

DLR

JB

VOLUME 129 NO.5 MAY 2001

THE JOURNAL OF BIOCHEMISTRY

**BIOCHEMISTRY
MOLECULAR BIOLOGY
CELL
BIOTECHNOLOGY**

JB Review

The Structure of Calpain
Hiroyuki Sorimachi and Koichi Suzuki

The JB is available on the Web at: <http://JB.bcasj.or.jp/>

Published Monthly by THE JAPANESE BIOCHEMICAL SOCIETY

JOBIAO 129(5)653-850(2001)

EDITORIAL BOARD

Editor-in-Chief

Koichi SUZUKI (Tokyo)

Editors

<i>JB Reviews</i>	Tadaomi TAKENAWA (Tokyo)
<i>Biochemistry</i>	Toshisuke KAWASAKI (Kyoto)
	Eiki KOMINAMI (Tokyo)
<i>Molecular Biology</i>	Yoshiaki FUJII-KURIYAMA (Sendai)
<i>Cell</i>	Toshiaki KATADA (Tokyo)
<i>Biotechnology</i>	Izumi KUMAGAI (Sendai)

Managing Editors

Toshiaki KATADA (Tokyo) Naoyuki TANIGUCHI (Suita)

Associate Editors

<i>Biochemistry</i>	Kuniyo INOUE (Kyoto)	Katsura IZUI (Kyoto)
	Hideo KANO (Sapporo)	Hisao KATO (Suita)
	Shinichi KOHSAKA (Kodaira)	Masataka MORI (Kumamoto)
	Masaru TANOKURA (Tokyo)	Tomofusa TSUCHIYA (Okayama)
	Shuichi TSUJI (Hadano)	Akihito YAMAGUCHI (Ibaraki)
<i>Molecular Biology</i>	Kenji YAMAMOTO (Fukuoka)	
	Fumio HANAOKA (Suita)	Kenshi HAYASHI (Fukuoka)
	Motoya KATSUKI (Okazaki)	Kunihiro MATSUMOTO (Nagoya)
	Hiroyuki SASAKI (Mishima)	Masayuki YAMAMOTO (Tsukuba)
	<i>Cell</i>	Tatsuya HAGA (Tokyo)
Akihiko NAKANO (Wako)		Shigeo OHNO (Yokohama)
Kenji SOBUE (Suita)		
<i>Biotechnology</i>		Shinji IJIMA (Nagoya)
	Yasufumi KANEDA (Suita)	Eiichi TAMIYA (Ishikawa)

Advisory Board

Biochemistry

Elinor T. ADMAN (Seattle)
Shoei FURUKAWA (Gifu)
Masaaki HIROSE (Uji)
Tokuji IKEDA (Kyoto)
Makoto ITO (Fukuoka)
Ushio KIKKAWA (Kobe)
Hisatake KONDO (Sendai)
Ta-Hsiu LIAO (Taipei)
Alfred H. MERRILL, Jr. (Atlanta)
Norio MUTO (Shobara)
Fumihiko SATO (Kyoto)
Yukio SUGIURA (Uji)
Dennis E. VANCE (Edmonton)
Satoshi YAMASHITA (Maebashi)
Tadashi YOSHIMOTO (Nagasaki)

Kurt DRICKAMER (Oxford)
Saburo HARA (Kyoto)
Michio HOMMA (Nagoya)
Tatsuro IRIMURA (Tokyo)
Keiichi KAWANO (Toyama)
Kiyoshi KITA (Tokyo)
Konosuke KUMAKURA (Tokyo)
Masatomo MAEDA (Suita)
Taeko MIYAGI (Natori)
Hideaki NAGASE (London)
Toru SHIMIZU (Sendai)
Koji SUZUKI (Tsu)
Tetsuro YAMAMOTO (Kumamoto)
Koji YODA (Tokyo)

Kiyoshi FURUKAWA (Tokyo)
Seisuke HATTORI (Kodaira)
Yoshimi HOMMA (Fukushima)
Akio ITO (Fukuoka)
Seiichi KAWASHIMA (Tokyo)
Takehiko KOIDE (Hyogo)
Kunihiro KUWAJIMA (Tokyo)
Peter MALONEY (Baltimore)
Tomonari MURAMATSU (Tokyo)
Takaaki NISHIOKA (Kyoto)
Kazuyuki SUGAHARA (Kobe)
Noriaki TAKEGUCHI (Toyama)
Hirohei YAMAMURA (Kobe)
Shinji YOKOYAMA (Nagoya)

