 216-220 (2000)

[Publications] R. Li, Y. Nagai, and M. Nagai: "Changes oftyrosine and tryptophan residues in human hemoglobin by oxygen binding : near- and far-UV circular dichroism of isolated chains and recombined hemoglobin"J. Inorh, Biochem.,. 82. 93-101 (2000)

[Publications] M. Nagai, M. Aki, R. Li, Y. Jin, H. Sakai: "Henie structure of Hemoglobin M Iwate [α87 (F8)His->Tyr] : A UV and visible resonance Raman study"Biochemistry. 43. 13093-13105 (2000)

[Publications] S. Nagatomo, Y. Jin, M. Nagai, H. Hori, and T. Kitagawa: "Changes in tne aonormai α-suounit upon Co-binding to the normal β-subunit of Hb M Boston : Resonance Raman, EPR, and CD study"Biophys. Chem.. (in press).

[Publications] M. Nagai, H. Wajcman, A. Lahary, T. Nakatsukasa, S.Nagatomo, and T. Kitagawa: "Quaternary structure sensitive tyrosine residues in human hemoglobin : UV resonance Raman studies of mutants at α40, β335, and β145 tyrosine"Biochemistry. 38. 1243-1251 (1999)

[Publications] S. Nagatomo, M. Nagai, A. Tsuneshige, T. Yonetani, and T. Kitagawa: "UV resonance Raman studies of α-nitrosyl hemoglobin derivatives : Relation between the α1-β2. Subunit interface interactions and the Fe-histidine bonding of α heme"Biochemistry. 30. 9659-9666 (1999)

[Publications] S. Nagatomo, M. Nagai, N. Shibayama, and T. Kitagawa: "Differences in changes of the α1-β2 subunit contacts between ligand binding to the α and β subunits of hemo-globin A : UV resonance Raman analysis using Ni-Fe hybrid hemoglobin"Biochemistry. (accepted for publication)(3/15/02).

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