

ALEXANDER M. KLIBANOV

**Date and Place of Birth:** July 15, 1949, in Moscow (Russia)

**Nationality:** Naturalized U.S. Citizen (1983)

**Education:**

1974 Ph.D. in Chemical Enzymology, Moscow University  
1971 M.S. in Chemistry, Moscow University

**Honors:**

2015 Tau Beta Pi's Leonardo Da Vinci Lecturer, MIT  
2007-11 and 2014-2012-13 Novartis Chair Endowed Professorship, MIT  
2012-13 Roger and Georges Firmenich Endowed Professorship, MIT  
2011 MIT Biological Engineering Senior Class Faculty Award  
2006 Distinguished GRUM Lecturer in Drug Discovery & Development,  
University of Montreal (Canada)  
2004 UNAM Distinguished Lecturer, National University of Mexico (Mexico  
City)  
2001 Walter Enz Lecturer in Pharmaceutical Chemistry, University of Kansas  
2001 Elected a Corresponding Fellow of the Royal Society of Edinburgh  
(Scotland's National Academy of Science and Letters)  
2000 Merck Distinguished Lecturer, Rutgers University  
2000 Top 20 *Biotechnology & Bioengineering* Papers of the Last Forty Years  
1998 Robert Lutz Lecturer, University of Virginia  
1996 Perkin-Elmer Distinguished Lecturer, University of Pittsburgh  
1995 Elected to the National Academy of Sciences of the U.S.A.  
1995 Nathan O. Kaplan Memorial Lecturer in Biological Chemistry, University  
of California at San Diego  
1994 R.W. Johnson PRI Lecturer, Pharmaceutical Research Institute  
1994 Warren McCabe Lecturer, North Carolina State University  
1993 Elected to the National Academy of Engineering of the U.S.A.  
1993 Arthur C. Cope Scholar Award of the American Chemical Society  
1993 Biotechnology Divisional Lectureship Award of the Institute of Food  
Technologists  
1992 Charles Sabat Lecturer, Rutgers University  
1992 Elected a Founding Fellow of the American Institute for Medical and  
Biological Engineering  
1992 Louis C. Jordy Research Scholar Lecturer, Drew University  
1991 International Enzyme Engineering Award  
1991 Marvin J. Johnson Award of the American Chemical Society  
1990 Monsanto Lecturer, Ohio State University  
1990 NRC Distinguished Lecturer, Academia Sinica (Taiwan)  
1989 Ipatieff Prize of the American Chemical Society  
1989 Backer Lecturer, Groningen University (Holland)  
1988 Dow Lecturer, University of Ottawa (Canada)  
1987 Distinguished Scholar Lecturer, Hope College  
1986 Leo Friend Award of the American Chemical Society

1984 Who's Who in Frontier Science and Technology  
1984 Sohio Lecturer, Case Western Reserve University  
1982 American Men and Women of Science  
1981-1983 Henry L. Doherty Career Development Professorship, MIT  
1975 U.S.S.R. Ministry of Higher Education Prize

**Professional Experience:**

2007-11 and 2014- Novartis Chair Endowed Professor of Chemistry and Bioengineering, MIT  
2012-2013 Roger and Georges Firmenich Professor of Natural Products Chemistry  
Department of Chemistry, MIT  
2000-present Professor of Bioengineering  
Department of Biological Engineering, MIT  
1988-present Professor of Chemistry  
Department of Chemistry, MIT  
1987-1988 Professor of Applied Biochemistry  
Department of Applied Biological Sciences, MIT  
1983-1987 Associate Professor of Applied Biochemistry  
Department of Applied Biological Sciences (formerly  
Department of Nutrition and Food Science), MIT  
1979-1983 Assistant Professor of Applied Biochemistry  
Department of Nutrition and Food Science, MIT  
1977-1979 Postdoctoral Associate, Department of Chemistry  
University of California at San Diego  
1974-1977 Research Chemist  
Department of Chemistry, Moscow University