Molecular Biology

Hiroyuki ARAKI (Mishima)
Akira HORII (Sendai)
Hidetoshi INOKO (Isehara)
Daisuke KITAMURA (Noda)
Ken-ichirou MOROHASHI (Okazaki)
Lorenz POELLINGER (Stockholm)
Takashi TODA (London)
Hideyo YASUDA (Hachioji)

James D. ENGEL (Evanston)
Nobumichi HOZUMI (Noda)
Tetsuro ISHII (Tsukuba)
Hisao MASAI (Tokyo)
Tsunehiro MUKAI (Saga)
Tomokazu SUZUKI (Itami)
Morimasa WADA (Fukuoka)
Yoshihiro YONEDA (Suita)

Akiyoshi FUKAMIZU (Tsukuba)
Toshinori IDE (Hiroshima)
Takeo KISHIMOTO (Yokohama)
Takeshi MIZUNO (Nagoya)
Yusaku NAKABEPPU (Fukuoka)
Shoji TAJIMA (Suita)
Masao YAMADA (Tokyo)

Cell

Toshiya ENDO (Nagoya)
 Haruhiro HIGASHIDA (Kanazawa)
 Koza KAIBUCHI (Nagoya)
 Eisuke MEKADA (Suita)
 Toru NAKANO (Suita)
 Hiroshi OHNO (Kanazawa)
 Mamoru SANO (Kyoto)
 Mitsuo TAGAYA (Hachioji)

Yukio FUJIKI (Fukuoka)
 Masaki INAGAKI (Nagoya)
 Akira KIKUCHI (Hiroshima)
 Takashi MURAMATSU (Nagoya)
 Kazuhisa NAKAYAMA (Tsukuba)
 Harumasa OKAMOTO (Tsukuba)
 Hiroyuki SUGIYAMA (Fukuoka)
 Takashi YOKOTA (Tokyo)

Yasuhisa FUKUI (Tokyo)
 Makoto INUI (Ube)
 Toshio KITAMURA (Tokyo)
 Shigekazu NAGATA (Suita)
 Masuo OBINATA (Sendai)
 David SAFFEN (Tokyo)
 Tetsuya TAGA (Tokyo)
 Akihiko YOSHIMURA (Kurume)

Biotechnology

Yoshiharu DOI (Wako)
 Patricia A. JENNINGS (San Diego)
 Izumi KUBO (Hachioji)
 Fumio MIZUTANI (Tsukuba)
 Shigemi NORIOKA (Suita)
 Kiyotaka SHIBA (Tokyo)
 Toshifumi TAKEUCHI (Hiroshima)

Nobuyoshi ESAKI (Uji)
 Makoto KIMURA (Fukuoka)
 Isamu MATSUMOTO (Tokyo)
 Teruyuki NAGAMUNE (Tokyo)
 Takahiro OCHIYA (Tokyo)
 Masayasu SUZUKI (Iizuka)
 Norihiro TSUKAGOSHI (Nagoya)

Shigehisa HIROSE (Yokohama)
 Kazukiyo KOBAYASHI (Nagoya)
 Kohnosuke MITANI (Los Angeles)
 Satoshi NISHIKAWA (Tsukuba)
 Teruo OKANO (Tokyo)
 Yoshinobu TAKAKURA (Kyoto)

This JOURNAL, devoted to publication of original papers in the fields of biochemistry, molecular biology, cell, and biotechnology, was founded in 1922.

The JOURNAL is published monthly, with two volumes per annum.

All correspondences concerning this JOURNAL should be addressed to: The Japanese Biochemical Society, Ishikawa Building-3f, 25-16, Hongo 5-chome, Bunkyo-ku, Tokyo 113-0033, Japan. Tel. +81-3-3815-1913, Fax. +81-3-3815-1934

Subscription

The price for a subscription per year (two volumes) is US \$250.00 (postal surcharge airmail only, US \$60). Remittance should be made preferably by check or draft payable to the Japanese Biochemical Society. Subscriptions from abroad should be paid to the agencies listed below.

