

Relationship between structural changes of protein and function of abnormal hemoglobin.

メタデータ	言語: jpn 出版者: 公開日: 2022-06-30 キーワード (Ja): キーワード (En): 作成者: Nagai, Masako メールアドレス: 所属:
URL	https://doi.org/10.24517/00066694

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1994 Fiscal Year Final Research Report Summary

Relationship between structural changes of protein and function of abnormal hemoglobin.

Research Project

Project/Area Number

05670116

Research Category

Grant-in-Aid for General Scientific Research (C)

Allocation Type

Single-year Grants

Research Field

General medical chemistry

Research Institution

Kanazawa University

Principal Investigator

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Project Period (FY)

1993 - 1994

Keywords

Hemoglobin / Ultraviolet Resonance Raman / Circular Dichroism / Protein Structure / Function of Hemoglobin / Aromatic Amino Acids

Research Abstract


X-ray crystallographic studies have shown that the deoxy and liganded forms of hemoglobin (Hb) possess two distinct quaternary structures named T- and R-states, respectively. Cooperative oxygenation to Hb has been explained in terms of a reversible transition between the two quaternary structures upon partial ligation to the four hemes. Environmental changes of tyrosine (Tyr) and tryptophan (Trp) residues of Hb upon its T-to-R transition of quaternary structure was investigated with ultraviolet resonance Raman (UVRR) spectroscopy and circular dichroism (CD). To characterize the spectral change of Trp beta37 at alpha_1beta_2 interface due to the quaternary structure transition, the UVRR spectra of Hb A were compared with the corresponding spectra of Hb Hirose in which Trp beta37 is replaced by serine (Ser). Difference spectrum between deoxyHb A and deoxyHb Hirose gave rise to only Trp RR bands, which were reasonably ascribed to Trp beta37 in deoxyHb A. Comparison of the Hb A-Hb Hirose


difference spectra in the oxy and deoxy states revealed that the oxygenation-induced changes of Trp RR bands arose mostly from Trp beta37 and the remaining minor part from Trp beta15, demonstrating that Trp beta37 plays a pivotal role in the quaternary structural change in Hb A.


Research Products (12 results)


All Other


All Publications (12 results)


[Publications] M.Nagai,S.Kaminaka,Y.Ohba,Y.Nagai,Y.Mizutani,T.Kitagawa: "Ultraviolet resonance Raman studies of quaternary structure of hemoglobin using a tryptophan β 37 mutant." Journal of Biological Chemistry. 270. 1636-1642 (1995) 


[Publications] A.Dong,M.Nagai,Y.Yoneyama,W.S.Caughey: "Determination of the amounts and oxidation states of Hemoglobins M Boston and M Saskatoon in single erythrocytes by infrared spectroscopy." Journal of Biological Chemistry. 269. 25365-25368 (1994) 


[Publications] S.Hirota,T.Ogura,K.Shinzawa-Itoh,S.Yoshikawa,M.Nagai,T.Kitagawa: "Vibrational assignments of the FeCO unit of CO-bound heme proteins revisited:Observation of a new CO-isotopesensitive Raman hand assignable to FeCO bonding fundamental." Journal of Physical Chemistry. 98. 6652-6660 (1994) 


[Publications] M.Nagai,T.Kitagawa: "Resonance Raman and circular dichroic spectra of Hemoglobin Hirose(β 37Trp-Ser)." Journal of Inorganic Biochemistry. 51. 126- (1993) 


[Publications] T.Kitagawa,Y.Sakan,M.Nagai,T.Ogura,F.A.Fraunfelder,T.Kitagawa: "Time-resolved resonance Raman studies of recombination intermediates of CO-photodissociated myoglobin,hemoglobin and its E7 mutants." Journal of Inorganic Biochemistry. 51. 217- (1993) 


[Publications] T.Lian,B.Locke,T.Kitagawa,M.Nagai,R.M.Hochstrasser: "Determination of Fe-CO geometry in the subunits of Hemoglobin M Boston using femtosecond infrared spectroscopy." Biochemistry. 32. 5809-5814 (1993) 


[Publications] M.Nagai, S.Kaminaka, Y.Ohba, Y.Nagai, Y.Mizutani, T.Kitagawa: "Ultraviolet resonance Raman studies of quaternary structure of hemoglobin using tryptophan beta37 mutant" J.Biol.Chem.270 (4). 1636-1642 (1995) 

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[Publications] T.Kitagawa, Y.Sakan, M.Nagai, M.Ikeda-Saito: "Time-resolved resonance Raman studies of recombination intermediates of CO-dissociated myoglobin, hemoglobins and its E7 mutants" J.Inorg.Biochem.51 (1&2). 217 (1993) 

[Publications] T.Lian, B.Locke, T.Kitagawa, M.Nagai, R.M.Hochstrasser: "Determination of Fe-CO geometry in the subunits of carbon monoxy Hb M Boston using femtosecond infrared spectroscopy" Biochemistry. 32 (22). 5809-5814 (1993) 

URL: https://kaken.nii.ac.jp/report/KAKENHI-PROJECT-05670116/056701161994kenkyu_seika_hokoku_

Published: 1996-04-14