**Current Journal Editorial/Advisory Boards:**

"Biocatalysis and Biotransformation", "Applied Biochemistry and Biotechnology", "Open Chemistry Journal", "Biotechnology Progress", "Biotechnology & Bioengineering", "Microbial Biotechnology", "Open Journal of Pharmacology", "Nanocarriers", "Journal of Antivirals and Antiretrovirals", "Open Access Academic Books in Chemistry", "Journal of Biological Chemistry and Molecular Pharmacology", "Archives of Natural Products and Medicinal Chemistry", "Recent Patents in Biotechnology", "Current Pharmaceutical Biotechnology", and "Archives of Medical Biotechnology", "International Journal of Drug Design, Delivery and Safety"

**Professional Societies:**

U.S. National Academy of Sciences, U.S. National Academy of Engineering, American Chemical Society, American Institute for Medical and Biological Engineering

**Current Research Interests:**

Enzyme chemistry and biotechnology      Medicinal and formulation chemistry  
Protein drug delivery      Antimicrobial polymers  
Enzymes as stereoselective catalysts in organic syntheses

**Publications:**

1. Varfolomeyev, S.D., Klibanov, A.M., Berezin, I.V. 1971. Light-initiated enzymic activity caused by photostereoisomerization of *cis*-4-nitrocinnamoyl- $\alpha$ -chymotrypsin. FEBS Lett. **15**: 118-120.
2. Varfolomeyev, S.D., Klibanov, A.M., Martinek, K., Berezin, I.V. 1972. Light-sensitive catalysts. 4-Nitrocinnamoyl residue as a chromophoric reporter group in the  $\alpha$ -chymotrypsin active center. Dokl. Acad. Nauk SSSR **203**: 616-619.
3. Klibanov, A.M., Samokhin, G.P., Martinek, K., Berezin, I.V. 1974. Mechanochemistry of catalytic systems. Regulation by a mechanical action of the enzymatic properties of  $\alpha$ -chymotrypsin covalently attached to a nylon fiber. Dokl. Acad. Nauk SSSR **218**: 715-718.
4. Berezin, I.V., Varfolomeyev, S.D., Klibanov, A.M., Martinek, K. 1974. Light and ultrasonic regulation of  $\alpha$ -chymotrypsin catalytic activity. Proflavin as a light- and sound- sensitive competitive inhibitor. FEBS Lett. **39**: 329-331.
5. Berezin, I.V., Klibanov, A.M., Martinek, K. 1974. The mechanochemistry of immobilized enzymes. How to steer a chemical process at the molecular level by a mechanical device. Biochim. Biophys. Acta **364**: 193-199.
6. Berezin, I.V., Klibanov, A.M., Goldmacher, V.S., Martinek, K. 1974. Mechanochemistry of catalytic systems. Regulation by a mechanical action of the enzymatic activity of trypsin entrapped in polyacrylamide gel. Dokl. Acad. Nauk SSSR **218**: 367-370.
7. Klibanov, A.M., Martinek, K., Berezin, I.V. 1974. The effect of ultrasound on  $\alpha$ -chymotrypsin. A novel approach to studying conformational transitions in active centers of enzymes. Biochemistry SSSR **39**: 878-887.
8. Berezin, I.V., Klibanov, A.M., Klyosov, A.A., Martinek, K., Svedas, V.K. 1975. The effect of ultrasound as a new method of studying conformational transitions in enzyme active centers. pH- and temperature-induced conformational transitions in the active center of penicillin amidase. FEBS Lett. **49**: 325-328.
9. Berezin, I.V., Klibanov, A.M., Martinek, K. 1975. Kinetic and thermodynamic aspects of catalysis by immobilized enzymes. Russ. Chem. Revs. **44**: 17-47.
10. Martinek, K., Goldmacher, V.S., Klibanov, A.M., Berezin, I.V. 1975. Denaturing agents (urea, acrylamide) protect enzymes against irreversible thermoinactivation: a study with native and immobilized  $\alpha$ -chymotrypsin and trypsin. FEBS Lett. **51**: 152-155.
11. Martinek, K., Klibanov, A.M., Tchernysheva, A.V., Berezin, I.V. 1975. The stabilization of  $\alpha$ -chymotrypsin by entrapment in polymethacrylate gels. Dokl. Acad. Nauk SSSR **223**: 233-236.
12. Tchernysheva, A.V., Goldmacher, V.S., Klibanov, A.M., Martinek, K., Berezin, I.V. 1975. The catalytic activity and thermostability of  $\alpha$ -chymotrypsin oligomers entrapped in cross-linked polymeric gels. Bull. Moscow Univ. **19**: 428-431.