Agencies

Japan Publications Trading Co., Ltd.
 P.O. Box 5030, Tokyo International,
 2-1, Sarugaku-cho 1-chome, Chiyoda-ku,
 Tokyo 101-0064, Japan

Maruzen Co., Ltd.
 P.O. Box 5050, Tokyo International,
 100-3199, Japan

All back issues of the *Journal of Biochemistry* from Volume 1, 1922, are available from our agency: TOA BOOK EXPORTS, INC., Ikebukuro 4-13-4, Toshima-ku, Tokyo 171-0014, Japan. Tel. +81-3-3985-4701, Fax. +81-3-3985-4703

Copyright © 2001, by the Japanese Biochemical Society

Printed by Daishowa Printing Co., Ltd., Tokyo, Japan
 under the supervision of
 Center for Academic Publications Japan

Notice on photocopying With the exception of cases permitted by the Copyrights Law, such as the photocopying services provided by the libraries duly designated by government ordinance and photocopying for lectures by teachers at educational institutions, the photocopying of any part of this publication without explicit consent of the relevant author is a violation of the law. To legally photocopy any part of this publication, the person wishing to photocopy, or the corporation or organization employing such person, is recommended to enter into a comprehensive copyright approval agreement with the following trustee of copyrights from the authors:

(Except in the U.S.A.) The Copyright Council of the Academic Societies, 41-6, Akasaka 9-chome, Minato-ku, Tokyo 107-0052, Japan. Phone: 3-3475-4621, Fax: 3-3403-1738

(In the U.S.A.) Copyright Clearance Center, Inc., 222 Rosewood Drive, Danvers, MA 01923, U.S.A. Phone: 508-750-8400, Fax: 508-750-4744

NOTES TO CONTRIBUTORS

The JOURNAL OF BIOCHEMISTRY publishes contributions, written in English, in the forms of (1) Regular paper and (2) Rapid communication, covering materials requiring prompt publication.

Submission of a paper implies that the work described has not been published previously; that it is not under consideration for publication elsewhere, and that if the paper is accepted for publication, the author(s) will transfer the copyright to the Japanese Biochemical Society.

Manuscripts should be written in succinct forms. No length-limit is set for a Regular paper, whereas a Rapid communication is not allowed to exceed 3.5 printed pages. Charges of ¥700 and ¥7,200 are made for every printed page of a Regular paper and a Rapid communication, respectively.

The manuscript should be typewritten in double-spacing and appropriately numbered. Submission of four copies of manuscript is requested. The manuscript should be sent to: The Japanese Biochemical Society, Ishikawa Building-3f, 25-16, Hongo 5-chome, Bunkyo-ku, Tokyo 113-0033, Japan.

Reprints can be purchased, in lots of 50 copies, at cost prices. The order for reprints should be made on returning the proof.

On submission of papers, authors are requested to select one of the following four fields and its topic, under which the submitted papers should be reviewed, and to indicate their selection on the title page of the manuscript. Authors may suggest a few names and addresses of potential reviewers, who are suitable for reviewing the submitted papers.

Fields and topics to be selected:

Fields	Topics
<i>Biochemistry:</i>	Biochemistry General
	Protein Structure
	Biomolecular Structures
	Nucleic Acid and Peptide Biochemistry
	Glycobiology and Carbohydrate Biochemistry
	Lipid Biochemistry
	Enzymology
	Biochemistry of Proteolysis
	Metabolism and Bioenergetics
	Reactive Oxygen and Nitrogen Species
	Biochemistry in Cell Membranes
	Biochemistry in Diseases and Aging
	Neurochemistry
	Immunochemistry
	Physiological Chemistry
	Biochemical Pharmacology
	Analytical Biochemistry
<i>Molecular Biology:</i>	Molecular Biology General
	Genes and Other Genetic Materials
	Replication and Recombination
	Gene Expression
	Protein Synthesis
	DNA-Protein Interaction
	RNA Processing
	Genetic Engineering
	Genetic Diseases
	Molecular Genetics
	Molecular Evolution

Fields

Topics

Cell: Cell General
Biomembranes, Organelles, and Protein Sorting
Muscles, Cell Motility and Shape
Extracellular Matrices and Cell Adhesion Molecules
Cell Cycle
Receptors and Signal Transduction
Stress Proteins and Molecular Chaperones
Cell Death
Differentiation, Development, and Aging
Neurobiology
Tumor and Immunology

Biotechnology: Biotechnology General
Biomimetic Chemistry
Biomaterials
Bioactive Substances
Gene and Protein Engineering
RNA Technology
Glycotechnology
Immunological Engineering
Cell and Tissue Engineering
Transgenic Technology
Drug Delivery Systems
Biosensor and Bioelectronics
New Devices in Biotechnology
Environmental Technology

"Instructions to Authors" are printed in the January and July issues of this JOURNAL every year. Please conform to these instructions when submitting manuscripts. Reprint of "Instructions to Authors" is available.

New Announcement (Limited Publication)

JOURNAL OF BIOCHEMISTRY, GENERAL CONTENTS

Volume 37-66 (1950-1969) Cloth Bound
700 page, including Author and Subject
Index US \$90.00

Volume 67-98 (1970-1985) Cloth Bound
1000 page, including Author and Subject
Index US \$120.00

Now available through: TOA BOOK EXPORTS, INC.,
Ikebukuro 4-13-4, Toshima-ku, Tokyo 171-0014, Japan.

CONTENTS Vol. 129, No. 5

JB Review

- The Structure of Calpain H. Sorimachi and K. Suzuki 653

Rapid Communications

- Activation by 2-Arachidonoylglycerol, an Endogenous Cannabinoid Receptor Ligand, of p42/44 Mitogen-Activated Protein Kinase in HL-60 Cells Y. Kobayashi, S. Arai, K. Waku, and T. Sugiura 665
- Use of Bleomycin- and Heat Shock-Induced Calreticulin Promoter for Construction of a Mammalian Expression Vector H. Elmileik, T. Kumagai, M. Berengena, K. Ueda, and M. Sugiyama 671

Regular Papers

- Alkaline-Resistance Model of Subtilisin ALP I, a Novel Alkaline Subtilisin H. Maeda, O. Mizutani, Y. Yamagata, E. Ichishima, and T. Nakajima 675
- Effects of Deoxycholic Acid and Its Epimers on Lipid Peroxidation in Isolated Rat Hepatocytes A. Hino, M. Morita, M. Une, K. Fujimura, and T. Kuramoto 683
- Localization of Neuronal Growth-Associated, Microtubule-Destabilizing Factor SCG10 in Brain-Derived Raft Membrane Microdomains S. Maekawa, H. Morii, H. Kumanogoh, M. Sano, Y. Naruse, Y. Sokawa, and N. Mori 691
- The Human Homologue of Fission Yeast *cdc27*, p66, Is a Component of Active Human DNA Polymerase δ K. Shikata, S. Ohta, K. Yamada, C. Obuse, H. Yoshikawa, and T. Tsurimoto 699
- Characterization of Cytochrome *b₅* in the Ascidian *Polyandrocarpa misakiensis* and Budding-Specific Expression T. Yubisui, F. Takahashi, T. Takabayashi, S. Fujiwara, and K. Kawamura 709
- Effects of Recombinant Human Macrophage Colony-Stimulating Factor on Atherosclerotic Lesions Established in the Aorta of High Cholesterol-Fed Rabbits H. Irie, H. Koshiba, M. Koyama, E. Asakura, H. Shibata, K. Kimura, K. Naito, T. Yamauchi, K. Yada, T. Hanamura, S. Hanada, S. Abe, and N. Nakamura 717
- Effect of Aggregation of Amphotericin B on Lysophosphatidylcholine Micelles as Related to Its Complex Formation with Cholesterol or Ergosterol M. Kawabata, M. Onda, and T. Mita 725
- Differential Control of Cellular Gene Expression by Diffusible and Non-Diffusible EGF Y. Ito, G. Chen, Y. Imanishi, T. Morooka, E. Nishida, Y. Okabayashi, and M. Kasuga 733
- Dynamics of Intracellular Granules with CD63-GFP in Rat Basophilic Leukemia Cells T. Amano, T. Furuno, N. Hirashima, N. Ohyama, and M. Nakanishi 739
- Substrate Specificity of Ca²⁺/Calmodulin-Dependent Protein Kinase Phosphatase: Kinetic Studies Using Synthetic Phosphopeptides as Model Substrates A. Ishida, Y. Shigeri, Y. Tatsu, Y. Endo, I. Kameshita, S. Okuno, T. Kitani, M. Takeuchi, N. Yumoto, and H. Fujisawa 745
- Efficient Transfer of Intact Oligonucleotides into the Nucleus of Ligament Scar Fibroblasts by HVJ-Cationic Liposomes Is Correlated with Effective Antisense Gene Inhibition N. Nakamura, D.A. Hart, C.B. Frank, L.L. Marchuk, N.G. Shrive, N. Ota, K. Taira, H. Yoshikawa, and Y. Kaneda 755
- The Amino Acid Residues Affecting the Activity and Azole Susceptibility of Rat CYP51 (Sterol 14-Demethylase P450) Y. Nitahara, K. Kishimoto, Y. Yabusaki, O. Gotoh, Y. Yoshida, T. Horiuchi, and Y. Aoyama 761
- New Gene Cluster for Lantibiotic Streptin Possibly Involved in Streptolysin S Formation K. Karaya, T. Shimizu, and A. Taketo 769