13. Tchernysheva, A.V., Martinek, K., Klibanov, A.M., Mevkh, A.T., Berezin, I.V. 1975. The catalytic properties and thermostability of  $\alpha$ -chymotrypsin in different polymethacrylate gels. Izvestia Acad. Nauk SSSR, Ser. Khim. No.8: 1764-1768.
14. Klibanov, A.M., Samokhin, G.P., Martinek, K., Berezin, I.V. 1976. Enzymatic mechanochemistry: a new approach to studying the mechanism of enzyme action. Biochim. Biophys. Acta 438: 1-12.
15. Berezin, I.V., Klibanov, A.M., Samokhin, G.P., Martinek, K. 1976. Mechanochemistry of immobilized enzymes: a new approach to studies in fundamental enzymology. Regulation by a mechanical device of the catalytic properties of enzymes covalently attached to elastic polymeric supports. Meth. Enzymol. 44: 558-571.
16. Berezin, I.V., Klibanov, A.M., Goldmacher, V.S., Martinek, K. 1976. Mechanochemistry of immobilized enzymes: a new approach to studies in fundamental enzymology. Regulation by a mechanical device of the catalytic activity of enzymes trapped in polyacrylamide gel. Meth. Enzymol. 44: 571-576.
17. Klibanov, A.M., Kazanskaya, N.F., Larionova, N.I., Martinek, K., Berezin, I.V. 1976. A comparative study of the dynamic structures of the active centers of proteolytic enzymes by the ultrasonic method. The effect of ultrasound on  $\alpha$ -trypsin,  $\beta$ -trypsin, and trypsinogen. J. Bioorg. Chem. (Russ.) 2: 828-836.
18. Martinek, K., Goldmacher, V.S., Klibanov, A.M., Torchilin, V.P., Smirnov, V.N., Chazov, E.I., Berezin, I.V. 1976. Thermal stabilization of  $\alpha$ -chymotrypsin by covalent attachment to a complementary surface of a polymeric matrix. Dokl. Acad. Nauk SSSR 228: 1468-1471.
19. Poglazov, B.F., Samokhin, G.P., Klibanov, A.M., Levitsky, D.I., Martinek, K., Berezin, I.V. 1977. Mechanochemistry of the myosin molecule. Dokl. Acad. Nauk SSSR 234: 482-485.
20. Berezin, I.V., Klibanov, A.M., Samokhin, G.P., Goldmacher, V.S., Martinek, K. 1977. Mechanosensitive and sound-sensitive systems as chemical amplifiers of weak signals. In: *Biomedical Applications of Immobilized Enzymes and Proteins* (T.M.S. Chang, ed.), vol. 2, pp. 237-251, Plenum Press, New York.
21. Klibanov, A.M., Samokhin, G.P., Martinek, K., Berezin, I.V. 1977. A new mechanochemical method of enzyme immobilization. Biotechnol. Bioeng. 19: 211-218.
22. Martinek, K., Klibanov, A.M., Samokhin, G.P., Semenov, A.M., Berezin, I.V. 1977. Preparative enzymatic synthesis in biphasic water-organic systems. J. Bioorg. Chem. (Russ.) 3: 696-702.
23. Klibanov, A.M., Samokhin, G.P., Martinek, K., Berezin, I.V. 1977. A new approach to preparative enzymatic synthesis. Biotechnol. Bioeng. 19: 1351-1361.
24. Martinek, K., Klibanov, A.M., Goldmacher, V.S., Berezin, I.V. 1977. The principles of enzyme stabilization. I. Increase in thermostability of enzymes covalently bound to a complementary surface of a polymeric support in a multipoint fashion. Biochim. Biophys. Acta 485: 1-12.