Ancestral Residues Stabilizing 3-Isopropylmalate Dehydrogenase of an Extreme Thermophile: Experimental Evidence Supporting the Thermophilic Common Ancestor Hypothesis	J. Miyazaki, S. Nakaya, T. Suzuki, M. Tamakoshi, T. Oshima, and A. Yamagishi	777
Cyclic and Linear Peptides Derived from α -Amylase Inhibitory Protein Tendamistat	S. Ono, M. Umezaki, N. Tojo, S. Hashimoto, H. Taniyama, T. Kaneko, T. Fujii, H. Morita, C. Shimasaki, I. Yamazaki, T. Yoshimura, and T. Kato	783
Replacements of Amino Acid Residues at Subsites and Their Effects on the Catalytic Properties in <i>Rhizomucor pusillus</i> Pepsin, an Aspartic Proteinase from <i>Rhizomucor pusillus</i>	J. Aikawa, Y.-N. Park, M. Sugiyama, M. Nishiyama, S. Horinouchi, and T. Beppu	791
A Synthetic DAF (CD55) Gene Based on Optimal Codon Usage for Transgenic Animals	S. Miyagawa, M. Yamada, K. Matsunami, Y. Koresawa, M. Ikawa, M. Okabe, and R. Shirakura	795
Roles of N-Terminal Active Cysteines and C-Terminal Cysteine-Selenocysteine in the Catalytic Mechanism of Mammalian Thioredoxin Reductase	N. Fujiwara, T. Fujii, J. Fujii, and N. Taniguchi	803
Heat Shock Factor 2 Is Involved in the Upregulation of α B-Crystallin by High Extracellular Potassium	C. Sadamitsu, T. Nagano, Y. Fukumaki, and A. Iwaki	813
Only the Reduced Conformer of α -Lactalbumin Is Inducible to Aggregation by Protein Aggregates	J. Li, S. Zhang, and C. Wang	821
Characterization of a <i>Saccharomyces cerevisiae</i> Gene That Encodes a Mitochondrial Phosphate Transporter—LikeProtein	R. Takabatake, A.-B.M. Siddique, H. Kouchi, K. Izui, and S. Hata	827
Ca ²⁺ - and Myristoylation-Dependent Association of Calcineurin with Phosphatidylserine	B.A. Perrino and B.A. Martin	835
A Cluster of Basic Amino Acid Residues in Calcineurin B Participates in the Binding of Calcineurin to Phosphatidylserine Vesicles	B.A. Martin, B.C. Oxhorn, C.R. Rossow, and B.A. Perrino	843

Author Index

- Abe, S., 717
 Aikawa, J., 791
 Amano, T., 739
 Aoyama, Y., 761
 Arai, S., 665
 Asakura, E., 717

 Beppu, T., 791
 Berengena, M., 671

 Chen, G., 733

 Elmileik, H., 671
 Endo, Y., 745

 Frank, C.B., 755
 Fujii, J., 803
 Fujii, Takayoshi, 783
 Fujii, Tsuneko, 803
 Fujimura, K., 683
 Fujisawa, H., 745
 Fujiwara, N., 803
 Fujiwara, S., 709
 Fukumaki, Y., 813
 Furuno, T., 739

 Gotoh, O., 761

 Hanada, S., 717
 Hanamura, T., 717
 Hart, D.A., 755
 Hashimoto, S., 783
 Hata, S., 827
 Hino, A., 683
 Hirashima, N., 739
 Horinouchi, S., 791
 Horiuchi, T., 761

 Ichishima, E., 675
 Ikawa, M., 795
 Imanishi, Y., 733
 Irie, H., 717

 Ishida, A., 745
 Ito, Y., 733
 Iwaki, A., 813
 Izui, K., 827

 Kameshita, I., 745
 Kaneda, Y., 755
 Kaneko, T., 783
 Karaya, K., 769
 Kasuga, M., 733
 Kato, T., 783
 Kawabata, M., 725
 Kawamura, K., 709
 Kimura, K., 717
 Kishimoto, K., 761
 Kitani, T., 745
 Kobayashi, Y., 665
 Koresawa, Y., 795
 Koshiha, H., 717
 Kouchi, H., 827
 Koyama, M., 717
 Kumagai, T., 671
 Kumanogoh, H., 691
 Kuramoto, T., 683

 Li, J., 821

 Maeda, H., 675
 Maekawa, S., 691
 Marchuk, L.L., 755
 Martin, B.A., 835, 843
 Matsunami, K., 795
 Mita, T., 725
 Miyagawa, S., 795
 Miyazaki, J., 777
 Mizutani, O., 675
 Mori, N., 691
 Morii, H., 691
 Morita, H., 783
 Morita, M., 683
 Morooka, T., 733

 Nagano, T., 813
 Naito, K., 717
 Nakajima, T., 675
 Nakamura, Norifumi, 717
 Nakamura, Norimasa, 755
 Nakanishi, M., 739
 Nakaya, S., 777
 Naruse, Y., 691
 Nishida, E., 733
 Nishiyama, M., 791
 Nitahara, Y., 761

 Obuse, C., 699
 Ohta, S., 699
 Ohyama, N., 739
 Okabayashi, Y., 733
 Okabe, M., 795
 Okuno, S., 745
 Onda, M., 725
 Ono, S., 783
 Oshima, T., 777
 Ota, N., 755
 Oxhorn, B.C., 843

 Park, Y.-N., 791
 Perrino, B.A., 835, 843

 Rossow, C.R., 843

 Sadamitsu, C., 813
 Sano, M., 691
 Shibata, H., 717
 Shigeri, Y., 745
 Shikata, K., 699
 Shimasaki, C., 783
 Shimizu, T., 769
 Shirakura, R., 795
 Shrive, N.G., 755
 Siddique, A.-B.M., 827
 Sokawa, Y., 691
 Sorimachi, H., 653

 Sugiura, T., 665
 Sugiyama, Masakazu, 791
 Sugiyama, Masanori, 671
 Suzuki, K., 653
 Suzuki, T., 777

 Taira, K., 755
 Takabatake, R., 827
 Takabayashi, T., 709
 Takahashi, F., 709
 Taketo, A., 769
 Takeuchi, M., 745
 Tamakoshi, M., 777
 Taniguchi, N., 803
 Taniyama, H., 783
 Tatsu, Y., 745
 Tojo, N., 783
 Tsurimoto, T., 699

 Ueda, K., 671
 Umezaki, M., 783
 Une, M., 683

 Waku, K., 665
 Wang, C., 821

 Yabusaki, Y., 761
 Yada, K., 717
 Yamada, K., 699
 Yamada, M., 795
 Yamagata, Y., 675
 Yamagishi, A., 777
 Yamauchi, T., 717
 Yamazaki, I., 783
 Yoshida, Y., 761
 Yoshikawa, Hideki, 755
 Yoshikawa, Hiroshi, 699
 Yoshimura, T., 783
 Yubisui, T., 709
 Yumoto, N., 745

 Zhang, S., 821