25. Martinek, K., Klibanov, A.M., Goldmacher, V.S., Tchernysheva, A.V., Mozhaev, V.V., Berezin, I.V., Glotov, B.O. 1977. The principles of enzyme stabilization. II. Increase in thermostability of enzymes as a result of multipoint non-covalent interactions with a polymeric support. Biochim. Biophys. Acta **485**: 13-28.
26. Torchilin, V.P., Maksimenko, A.V., Smirnov, V.N., Martinek, K., Klibanov, A.M., Berezin, I.V. 1978. The principles of enzymes stabilization. III. The effect of the length of intramolecular cross-linking agents on the thermostability of enzymes. Biochim. Biophys. Acta **522**: 277-283.
27. Samokhin, G.P., Klibanov, A.M., Martinek, K. 1978. Photochemical immobilization of enzymes. Bull. Moscow Univ. **19**: 433-436.
28. Poglazov, B.F., Samokhin, G.P., Klibanov, A.M., Levitsky, D.I., Martinek, K., Berezin, I.V. 1978. The effect of mechanical stretching of myosin rod part (fragment LMM + HMM S-2) on the ATPase activity of myosin. Biochim. Biophys. Acta **524**: 245-253.
29. Klibanov, A.M., Semenov, A.N., Samokhin, G.P., Martinek, K. 1978. Enzymatic reactions in water-organic solutions. The criterion for selecting optimal organic co-solvents. J. Bioorg. Chem. (Russ.) **4**: 236-242.
30. Sinitsyn, A.P., Klibanov, A.M., Klesov, A.A., Martinek, K. 1978. The dependence of stability of immobilized glycoamylase on the method of immobilization. Appl. Biochem. Microbiol. (Russ.) **14**: 236-242.
31. Klibanov, A.M., Mozhaev, V.V. 1978. On the mechanism of irreversible thermoinactivation of enzymes and possibilities for reactivation of "irreversibly" inactivated enzymes. Biochem. Biophys. Res. Commun. **83**: 1012-1017.
32. Klibanov, A.M., Kaplan, N.O., Kamen, M.D. 1978. A rationale for stabilization of oxygen-labile enzymes: application to a clostridial hydrogenase. Proc. Natl. Acad. Sci. USA **75**: 3640-3643.
33. Torchilin, V.P., Maksimenko, A.V., Smirnov, V.N., Berezin, I.V., Klibanov, A.M., Martinek, K. 1979. The principles of enzyme stabilization. IV. Modification of "key" functional groups in the tertiary structure of proteins. Biochim. Biophys. Acta **567**: 1-11.
34. Klibanov, A.M., Kaplan, N.O., Kamen, M.D. 1979. Chelating agents protect hydrogenase against oxygen inactivation. Biochim. Biophys. Acta **547**: 411-416.
35. Klibanov, A.M. 1979. Stabilization of enzymes by immobilization. Anal. Biochem. **93**: 1-25.
36. Klibanov, A.M., Kaplan, N.O., Kamen, M.D. 1980. Thermal stabilities of membrane-bound, solubilized and artificially immobilized hydrogenase from *Chromatium vinosum*. Arch. Biochem. Biophys. **199**: 545-549.
37. Klibanov, A.M., Puglisi, A.V. 1980. The regeneration of coenzymes using immobilized hydrogenase. Biotechnol. Lett. **2**: 445-450.
38. Klibanov, A.M., Kaplan, N.O., Kamen, M.D. 1980. Approaches to stabilization of hydrogenase and nitrogenase against oxygen inactivation. In: Enzyme Engineering V (H.H. Weetall and G.P. Royer, eds.), pp.135-142, Plenum Press, New York.

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